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Power Transformers

Development of Power Transformers with some Modern Features and Applications

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Paper read before the Montreal Branch, The Engineering Institute of Canada, April 23rd, 1925.

In presenting a paper on Power Transformers it has occurred to me that it might be sufficiently interesting to justify our starting with the first transformers and rather hurriedly follow their development or evolution up to the present time before calling attention to some of the more important modern features and applications of this type of electrical apparatus.

Early Use of Electricity

The first practical use of electricity was that of the battery used in telegraphy. Volta produced the battery in 1800 although it was not put to practical use until about forty years later. In 1830 Faraday in Europe and Hendry in America discovered the principle of electro magnetic induction which gave rise to the dynamo and later the transformer. Generators were at first built as direct current units and used principally for series arc lighting, under the Brush, Thompson-Houston, Wood and other systems. This system was, of course, only applicable for street lighting due to the high voltage which had to be employed. Efforts were made to find a different type of lamp from the arc and Edison succeeded in producing his incandescent lamp in 1879. In 1882 he started in New York the first central station in existence in which he used the parallel direct current system.

As the system grew and the demand for electric light increased the amount of copper necessary to carry the current became excessive and so the scheme became somewhat limited in its application. Its scope was, however, greatly extended by the development and adoption of the three wire system.

Series Transformer System Introduced

Alternating current generators had been built but only for low voltage, and were used on the multiple system of lighting. Those interested in the work were, therefore, confronted with the limitation of the multiple system due to the restricted area it could cover on the one hand, and the danger in using the series system due to high voltage on the other. About 1884 Mr. Goulard, a French engineer, invented a system among the component parts of which was what he termed "secondary re-generators" and what we to-day would call series transformers. The distributing line was carried through the area to be supplied and when a service was to be provided a "secondary re-generator" was installed, usually indoors, the primary of which was connected in series with the line and the secondary carried through the house or shop to be supplied. Each transformer had to be built to suit the demands of the service, the turns on the primary being varied with the amount of current to be taken off, while, of course, the voltage varied with the current used.

This scheme was introduced into England and America about the same time, the transformers used in America being first imported from Europe. Of course, this system was subject to a number of objections and handicaps, among them being the fact that it required a high voltage and the necessity for a constant current in the line. The high voltage was objectionable due to the lack of familiarity with the problems of insulation while the constant current had to be maintained by hand control. There was also the difficulty that if one transformer burned out the whole system was put out of commission.

Parallel Transformer System

About this time Mr. William Stanley became associated with Mr. George Westinghouse and was assigned the problem of studying the improvement of electric lighting. He first devoted his energies towards develop-

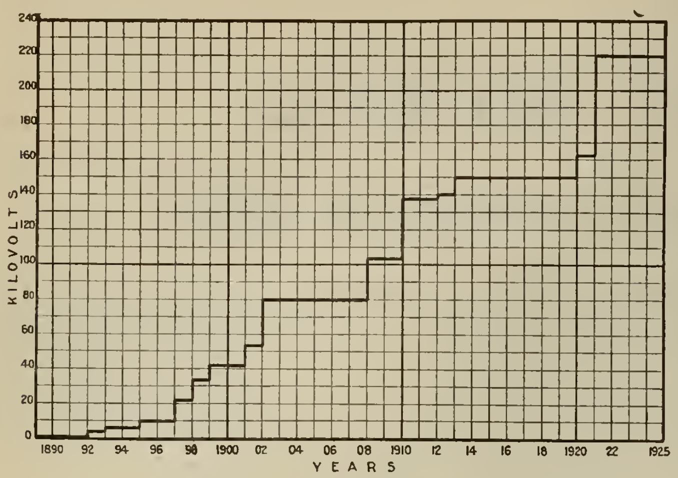

Figure No. 1.—Maximum Transmission Potentials Growth Since 1888.

ing the self-regulating feature of the generators but later concentrated his efforts on and finally produced the parallel or constant voltage transformer such as is employed to-day. The scheme which was proposed was to connect a transformer across the two wires of the system so that if the transformer got into difficulty it would not interfere with the successful operation of its neighbours. By many this was regarded as impracticable as it was feared that such a connection would short circuit the system or that the leakage or exciting current would prove too great a waste to permit of anything like a reasonable efficiency.

However, Mr. Stanley had discovered during his experimenting that coils with an alternating current flowing in them developed a counter e.m.f., and had in fact suggested the use of coils to replace lamps in the multiple series low voltage systems that had been employed to some extent. He spent the winter of 1885-1886 working on this multiple transformer and by the spring of 1886 had it in operation on the first multiple alternating current system using transformers in the world. This installation was at Great Barrington, Mass., and was the beginning of what has been a very rapid development in the transmission and distribution of electricity.

The original Stanley transformer is now in the possession of the American Institute of Electrical Engineers in New York City. This transformer had a voltage ratio of 500:100, was built for a frequency of 133 cycles and was of the natural air cooled type.

An Early European Installation

Higher voltages were employed in Europe earlier than in America, a great deal of the pioneer work in England being done by Dr. Ferranti. In about 1889 there were installed, in a station about six miles from London, generators wound for 10,000 volts and transformers for "stepping down" from this voltage at the London end of the line. A group of 10,000—2500 volt transformers were installed in London in 1891, and were still in service in 1921, although no doubt they had received some repairs in the meantime. These units were natural draft cooled as were all Transformers built even for some time afterwards.

Air Blast Transformers Used

However, with the development of larger generators the capacity of transformers had to be increased and the necessity for artificial cooling was soon experienced. The forced draft apparatus or air blast type was the next step in the development, this artificial cooling permitting greater electrical capacity to be taken from the same size of unit and thereby decreasing the cost of manufacture and improving the efficiency.

Oil Insulating and Cooling

With the increase in voltage, however, the necessity for other than dry insulation arose and it was not long before the use of oil in connection with transformers was adopted, the value of same as an insulating and cooling medium commending it against prejudices of those who had visions of the destruction of whole plants due to the inflammability of the oil.

Water-Cooled Units Adopted

As the losses in the core and coils of a transformer vary as the cube of the dimensions and as the radiating surface of these parts, as well as of the tank, vary as the square of the dimensions, soon the problem of providing sufficient surface to transfer the heat gathered by the oil to the surrounding air became difficult and expensive, so that artificial means of cooling the oil immersed apparatus was required and was developed in the water-cooled transformer in which water was circulated through pipes immersed in the oil, or in the forced oil cooling in which the oil was carried away from the transformer to a cooling medium such as water and returned to the transformer in a closed system.

Increase in Voltage

The increase in capacity and voltage of transformers has, of course, been necessitated by the increase in length of transmission systems and the development of larger generating stations located at strategic points, often quite remote from the point or points at which it is desirable to use the energy. A curve is shown in figure No. 1, giving the increase in potential for which transformers have been built.

It is somewhat interesting to note that this increase has been fairly gradual and as the demand for electric energy increases and the necessity of developing water powers more remote from their centres of population arises, transmission at voltages of 220,000 and over will quite likely be employed much more than was dreamed of but a few years ago. If you extend the curve shown in figure No. 1 say to 1935, it will be noted that you

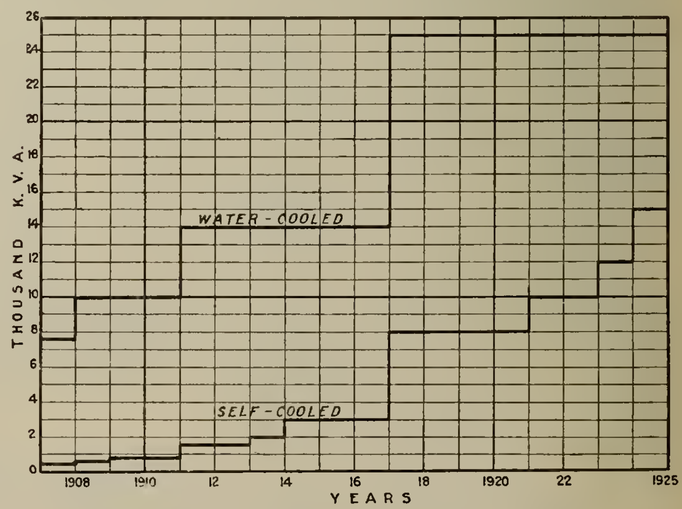

Figure No. 2.—Growth of Transformer Units.

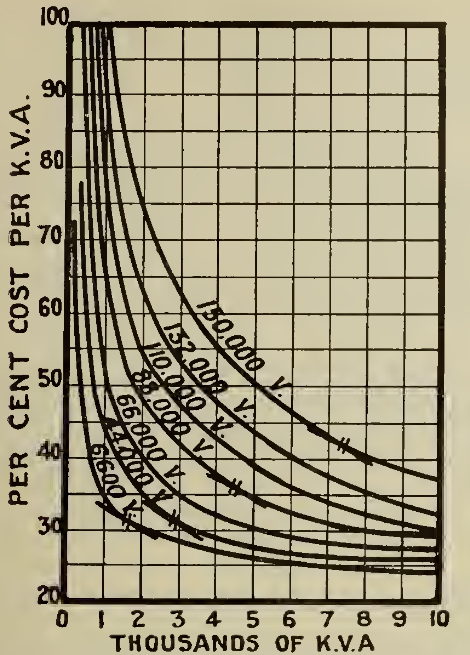

Figure No. 3.—Relative Costs per kv.a. of Transformers of Various Voltages.

obtain a voltage of approximately 300,000 volts, which is quite within the realm of possibility; although, if we are to follow what seems to be an established practice of using voltages which are a multiple of eleven, the next step will probably be 330,000 volts.

Growth in Capacity

It is equally interesting to note the increase in capacity of transformers built. In 1887 a 9-kv.a., transformer was built having a voltage of 1,000, and was used on a transmission line of about one-half mile. In 1890 an effort was made in America to transmit a few kilowatts several miles. In 1892, the largest transformer which had been built in America was a 30-kv.a., which had a voltage of 5,000. Figure No. 2 shows the growth of transformers since 1906, and up to the present time, on this continent. It will here be noted that there is a fairly continuous increase in capacity and if we project this curve we soon come to a rating of 40,000 or 50,000 kv.a., which is quite probable, and in fact quite essential if we are to employ high voltages and wish to keep the efficiencies of a transformer bank up and the cost down.

As the cost per kilovolt-ampere of high voltage transformers increases with the voltage but decreases within reasonable limits with the capacity, and as the efficiency increases with the capacity, the natural tendency will be toward larger units.

Relation Between Capacity, Cost, Voltage and Efficiency

It may be interesting to here reproduce a couple of curves showing how the cost and efficiency of transformers vary with the voltage and capacity. Figure No. 3 gives the relative cost per kilovolt-ampere of different sizes with different voltages. These curves were plotted for self-cooled transformers but are equally representative of water-cooled units. The point on the curves where there is a rapid upward turn indicates the capacity below which it is uneconomical to go.

Thus we see that the smallest 66,000-volt transformer that should be adopted in order to avoid undue costs is approximately 3,500 kv.a. At 110,000 volts, this point is found to be 5,000 to 6,000 kv.a., while at 150,000 volts the smallest economical size is about 7,500 kv.a. Although not included in the curve the smallest 220,000-volt unit that will keep below the point where the cost per kilovolt-ampere increases rapidly is about 10,000 kv.a. It is, of course, quite appreciated that it is not always possible to keep above these economical points indicated but in many cases if a small quantity of power is to be taken from a high voltage system it will be found more economical to use a small unit on a second transformation rather than to build it with a higher voltage.

The advantage of higher efficiency is also of extreme importance in determining the size of transfoimer to be installed as will be appreciated from figure No. 4. This gives the efficiencies of a number of sizes of 110,000-volt transformers demonstrating the decided advantage in the larger units.

Comparison Between Water- and Self-Cooled

The relative development of water- and self-cooled transformers within the last few years, as built by one American manufacturer, is shown in figure No. 2. It will be noted that while the self-cooled unit is of smaller capacity, the rate of growth of this type has been very marked due to certain advantages inherent in this design. There are a number of factors which will affect the decision as to whether self- or water-cooled transformers should be installed. For instance the water-cooled will in general be cheaper as to first cost, as will be seen from figure No. 5, which gives the cost of water-cooled units compared with self-cooled. This curve must be regarded as merely showing the trend in costs and should not be used for any specific combination of frequencies, voltages, etc. As the size increases, the advantage of the artificial cooling becomes more pronounced.

However, the cost of water, and in some cases pumps to supply it, must also be taken into the calculation as well as the supervision of the artificial cooling if the amount of water used is to be kept as low as possible. It might be well to call attention to this curve at the smaller capacity end. It will be noted that there is very little difference in the cost between self- and water-cooled transformers at about 400 kv.a., and when the cost of water, piping, etc., is taken into

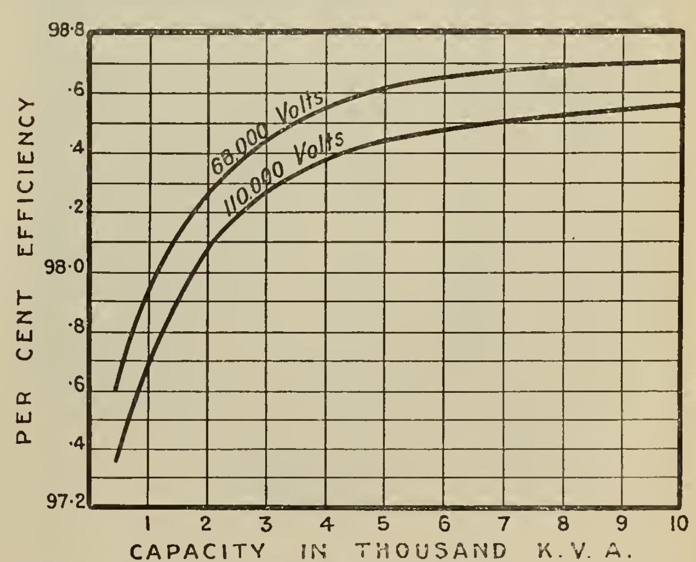

Figure No. 4.—Efficiencies of 66,000 - and 110,000-volt Transformers of Various Capacities.

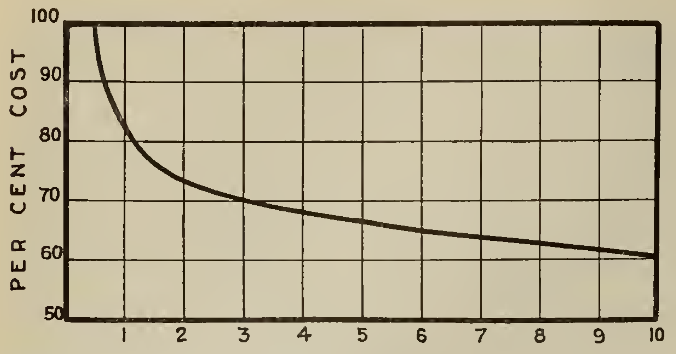

Figure No. 5.—Water-Cooled Transformer Cost in Percent of Self-Cooled Transformer Cost.

consideration the self-cooled unit has the advantage at these small sizes. The self-cooled unit is practically self-contained and will operate with but little attention and may be placed in an unattended station or sub-station, where it will receive only occasional oil test and general inspection. It is, of course, better suited for automatic stations where the problem of water supply may be forgotten.

The heat generated in the so-called self-cooled transformer is carried off by the natural means of convection and radiation into surrounding air. Means must be provided for exchanging this air sufficiently often to insure against its becoming unduly heated. If the transformer is located in a room or building, means must be provided to exhaust and supply air through ventilating openings or through doors and windows, otherwise the air must be cooled by coming in contact with the walls. Neglecting to provide the proper cooling of indoor air may lead to greatly shortening the life of the apparatus due to overheating of the insulation or the sludging of the oil.

Ventilating Self-Cooled Indoor Installations

The volume of air necessary may be determined from the specific heat of air at the temperature agreed upon. At 40° C. (the standard ambient temperature adopted by the A.I.E.E.), the specific heat of air is approximately .0088 watt hours per cubic foot per degree centigrade; so that for each kilowatt loss there are required 1,900 cubic feet of air per minute per degree centigrade rise. A 5° rise of room temperature over the incoming air is usually selected as a practical limit and by using the equation covering the theoretical velocity of a column of heated air, we find that, for rooms with heights varying from 10 to 35 feet, we require an opening area varying from 1.96 to 1.05 square foot per kilowatt loss.

If the room or vault is made only large enough to accommodate the transformer some allowance for friction should be made before using these figures and in order to play safe it might be well to double them. On the other hand, if the room is large in proportion to the transformers there will be considerable heat storage available to carry the apparatus over periods of peak load, while at the same time the larger the room the larger will be the cooling effect of the walls, doors and windows. In general, with the average type of building and the usual load cycle, it would probably be found sufficient to allow 1.5 square foot for each of inlets and outlets per kilowatt loss at full load. In arranging openings, the inlets should be near the floor level so as to bring the cool air to the bottom of the transformer and the outlets as high above the apparatus as the construction of the building will permit in order to increase the height of the air column.

It will be noted, however, with a bank of three 5,000-kv.a. transformers having an efficiency of 98.5, installed indoors with a roof 30 feet above the floor, the theoretical area of the air inlets and outlets to carry full load losses at 5° C. will be 250 square feet. If full load is to be carried for considerable period at least double this amount should actually be provided or say ten openings, each 7 feet square, at the floor and the same at or in the roof.

Outdoor Self-Cooled Units

These figures show that the proper place for a large self-cooled transformer is outdoors where the restrictions in the flow of air may in general be forgotten. As an alternative it may be found advantageous to provide artificial draft for the transformer chamber, when the transformer can no longer be termed self-cooled.

Two types of large self-cooled transformer tanks have become of general use, one consisting of external

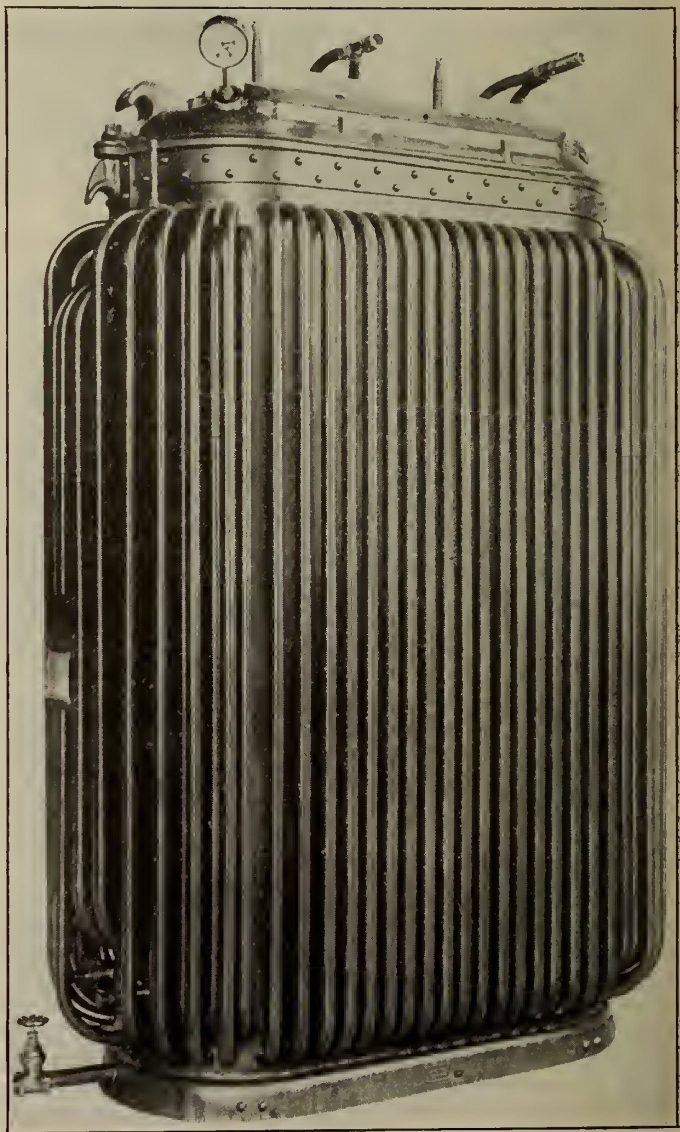

Figure No. 6.—1,000-kv.a. Single-phase Core Type Transformer with Combination Water- and Self-Cooled Radiator Tubes.

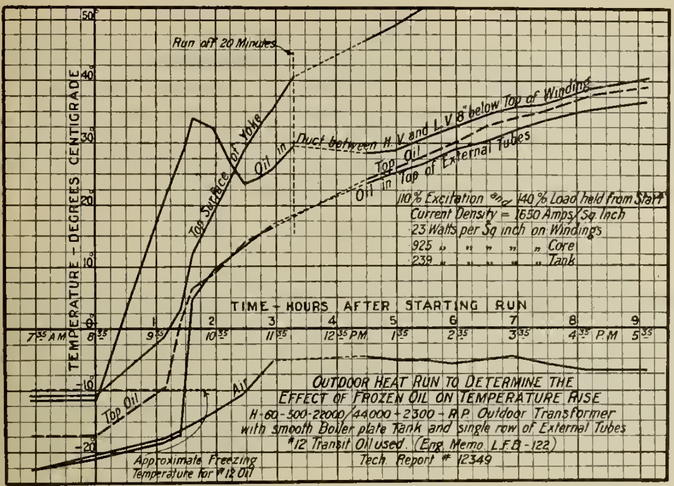

Figure No. 7.—Outdoor Heat Run to Determine the Effect of Frozen Oil on Temparature Rise.

tubes connected to the tank at the top and bottom as shown in figure No. 6, the other having its necessary surface provided by the addition of pressed steel radiators as shown in figure No. 8.

The practice of installing a transformer indoors but locating the cooling radiators outdoors has been used in a number of instances. The radiators are arranged in a double bank mounted on two large manifolds connected to the top and bottom of the tank. The whole is mounted on a truck which permits the assembled parts to be moved as a unit. Another installation recently described in the *Electrical World* has the radiators placed on the roof of the station and the transformer piped to same through an expansion tank.

Some doubt has existed in the minds of many as to the effect that extremely cold weather might have on the oil in transformers with the external cooling features. An experiment was made with a 500-kv.a., unit which had been exposed to a temperature of approximately 20° C. below zero for some time and was then loaded by applying 110 per cent voltage and 140 per cent load. Figure No. 7 shows a summary of the results obtained. It will be noted that the oil between coils, where we might expect the highest temperatures, kept well within a safe limit. No extreme temperatures were found and the transformer soon went merrily on its way with the oil circulating freely.

Outdoor Water-Cooled Units

Of recent years, due to the increase in the size of all units and the attending cost of housing same, the practice of installing water-cooled units outdoors has been finding increasing favour. This was at first considered an unwarranted risk in our climate on account of the anticipated danger from the freezing of the water used for cooling. However, there are a number of outdoor water-cooled stations in Canada which have passed through the last winter without any trouble having been experienced with the water. One of these is on the New Brunswick Hydro-Electric Power Commission's system, a number are in Toronto and western Ontario and two in northern Ontario on the system of the Hydro-Electric Power Commission of Ontario. The ones in northern Ontario are located near Port Arthur and have been subjected to the extreme weather conditions experienced in that vicinity. In the case of the installations in Toronto and western Ontario the only precaution taken to protect the water piping was to lag them heavily with sheet cork. However, it was considered advisable to adopt more elaborate precautions in the case of the Port Arthur units. These transformers were equipped with a housing over the cooling water piping, the cold water feed pipes receiving a certain amount of heat from the warmer water in the discharge pipes. It was also deemed advisable to locate a small heater at the lower end of this housing.

The water piping for all these units enters the transformer on the side of the tank. It would be much more simple and convenient to have the pipe carried through a tunnel or passage to a point beneath the transformer and have them enter the transformer tank through the bottom. There will be a certain amount of natural heat in the tunnel and if necessary a small heater sufficient to insure against trouble could readily be added.

Forced Oil-Cooled Systems

A means of cooling which has been in use in Europe perhaps more than in America is the so-called forced oil-cooled system, which has been used in place of the water-cooled system having the cooling coils within the transformer, and has been regarded with considerable favour for outdoor installations. The insulating and cooling oil is carried from the transformer to a cooler which may be placed at any convenient distance or location where the water will be protected against excessive cold. The cooler may either consist of a series of pipes in the tail race of the power station or an enclosed device where the oil is brought in fairly close contact with cooling water.

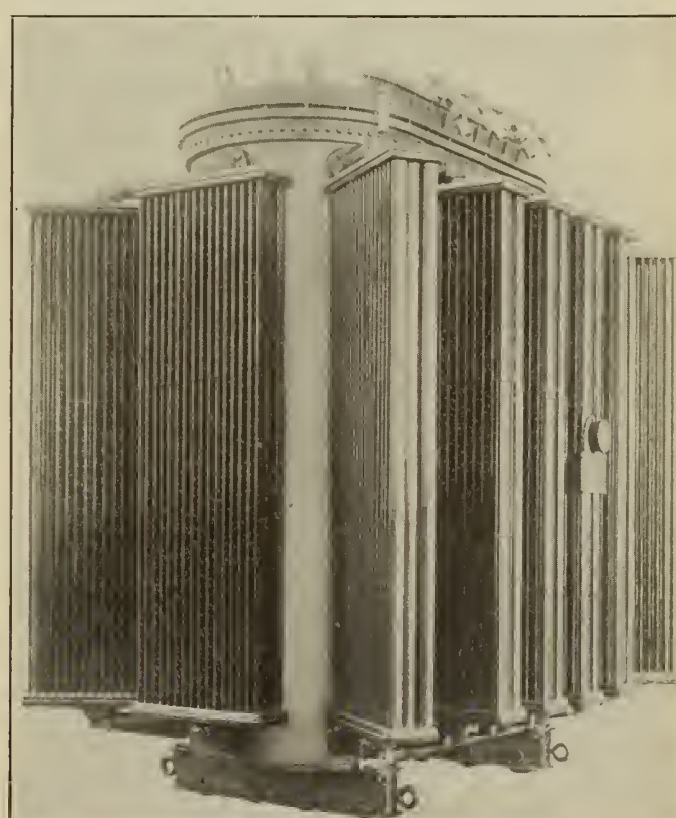

Figure No. 8.—5,000-kv.a. 25-Cycle Combination Self- and Water-Cooled Transformer with Radiators.

These artificial coolers can be conveniently located in the basement of the station or at some place where they are out of the way and at the same time insured against danger from freezing. This type of transformer will be slightly more expensive than the so-called water-cooled unit. It is possible that as the size of transformers built increases this forced oil cooling system may be more generally adopted, the oil circulating system permitting of the permanent installation of oil purifying equipment.

Combination Water- and Self-Cooled Transformers

A combination of water- and self-cooled transformer has been used to advantage in many instances and should, we believe, be found to recommend itself in many installations, particularly in many parts of Canada where we encounter a fairly cold climate during certain parts of the year. Figure No. 8 shows a 5,000-kv.a., transformer conservatively built for 35° rise at a normal load as a water-cooled unit and which will carry a substantial overload without undue heating and will also carry full load as a self-cooled unit with a rise not exceeding 55° C., which with an ambient temperature such as is experienced at the point of installation still keeps the ultimate temperature down to conservative point determined on by the operating company. This construction also permits of the apparatus carrying a fair percentage of its normal load even with a high ambient temperature and should work to advantage should there be considerable variation in the load demanded. With this construction, therefore, we are in a position either to secure some compensation for the extreme climate in which we have chosen to live or some economy in the use of water in case of the load demand dropping off periodically.

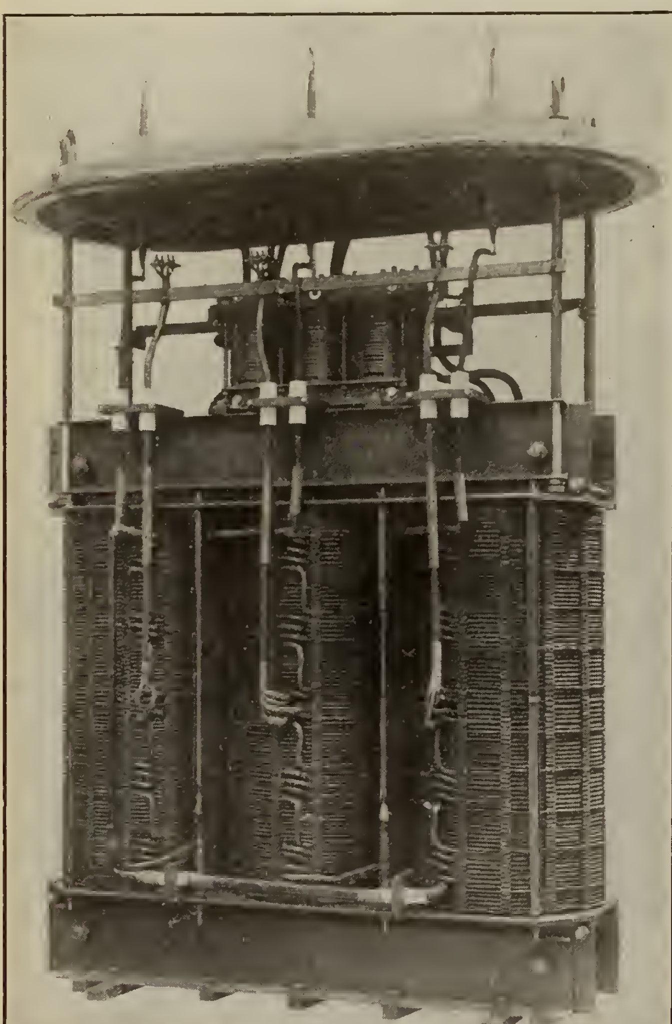

Figure No. 9.—5,000-kv.a. 25-Cycle Transformer with Interleaved Disc Core and Coils.

Smaller Sizes Require Careful Designing

We have allowed ourselves to be lead into a discussion of the different methods of cooling and their relation to the location or type of installation. However, we naturally find ourselves interested in the development of the size and voltage of this type of equipment, and consequently the questions of the means of cooling and where we are going to locate the equipment force themselves upon us.

On the other hand the improvement of the smaller sizes of transformers must not be overlooked if we are to better the efficiency, reliability and economy of our systems as a whole. In fact some of these features force themselves before our attention, as for instance, as the capacity of our systems increases the amount of power behind a small transformer becomes in comparison practically unlimited, and designs must be such that short circuits on the line or other extremely heavy sudden demands of power will not give rise to such severe mechanical strains as to distort the windings.

These forces should be so distributed and the several parts of the apparatus so supported as to resist any tendency to move. It is only of recent years that the magnitude of these forces had been fully appreciated and designing engineers familiarized themselves with same in order to be able to calculate accordingly. Thus the transformer designer must be a better mechanical engineer than was the case earlier in the art. Figure No. 9 shows a three-phase unit having its windings thoroughly supported by rows of insulating spacers and rigidly braced by means of substantial steel members.

Alloy Steel

The vital parts or features of a transformer are the core, the windings, the insulation and the means of cooling. The discovery of alloy steel for the magnetic circuit has been one of the greatest contributions made to the economic and efficient development of transformers. Steel is now produced which has a loss per pound of one-half of what was obtained with the advent of silicon steel and infinitely better than what the first manufacturers were compelled to use. Some interesting discoveries of other iron alloys have recently been made and we are hopeful of laying hold of something permanent and practical in this line ere long. The use of silicon or other elements in steel has a tendency to render it hard and somewhat brittle. While mechanical work upon it, of any sort, has the same effect. It is, therefore, desirable that the laminations of the core should be carefully annealed to remove all strains after all mechanical work such as shearing, piercing, etc., has been completed. Silicon steel of the better grade now employed is practically non-aging.

Winding

Copper is, of course, the universal metal used in the winding of almost all electrical apparatus. We have come to regard the conductivity of copper as a fixed and unalterable characteristic. However, we know that the addition of an extremely small percentage of certain substances will reduce its electrical conductivity very materially so great care is required to keep the copper pure. Improved methods of annealing copper have been developed and we trust more reliable means of rolling and drawing it so as to insure against those fatal enemies burrs, splinters, etc., for which it is now found necessary to inspect before the conductor is covered with its insulation, may be found.

Insulation

Transformers are essentially insulation apparatus and the development of insulating materials and the proper application of them has been vital to the possibility of producing transformers to meet the ever increasing demand for higher voltages. Characteristics of insulation and the most advantageous method of applying the same present a very wide and promising field for careful investigation.

It is rather interesting to note that the first insulation employed in the construction of transformers was paper, and by a more or less curious cycle the manufacturers of the highest voltage transformers to-day employ paper to a very large extent although it now receives very carefully thought out treatments to improve its dielectric qualities. In the early days, especially when air cooled transformers were employed to a great extent and even after the introduction of oil, it was the practice to wrap the coils with a number of wrappings of some textile material and fill the same with an insulating varnish or other compound applied by brushing. This had the evil effect of blanketing the windings unduly and in the case of the oil insulated units it interfered with the proper dissipation of heat by means of the oil.

Every effort is now made to insure that the oil which serves the dual purpose of an insulator and cooling medium, comes as close to all parts of the winding as possible. The winding should, therefore, be thoroughly broken up and positive access of the oil to all parts of the coils insured. This is equally important from a point of view affecting the condition of the oil as well. Improvements have been made in the quality of the insulating oil offered to the trade but it has not been possible to produce an oil which will not sludge to some extent. This objectionable feature can be remedied to a large extent but only at considerable cost. Care should therefore be taken to insure that not only the windings but also the cores, especially those of greater size, are carefully opened up to insure against excessive temperatures at any points. Figure No. 9 shows a modern transformer in which a thorough ventilating of the parts is insured.

Oxidation of Oil

In selecting an insulating oil probably the characteristics that should receive first consideration are its tendency to oxidize or sludge. Almost any oil can be brought to a high dielectric strength by cleaning and drying, while a safe fire point and degree of viscosity is not so difficult to obtain, but it is expensive to produce an oil that will not sludge readily.

Conservator Tanks

The most effective method of preventing the oxidation of oils is to keep oxygen away from the oil particularly when warm. This is effected by means of the use of a conservator which forms an expansion chamber in which the oil is comparatively cool and has a comparatively small surface exposed to the air. This is connected to the highest point of the transformer cover by means of a pipe not too large in diameter to permit too free a flow of warm oil into the conservator tank. The connecting pipe enters the conservator tank a short distance above the bottom of the tank. This expansion chamber should have sufficient capacity to take care of the expansion of the oil in the main transformer due to variation in its temperature as affected by changing loads. The transformer tank proper is completely filled with oil. The oil in the conservator being comparatively cool is very much less subject to oxidation than the warm oil in the transformer and should any slight oxidation take place the sludge will collect in the conservator tank.

This filling of the transformer tank proper has the additional advantage of insuring against the development of excessive pressures due to an explosion of arc gases and air. The mixture of oil vapours and air is not explosive in the usual sense, but an arc beneath the oil may evolve such gases as hydrogen, carbon monoxide and methane which are fairly readily explosive when mixed with air in the proper proportion and under the proper conditions. The proper conditions require a temperature of about 550° C. in the air space, which will never be found under normal conditions but may arise by the failure in a transformer, especially if exposed arcs are produced. The complete elimination of the transformer "air space" therefore reduces the contact between air and oil, decreases sludging and very materially reduces pressure hazard.

Pressure Relief Vents

However, a pressure may be generated in the transformer tank by the development of a fault in the apparatus which evolves gases so quickly that relief cannot be obtained through the comparatively small pipe leading to the conservator. Such a pressure may reach a magnitude sufficient to do mechanical damage to the tank or cover. To insure against this a pressure relief vent is provided such that a sudden rise in the internal pressure will shatter a diaphragm placed across the pipe sufficiently high above the cover as to prevent the outpouring of the oil due to the head in the conservator.

When these relief vents were first adopted diaphragms were made of metal which when pressure was created were dished outward and had their strength very materially increased due to their shape, preventing release of the pressure and in one or two cases causing damage to the tank. A fragile material is now employed and since its adoption the writer has no record of this relief vent not functioning in a way that protected the tank.

Inert Gas Cushion and High Pressure Tanks

Another method recently developed is to fill the upper part of the tank with an inert gas which does not provide an explosive mixture with air and which affords a cushion effect against increased pressure. This arrangement requires a device for admitting an inert gas at low pressure from a higher pressure supply or a means of deoxidizing the air as it passes into the tank through a chamber provided with a special material having this deoxidizing ability.

Some operating companies in wishing to make assurance still more sure in addition to the conservator and pressure relief vent use a tank and cover designed to withstand a hydrostatic pressure of from 25 to 150 pounds per square inch. Figure No. 10 shows such a transformer. Its tank was tested with a pressure of 150 pounds per square inch.

Changing Ratio of Transformers

Taps in transformer windings are always a source of weakness and danger. However, they are evils which appears to be necessary and everyone has past from the stage of enduring to that of embracing them. Among the many serious objections to taps was the inconvenience and danger in changing tap connections when necessary.

The first and most simple method of changing ratio was to bring the various leads outside the transformer case and use any pair which gave the desired ratio. These taps were necessarily located at the ends of the winding.

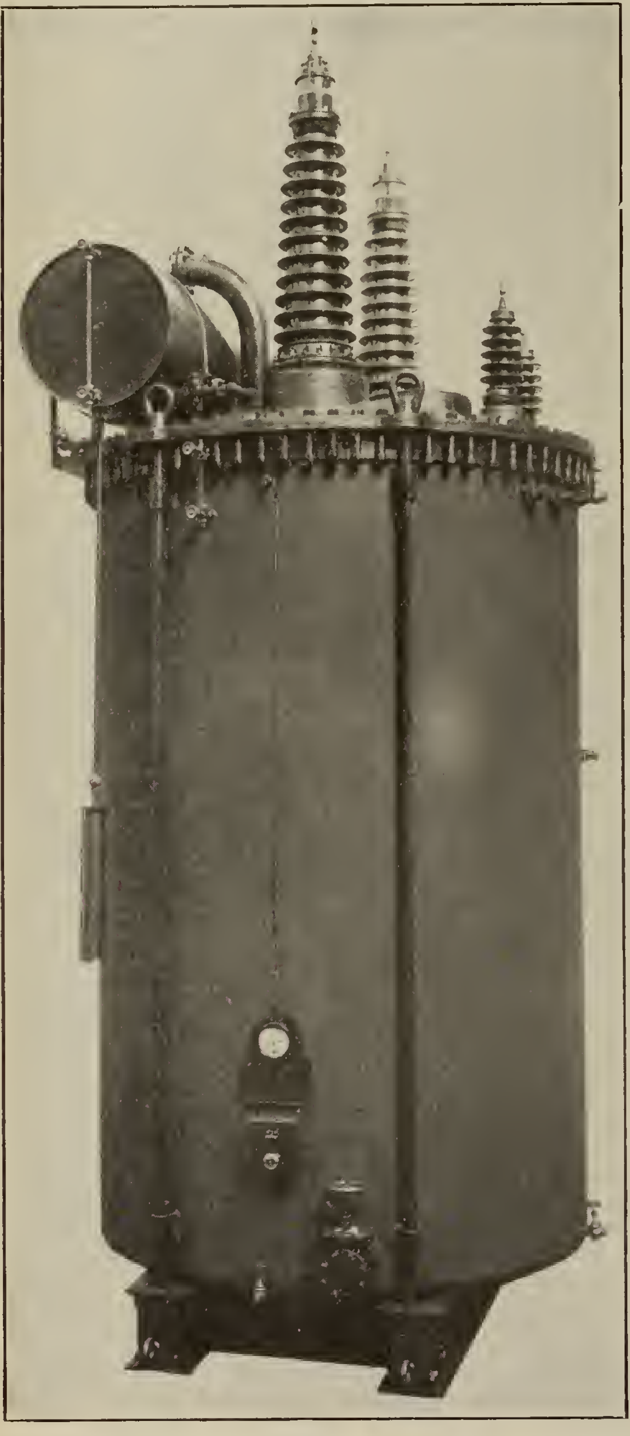

Figure No. 10.—High Voltage Water-Cooled Transformer in Round Steel Tank and with Conservator.

The next step was to use a connection board inside of the tank to which all the leads and taps were brought. Only the line leads were brought through the cover and they could be connected to any desired terminal on the connection board. It was later found necessary to put the connection board under oil due to the increase in voltage. It was soon found to be desirable to locate the tap leads near the centre of the winding in order not to interfere with the heavier insulation placed on the ends turns. The taps were then brought through a multi-conductor lead to the top of the transformer so as to be conveniently reached through the handhole in the cover.

To make the change in the ratio necessitated removing the handhole cover and either lowering the oil or working in what was sometimes found to be uncomfortably hot oil. It was felt that a device for changing the connections more quickly and more comfortably would justify itself and in response to this demand a device called a ratio adjuster was produced. It was first employed on small units but has been more recently developed so as to take care of practically all voltages and currents capacities.

The operating handle of this device was first placed just inside of the cover but the next natural step in the development was to bring the operating handle out through the cover so that the change could be made in a very short time. This arrangement has been provided on a number of outdoor transformers as well as on those for indoor service.

In the case of very large units it was considered unduly awkward to climb to the top of the transformer in order to make adjustment and an operating mechanism consisting of a hand wheel, operating shaft and the proper gears has been employed. Thus the connections can be made from the floor.

In selecting this tap changing device due consideration should be given to the positiveness of operation of the mechanism. This is best insured by having the device self-contained so far as the actual connections are concerned and the movement from one point to another positive. The carrying capacity of the apparatus should be sufficient to take care of short circuit currents and should also be built to withstand practically full line voltage between points.

Changing Taps on Loaded Transformers

Up to this time, the question of changing taps only when the apparatus was not under load has been considered. A demand has existed for some time for a device which would change the ratio when the transformers were loaded. The first attempt to meet this demand was an arrangement in which all taps were brought out of the tank to a quick brake dial switch arranged with reactance which would limit any arcing between contacts. However, this contrivance was limited to a very small capacity and therefore did not meet the general demand.

In order to take care of the larger capacities, transformers were designed connected delta-delta and provided with taps on the ends of the windings. By means of switches outside the transformer one corner of the delta could be opened and closed again upon the tap desired, the load being carried by the other two units in open delta. This operation was repeated for each transformer.

Later transformers were built using parallel "Y" connected circuits, the line ends of the phases being brought outside the tank to two solonoid operated three-phase oil switches. The whole mechanism was controlled from one point by means of a hand wheel mounted on

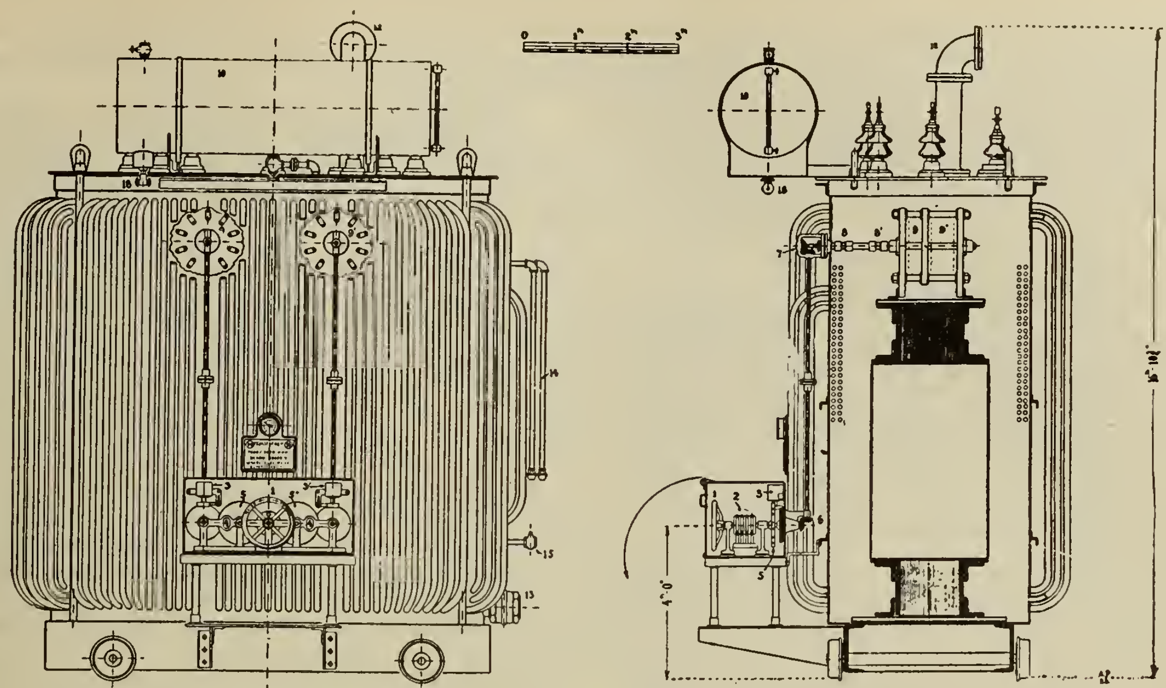

Figure No. 11.—Arrangement of Tap Switching Mechanism when Installed on Transformer.

the side of the tank. In operation one of the parallel circuits was opened by means of one of the oil switches, the position of its ratio adjuster changed one point, and the winding again connected in circuit. The other parallel circuit was then opened, its ratio adjuster brought to a corresponding position, and the circuit closed. This cycle was repeated until both circuits were on the desired tap.

Of course, one circuit carries the entire current during the time the other circuit is opened and a circulating current will flow while the two adjusters are not on the same tap. The circulating current is limited by the inherent reactance of the transformer. Introduction of external reactances in order to limit the circulating current was a further step in the development. This arrangement of tap switching mechanism is shown in figure No. 11; while the diagram showing the sequence of operations of the tap switching mechanism is shown in figure No. 12.

In larger high-voltage units, where it may be desirable to keep the power units free from taps, the regulating part of the equipment may be separated from the other winding and provided by means of a regulating transformer having windings for the regulating operation and being connected by means of oil circuit breakers and reactors so that the ratio can be raised or lowered in very much the same manner as described above. These regulating transformers can be placed either in the centre of the delta winding, at the end of the delta winding or at the neutral end of a "Y" connected bank. If closer regulation is required than can be obtained by the use of taps additional equipment in the form of regulators may be employed to this end.

Some of the installations made have employed a driving motor for more or less automatic operation, while others have been manually operated.

220,000-Volt Transformers

So far as transformers are concerned we have passed into the use of 220,000-volt transmission with but very little stir. No entirely new features have been introduced and the same standard practices as have been employed for some time on high voltage transformers have been maintained. As a matter of economy all the present 220,000-volt systems are operating with a grounded neutral. Considerable economy was, therefore, effected by arranging the transformers to take advantage of this feature by economizing in the insulation at the end of the winding which was connected to the ground. This did away with the necessity of a second high voltage lead.

The terminal connected to the line is connected to the middle point of the winding and the two legs of the high tension winding connected back and forth so as to keep the voltage between coils near each other at a safe low limit, the upper and lower halves of the winding being connected in multiple. This brings the upper and lower ends of the winding to ground potential and permits the winding being located much closer to the core than would be otherwise possible.

The question might naturally arise as to why the economy effected by this arrangement of grounded neutral should not be extended to other voltages. As a matter of fact it has been employed in two or three installations

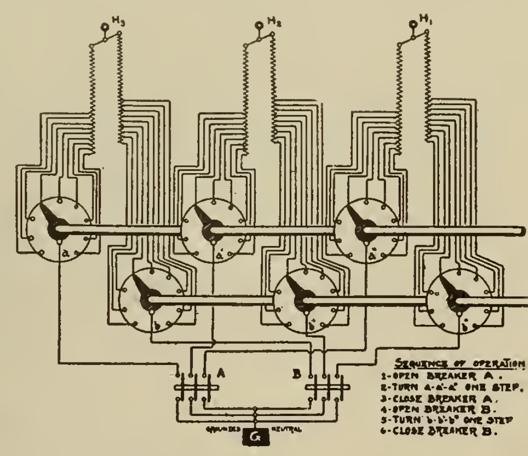

Figure No. 12.—Diagram Showing Sequence of Operations of Tap Switching Mechanism.

with which the writer is familiar. The percentage of economy will, of course, depend upon the voltage and capacity of the units. For instance a greater percentage of saving would be obtained by the use of this system in connection with a 5,000-kv.a., 110,000-volt transformer than with a 10,000-kv.a., 110,000-volt unit. The percentage of saving in a 10,000-kv.a., 220,000-volt would also be greater than with a 10,000-kv.a., 110,000-volt.

Three-Winding Transformers

The growth of transmission systems has not only increased the voltage and capacity of transformers but has in a number of cases developed high voltage networks that must be tied together in order that power may be interchanged between them. In some cases three sections operating at different voltages are tied together at one bank of transformers. This requires a three-winding transformer which requires careful designing in order to allow the proper interchange of load and at the same time maintain satisfactory regulation.

It is desirable at times in tying two systems together that the phase positions should be kept identical and at the same time a neutral connection provided. In this case both windings will be connected star or "Y", and in order to take care of the third harmonic component of the exciting current it is desirable to add a third winding which will be connected in delta and which is generally referred to as a tertiary winding. The capacity of this winding will be controlled by the short circuit load which it has to carry in case a fault develops in the transformer.

In extensive high voltage systems a problem which presents itself is that of voltage regulation which is taken care of usually by means of synchronous condensers. The voltage for these condensers is quite often obtained from the transformer bank and in many cases by means of a third winding. These three-winding transformers, while proving a decided economy both in space and cost of equipment, present some rather interesting problems in design. One complicated determination is that of the reactance between different windings. There have not been very many of these transformers installed in Canada as yet. A couple of such banks are in existence although of comparatively small capacity.

The changes which have taken place in transformer construction have, of course, been very largely called for due to requirements met with in the development of our large generating and transmitting systems and the extension of the application of electricity to a vast number of industries. As to what the future will demand in this connection we cannot, of course, definitely predetermine but since transformer manufacturers have been able to meet almost all demands in the past we are confident that the transformer designer will not be found wanting when further demands are made upon him.

No. 1-B Colliery of the Dominion Coal Company, Limited

A Description of the New Colliery of the Dominion Coal Company Limited, at Glace Bay, N.S., which Contains Features New to Coal Mining Practice in that Province.

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Asst. Mining Engineer, Dominion Coal Company, Limited, Glace Bay, N.S.

Paper read before the Cape Breton Branch, The Engineering Institute of Canada, August 29th, 1925.

No. 1-B colliery, located at Glace Bay on the well-known Phalen seam, is the latest addition to the coal mines of the province of Nova Scotia. A great deal of interest has been shown in the development of this mine, for the following reasons: It was the first-fruits of the merger of the two large coal producing companies of Cape Breton — the Dominion Coal Company and the Nova Scotia Steel and Coal Company. It is not a new mine in the strictest sense of the word, but rather an outgrowth of an old mine, known as Dominion No. 1. Its capacity is greater than that of any other mine in the province. It is entirely submarine, except for the fact that the shaft itself is located on land. Certain innovations have been introduced new to the hitherto accepted mining practice in Nova Scotia.

It will be noted from figure No. 1 that the Sydney coalfield consists of a series of basins, divided by anticlinal folds and named from east to west as follows: Morien, Glace Bay, New Waterford, and Sydney Mines. While New Waterford and Sydney Mines are usually spoken of as two basins, in reality there is one basin only. The synclinal fold of this basin is approximately under and parallel to Sydney harbour.

It will be noted on the same map that the seams are continuous for the most part throughout the field. The Blockhouse seam in the Morien Basin is the same as or at least corresponds to the Harbour seam at Glace Bay, the Victoria at Waterford, and the Main seam at Sydney Mines. Some of the seams, while easily correlated throughout the basins, change somewhat in their physical and chemical characteristics.

The workable seams and those of present proved economic value in Glace Bay are, beginning at the top: Hub, Harbour, Phalen, Emery and Gardiner. The vertical interval between the Hub and Gardiner is 1420 feet.

The Phalen and Harbour seams have been worked extensively, as their quality and physical characteristics are such as to make them attractive economical propositions. Other seams have been proved, such as the Boutilier and Back Pit, which lie between the Harbour and Phalen. Their thickness and quality are such that they are not considered to-day as being of any real importance. There is no doubt, however, that these seams will eventually be worked and millions of tons of coal from them drawn through No. 1-B shaft.

In 1893 a shaft was sunk at Dominion No. 1. In 1900 another shaft was sunk at what is now known as Dominion No. 2. The object of these two shafts was to afford entrance to win all the coal held under lease by the Dominion Coal Company in this section of the field. (See figure No. 2.) All coal to the dip of the barrier was allocated to Dominion No. 2 and the balance to Dominion No. 1.

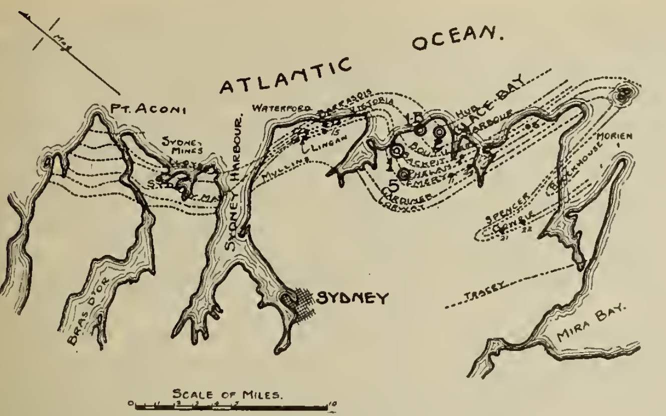

Figure No. 1.—Map of Sydney Coal Field.

In 1914 considerable difficulty began to be experienced in maintaining satisfactory ventilation. This condition had developed gradually, but as the airways became lengthened, the difficulty was accentuated. Increasing the ventilating pressure resulted in very heavy leakage losses without improving the ventilation to any appreciable extent. The cost of opening up these airways and building concrete stoppings was considered prohibitive.

The distance a miner was compelled to walk from the shaft to his working face was in some cases upwards of two miles. When it is remembered that a miner's work is usually quite strenuous, it can be seen that the time and energy expended in walking four or five miles a day underground was unprofitable to both the miner and the company. The roadways in years gone by had not always been developed with the end in view of ultimately making them haulageways for the transportation of men, with the result that a very heavy expenditure would have to be made if these roadways were to be built at this late date.

Another point that was being given serious study at this time was the desirability of establishing an additional escapeway from No. 2 colliery against the possibility of a disaster, such as a fire or explosion. At that time there were three entries into No. 2 mine. One of these entries was via No. 5 colliery. As this latter colliery was rapidly reaching the point of exhaustion, it was deemed advisable to provide another escapeway.

With these objects in view: — improving the ventilation of No. 1 mine; reducing to a minimum the length of walk for the miners of No. 1 colliery; and providing an additional escapeway for the miners of No. 2, it was decided to sink a shaft to No. 1 mine as close to the working face as possible and build a branch line from the S. & L. Railway for the transportation of men on the surface.

It will be seen from figure No. 2 that the seam had been worked out entirely under the land and also for a very considerable area under the sea. The narrow strip which formed the boundary between Dominion Nos. 1 and 2 collieries still remained intact and afforded the only suitable site for a shaft. This explains why the shafts are located within fifty-five yards of the sea cliff, which has an average erosion of eight inches per year.

A circular shaft was sunk and completed as a man shaft and return airway in 1921. The shaft was 670 feet deep and 12 feet in diameter. It was lined with brick for a distance of 213 feet from the surface and below this point was lined with concrete. For a time the shaft was quite wet, due to seepage of sea water. Holes were therefore drilled through the concrete lining and cement grout pumped in under pressure. This practically eliminated the leakage and the shaft to-day is dry.

The long haul necessary to win the coal from the outward limits of the Dominion Coal Company area to Dominion No. 1 shaft was adding very considerably to production costs. On the other hand the limited tonnage available from this area would not justify the cost of sinking a coal shaft and erecting a new surface plant. The economical mining limit was being approached rapidly when the merger was consummated. This completely changed the aspect of things, since it gave access to a large area of coal held under lease by the Nova Scotia Steel and Coal Company, seawards of the Dominion Coal Co.'s. leasehold. (See figure No. 2.) Under these circumstances, it was considered advisable to sink a coal shaft near the air shaft which was the only possible site. The advantages of such a proposition are obvious: the length of haul would be reduced nearly two miles; maintenance of compressed air line and intake airway would be reduced by two miles; a modern and more economical screening and surface plant would be erected; and production would be doubled.

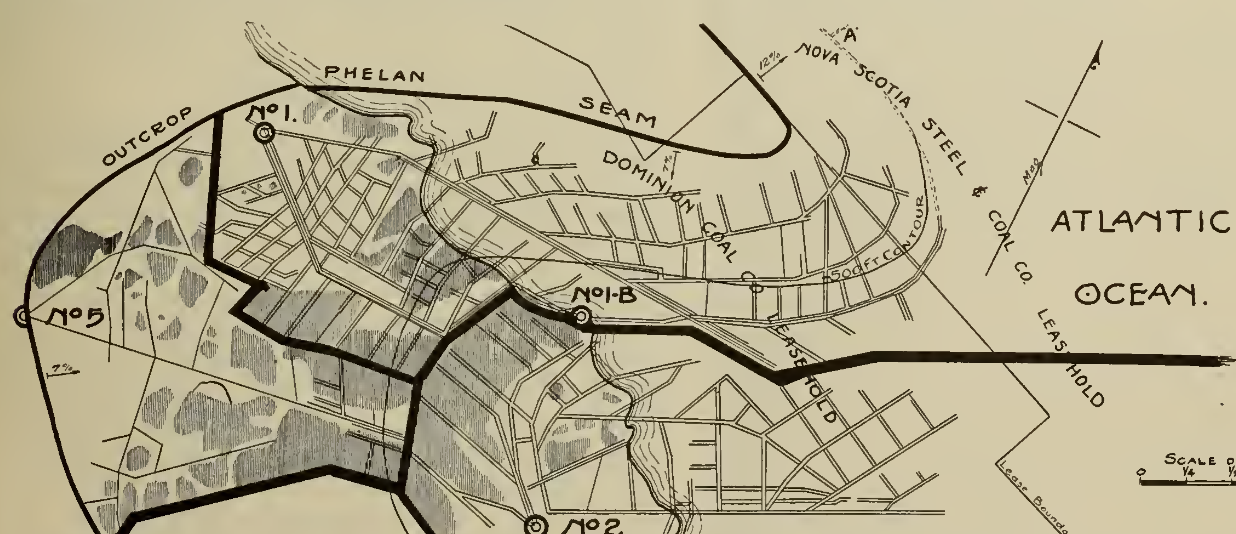

Figure No. 2.—Map Showing Section of Coal Field Held Under Lease by the Dominion Coal Company Limited.

The shaft was located July 30th, 1921, and sinking operations commenced the following month. As already stated the location was restricted within certain narrow limits, which hampered the layout to some extent, both on the surface and underground, but particularly underground.

Since the life of this colliery is estimated at a minimum of 126 years, it was judged to be true economy to give every structure the character of permanence and this has been the dominant note throughout.

The coal shaft is 670 feet deep and 31 feet 2 inches by 13 feet 4 inches in the clear. The shaft collar is of concrete and extends 32 feet from the surface. Below this point the shaft is timbered with 8 by 10-inch buntons and wall plates, and 6 by 10-inch posts, placed at 6-foot intervals, sheathed skin-tight, with 3-inch pine lagging. At 36-foot intervals an additional set of timbers was put in, hitched into the shaft wall for additional support. The shaft timbers are mortised in such a manner that all are interlocked, obviating the use of nails or spikes. All the timber used in the shaft has been treated with creosote. A shaft ring about 230 feet from the surface drains the water off the shaft into a pipe and the shaft is comparatively dry.

There are three compartments to the shaft. Two of these, each 11 feet 3½ inches by 12 feet, are used for hoisting coal and are fitted with double steel guides of 85-pound rail section. The third compartment, 6 feet 3 inches by 12 feet, is used as a pipeway. At the present time there is one 12-inch air line, one 14-inch cast iron water discharge column and a 3-inch water supply pipe.

There is a rock tunnel, 5 by 8 feet, driven from the north end of the shaft at a point 34 feet below the surface to the face of the cliff. The mine water, 1250 g.p.m. is discharged through the 14-inch shaft column to this drift, whence it flows into the sea at a point 9 feet above mean sea level.

At the west side of the shaft and at a point 112 feet above the shaft bottom, an opening, 8 by 15 feet, has been made into the Back Pit seam. Connection is made through a tunnel having an inclination of 55° with the workings of No. 1-B. This serves as a return airway for the colliery.

Shaft Bottom

At the site of the shaft, workings had already been developed without regard to the requirements of a new mine. Consequently in the layout of the pit bottom, the roads in existence had to be utilized whether of suitable grade or not. This necessitated very heavy rock grading. The amount of rock blasted to meet the requirements of standage exceeded 8,000 cubic yards. The pillars in the vicinity of the shaft were very small and the rock blasted from the roadways for height and grade was used to fill the open spaces, thus reinforcing the coal pillars and arresting the process of coal pillar disintegration.

Due to the fact that the shaft was sunk close to the workings of No. 2 colliery, where all the coal had been extracted, there was a possibility of a movement of the overlying strata in the vicinity of the shaft. Any such movement would prove disastrous to the colliery, consequently special precautions were taken to prevent this. For this reason the approach to the shaft, for a distance of 48 feet on either side, was secured by fabricated steel sets, roof, floor and side members being tied together. The roof members vary from 17 feet to 23 feet in length and are 18 inches in depth, with flanges of 11½ inches. The floor members are 12-inch I-beams with 5½-inch flanges. The vertical members are 8-inch H-beams, except in the immediate vicinity of the shaft, where 10-inch H-beams are used. Concrete walls were erected along the sides of the opening, into which the vertical steel supports were bedded and concrete filling arched between the roof members. To give further support, concrete walls were carried for a distance of 600 feet from the shaft. These walls vary from 12 inches to 15 inches in thickness, depending on the roof members they carry and on the condition of the pillars contiguous to them. The roof throughout the roadways of the pit bottom standage is supported by 10-inch steel H-beams of Bethlehem section. The walls of the empty and full roads inbye the point where concrete walls were built were lined with rock from the excavation of the roads and the nearby ventilation tunnel, and were given a face of gunite. The main objects here were the preservation of the coal pillars and the prevention of the forming of coal dust from the crumbling of the ribs, the coal itself being quite friable.

Movement of Output

By referring to figure No. 3, the movement of the output may be readily understood. Trips of 50 or more cars are hauled by trolley locomotives through the main turnout "A" to the standage "AB". The gradient of this standage is 9/10 per cent, favouring the load. The locomotive uncouples at "B" and runs through the run-around track.

The trip is spragged and moves slowly to point "C", where a motor driven creeper chain engages the car axle and hauls the cars to an elevation which permits a gravity run to the shaft bottom. One man is employed at "B" to uncouple the cars and operate the chain. At "C" there is an automatic switching device, which operates to throw the switch points after the passage of two cars. At "D" two automatic switches throw the points alternately. In this way cars are fed to the shaft bottom on four tracks.

Near the shaft the cars are held by a car stop, which is operated by the seating of the descending coal cage. As soon as the cage comes to rest, stops in the cage itself are released and at the same time the car chocks in the full road are thrown open. The cars next to the cage, brought to rest on a 4 per cent grade, move forward by gravity and bump the empties off the cage. The entry of the full cars throws the pit bottom and the cage chocks into service. This automatic caging arrangement is known as the Nolan Cager. Two cars are caged side by side simultaneously and similarly two empties are pushed out on the empty tracks.

By means of a very simple automatic chocking device the cars are regulated to a single track. One car has a clear track to the empty standage, while the second car is retarded by a chock 8½ feet from the shaft. When the first car has travelled 30 feet, the wheel of the car engages with the lever arm of the retarder and releases the second car.

The cars run by gravity to point "E". At this point a creeper chain, similar to the one on the full road, engages the car axle and hauls the car to an elevation sufficient to deliver it to the level empty standage. The cars are coupled at this point and a motor driven pusher pushes the trip forward. The locomotive picks up the trip at "A" and hauls it into the inside workings.

There is a locomotive repair shop close to the pit bottom which has two stalls with pits and is equipped with a crane. Here repairs can be readily effected.

The grades throughout, in the vicinity of the pit bottom, are designed to take care of a constant stream of cars, that is to say, between the full and empty creeper chains the grades are sufficiently great to permit a box to start readily from rest and move forward its own length only and this without excessive jar or shock. If there is any delay in delivering coal from the mine to the pit bottom and hoisting is continued until all cars are removed, between the two creeper chains, it is evident that cars released at the full creeper chain knuckle will acquire a very considerable momentum before reaching the shaft.

As designed, three men are sufficient to handle 2,500 tons in 8 hours, that is, one man uncoupling and running the full road creeper, the motor for this having a remote control, one man signalling the shaft hoist and one man coupling the empties and operating the empty creeper.

Pumping

To centralize the pumping of Nos. 1 and 5 collieries, the combined water growth of which is 1,200 gallons per minute, it was decided to impound the water in one main lodgment near No. 1-B shaft, advantage being taken of existing barriers for this purpose. The make of water at No. 1-B itself, being less than 30 gallons per minute, is allowed to drain through two 2¾-inch boreholes driven through the barrier to No. 2 Mine. This mine is naturally dry, and very little of the water entering through these boreholes has to be pumped as the ventilating current takes up a considerable portion of it.

The pump room is located in an old chamber which was later excavated to a height of 14 feet and the ribs reinforced with 12-inch concrete walls. The roof is supported with 85-pound rails set at 9-inch centers and lagged with brick.

The pumping plant consists of two 3-stage Sulzer centrifugal pumps, each direct connected to a 400-h.p., 2,200-volt motor, running at 1,500 r.p.m. Each pump has a delivery of 1,250 g.p.m., against a head of 630 feet. There is a third pump of the reciprocating type, motor driven, which pumps the water from the shaft sump into the suction of the Sulzer pumps.

An ell of the pump room contains the switch gear and step-down transformers for the lighting of the pit bottom and the operation of the car haul motors. A split of fresh air, conducted through a 12-inch wrought iron pipe from the main aircourse, ventilates the pump room.

Development

As already mentioned, a very large area of coal is allocated to this mine. It is difficult to say just where the economic limiting line exists, but it is reasonable to assume that as the years go by and advances are made in engineering practice, this limit will be further seawards.

By referring to figure No. 2, it will be seen that the contour of the seam swings through an arc of 115 degrees, as it turns around the anticline separating the Glace Bay and Waterford basins. While the shaft is located in the Glace Bay basin, it is apparent that the bulk of the coal to be drawn to No. 1-B shaft will be from the Waterford basin. The seam is 7 feet thick, clean coal, and is suitable for metallurgical purposes.

By means of cross-measures drifts from No. 1-B workings overlying and underlying seams will eventually be won.

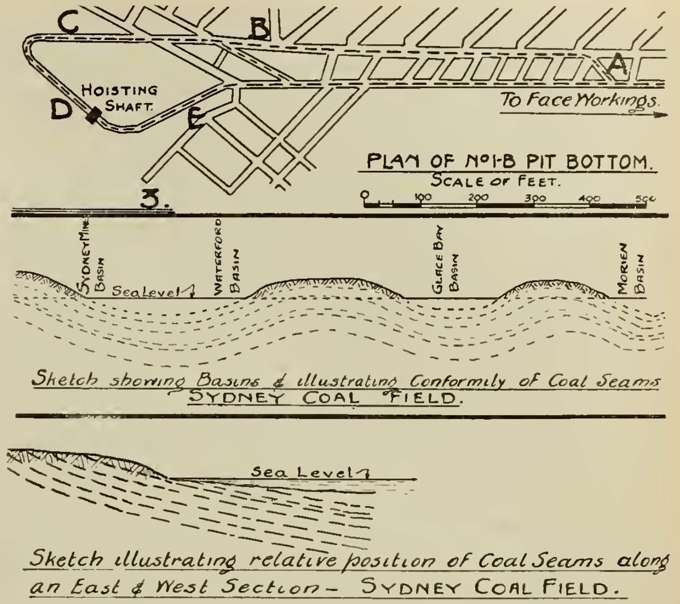

Figure No. 3.—Plan of No. 1-B Pit Bottom with Sketches Illustrating Conformity of Coal Seams and Relative Position of Coal Seams Along an East and West Section-Sydney Coal Field.

The tonnage of coal recoverable from these seams from a boundary line considered within the present economical limit is: Hub, 18 million tons; Harbour, 27 million; Phalen, 43 million; Emery, 22 million; Gardiner, 30 million; or a total of 140 million tons. With an output of 2,500 tons per day and continuous operation, i.e., 280 days per year, the Phalen and Upper seams alone will make the life of the colliery 126 years. If the lower seams are added, the life of the colliery will be 200 years.

The Phalen seam only is being worked at the present time. The main development at present is a haulage way which follows approximately the contour of the seam from the shaft bottom. At present the face of this roadway is 2.3 miles from the shaft. It will continue to drive along the contour until it reaches the western barrier, 4.3 miles distant from the shaft. This barrier is the eastern limit of an area reserved for development from North Head, Lingan.

At a point one mile from the barrier it is proposed to develop deeps on the full dip of the seam for a distance of at least two miles. The length of face between the barrier of the reserved area and No. 2 colliery is three miles. As this is considered too great a length of face tributary to one deep, a second set of deeps will be started shortly at point "A" and driven parallel to No. 2 barrier. This will take care of one mile of producing face. By the early winning of these deeps, the output of the mine can be easily maintained while the long development to and of the farthest deeps is being prosecuted.

The system of mining is pillar and room. This is the only system feasible within present cover limits, where 56 per cent of the coal is left to support the sea bottom. As the cover increases to the dip, a point will be reached where all the coal may be safely extracted. This may be done by removing the pillars formed by first operation or by longwall. Hydraulic stowing has been suggested for this seam, replacing the coal by sand, crushed slag and other refuse. This, however, is not considered economically feasible at the present time.

Until recently rooms have been developed 20 feet wide with crosscuts, at intervals of 75 feet, 12 feet in width. This has been the standard practice in all the collieries of the Phalen seam for the last twenty or more years. Recently a slight change has been made, the rooms being reduced in width to 16 feet and the crosscuts increased in width from 12 feet to 16 feet.

The same percentage of extraction is maintained and the rooms are so spaced that there is always a crosscut cutting face to each room. This change, slight as it is, has many advantages, the most important of which is a concentration of workings 100 per cent greater than obtains at present. It also results in a safer working condition at the face, improves the ventilation and makes it easier for the miner and loader. One-third of the present producing faces are working under the new system. It will require about eighteen months to make the system effective throughout the entire mine.

The coal is cut by air driven Ingersoll Rand radial coal cutter machines. These machines are comparatively light, weighing 391 pounds, and are easily moved. They are capable of undercutting seventy-five tons or more per machine per day, although the average perhaps does not exceed fifty tons.

For some time the company has had under consideration the installation of another type of mining machine, viz., the Arcwall chain machine. The machine weighs five tons and is equipped with either an electric or turbine-air drive. This machine will cut the coal in one-fifth the time of the radial cutter. On the other hand, it is much more difficult to move from place to place. This is particularly true of the turbine-air machine.

The electric driven Arcwall machine is undoubtedly an advance over our present coal cutter, but the introduction of electric current to the working face presents its own difficulties, as there is always the possibility of ignition of gas or dust from electric sparking. These machines are equipped with explosion-proof motors, but the cables leading to the machines have been known in several instances to be responsible for the ignition of gas.

To minimize the dangers from the use of electric current at the face, it has been proposed to use water to lay the dust and prevent its ignition and also to use stone dust to prevent the propagation of flame originating in a gaseous atmosphere. In the writer's opinion there is no doubt that electric coal cutting can be made reasonably safe if proper precautions are taken to offset possible dangers.

Electric coal cutting is coming more and more to the front in the coal mines competing against Nova Scotia. We must either adopt modern methods and take advantage of every reasonable means to produce cheaper coal or be relegated to the discard in the economic struggle.

At the present time air is compressed at Dominion No. 1 colliery and transmitted through an 8-inch main to No. 1-B workings. This is supplemented by a compressor of 3,000 cubic feet capacity at No. 1-B shaft. In the course of eighteen months, No. 1 colliery will be exhausted and either additional compressor capacity will be required at No. 1-B or electric coal cutters will be introduced.

Transportation

The coal is loaded at the working face into cars of two tons capacity. The dimensions of the cars are: height, above rail, 3 feet 8 inches; inside length, 8 feet 8 inches; between buffers, 10 feet 3 inches; width, 4 feet 4¾ inches. The rail gauge is 36 inches, wheels are 16-inch tread diameter and are equipped with Timken roller bearings. The cars are built with solid ends and require a complete revolution to empty them. As a result they are comparatively dust proof. The cars are hauled by horses from the producing face to room landings, an average distance of 1,300 feet.

Trips of seventeen cars are made up on the landings and lifted by a 15- by 16-inch Ingersoll Rand air hoist and lowered through a headway to the main landing. Three headway trips, or fifty-one cars, constitute a normal main haulage trip. Two headways are in operation at the present time, the average output from each being 750 tons.

Each air hoist is so designed that it is a combined hoisting and compressing engine. When hoisting, it offers all the advantages of an efficient hoist. When lowering, the design permits of air being compressed into the main pipe-line, with good efficiency.

The rope speed is controlled by the amount of air compressed and is at all times under control of the operator. By the movement of a lever, more or less air is compressed, thus governing the speed of the rope, thereby effecting a direct saving in energy that is usually absorbed by friction brakes.

Its operation from hoisting to lowering or compressing is automatic. The hoist is equipped with friction brakes for emergency. A compressor discharge valve is placed in a by-pass to insure automatic passage of the compressed air and to prevent the return of the compressed air when hoisting or with the throttle valve open.

Coal from the dips is hauled in 13-car trips from room landings by means of main and tail rope motor driven hoists. There are two of these hoists in operation, each driven by a 150-h.p. motor, at 2,200 volts. The coal is hauled from the main landings to the shaft bottom by three 13-ton, 240-h.p., d.c., Goodman trolley locomotives. The line pressure is 250–275 volts. These locomotives have a draw-bar pull of 6,500 pounds on a level grade, at a speed of eight miles per hour. The wheels, 33 inches in diameter, have cast iron centres with steel tires 2¾ inches thick, the tread being 3 inches wide, and the wheel base 66 inches. Each locomotive has two 120-h.p. geared motors, centrally hung, of the open type. There is a controller of the open drum type at each end of the locomotive.

Three of these locomotives provide ample margin in handling the total output from the present workings. It is estimated that the main haulage can be extended another 5,000 feet without additional locomotives.

The system of main haulage at most collieries, both here and on the main land, is plane rope, endless rope, or a modification of these. It is true that Jubilee colliery, Sydney Mines, had some years ago introduced storage battery locomotives for the main haul, which in this case was very short. Also about twenty years ago, compressed air locomotives were introduced in Nos. 2 and 9 collieries to meet a somewhat similar condition as that existing in No. 1-B to-day. While these locomotives did the work, they were far from economical and in time were discarded.

About twenty-five years ago, a trolley locomotive was used in No. 1 mine for comparatively short level hauls. Whether or not it was considered economical in those days, it is certain that it was operated without regard to the possible dangers arising from a dusty road.

At No. 1-B, owing to the changing direction of the contour, it was not considered feasible to work this mine with rope haulage with any degree of success. To meet this curvature condition, it was necessary to install locomotive haulage of some kind.

The merits of storage battery and trolley locomotives were discussed fully. It was felt that for long runs, such as will be the case in this colliery, that trolley locomotives would be the more economical. This decision led to special precautions being taken to prevent dust or gas ignition. It also necessitated the widening and increasing of the height of the roadway. The roadway as originally developed was 7 by 10 feet. It was necessary to increase this to 8 by 20 feet, giving it a finished clearance of 6 feet 6 inches by 18 feet. This clearance holds good, except for a distance of 1,000 yards between the shaft turnout and the assembly yard, which is laid with single track. Upwards of 14,000 tons of coal and 16,000 cubic yards of rock had to be excavated in preparing this roadway. The ruling grade is one-half of one per cent against the load.

The coal, of course, was loaded out to the surface, where it had a market value. The disposal of the stone, however, was a more difficult problem. All openings adjoining the roadway itself were stowed with excavated rock. Although there were numerous vacant chambers to the rise of the parallel roadway, these could only be used to a limited extent, as this latter place was the chief coal road of No. 1 colliery and intensive development work was being carried on at the same time as construction.

Stone packwalls were built along both ribs of the haulage way. These walls varied in thickness from 1 foot to 4 feet, depending on the road alignment. This absorbed about 6,000 cubic yards of excavated material. Where the rock was of a sandy nature it was crushed to a size suitable for road ballast. Apart from a small section at the pit bottom, all excavated material was disposed of as outlined above.

The packwalls were given a coat of gunite, 1 of cement, 3½ of sand. This bonded the walls, closed the crevices and reduced to a minimum irregularities where coal dust might lodge. The walls prevented spalling of the coal ribs, which would have created a very serious dust menace.

The roof, which consists for the most part of soft shale is supported by rail beams, 60 pounds to the yard where the span does not exceed 12 feet, and 85-pound and 100-pound rails where the span exceeds this. A number of 6-inch H-beams, rolled by the Dominion Iron and Steel Company, were also used. These, however, although of proper section were found to be too soft and 100-pound rails are now used exclusively. The rail booms are supported by black spruce props imbedded in the packwall. Considerable lofting is necessary over the steel booms as the roof deteriorates due to the changing temperature.

In the extension of the main haulage, now under construction, straight concrete walls 8 inches thick are erected on either side and these support the rail beams. To prevent the falling on the roadway of small pieces of stone from the roof between the beams, skin-tight lagging between rails has been resorted to.

The track rails are 60 pounds to the yard, laid on ties 6 inches by 6 inches by 5 feet, spaced at 30-inch centres. The rail is perhaps on the heavy side, but it makes a good substantial track for main line, which must serve for many years. The rails are bonded with copper bonds at each rail joint and cross-bonded at 200-foot intervals. At intervals of 2,500 feet, the track rail is grounded to the main air pipe on the parallel road. The tracks are laid at 8-foot centres and as the locomotives are 5 feet 2 inches in width, this gives a clearance of 2 feet 10 inches between passing locomotives. This is ample to permit centre supports if these should become necessary. There is a clearance of 1 foot 11 inches between the locomotives and packwall on the low side and 2 feet 11 inches on the high side. The high side is used as a walkway by workmen and officials, whose duties take them on the haulageway during operations. In addition to the clear space of 2 feet 11 inches, there are manholes established at 100-foot intervals as a further safety measure.

The trolley wire is hard drawn copper, 4/0, B. & S. gauge, fastened to insulators, secured to the roof beams. It is offset 6 inches east from the low side rail and supported at a height of 6 feet 4 inches above it. There is a feeder cable carried close to the packwall on the low side of the roadway. The drop at the end of the line does not exceed 45 volts.

Considerable sparking was experienced when operations commenced. This has been very much reduced by fixing the trolley wheel so that it makes a sliding contact.

The 300-k.w., C. G. E. motor generator set, which supplies direct current to the trolley system is located 4,600 feet from the shaft bottom in the same chamber as the motor driven deep hoists. A 4/0, 3-conductor, paper insulated, lead covered, armored cable, 2,200-volt, is carried from the air shaft along the intake airway to the motor generator set. The generator is driven by a synchronous motor, 750 r.p.m.

Throughout the entire length of the roadway, stone dust has been used freely to neutralize as much as possible the combustible coal dust. Coal spillage is cleaned regularly from the roadbed. In spite of this, quantities of small coal accumulate and are ground by traffic into dust. Coal dust is also swept off the top of full cars in motion. The combined velocity of the inbye air and the outward bound car creates a very strong current and at places produces a cloud of dust to the rear of the moving trips. Steps are being taken now to spray the loaded cars with water at the main landings, which will help this condition materially. The roadway is examined daily and samples of dust taken at frequent intervals. The degree of fineness is determined and the combustible matter present ascertained. It is aimed to keep the combustible dust below 25 per cent, although as high a percentage as 45 might be considered safe. The stone dust is derived from George's River limestone, crushed by a Bradley pulverizer, to pass 85 per cent through a 200 mesh.

Ventilation

The mine is ventilated by a 5- by 10-foot Sirocco forcing fan, connected by a Morse silent chain drive to a 400-h.p., Canadian General Electric synchronous motor. The fan is designed to deliver 300,000 cubic feet of air at 6 inches w.g. At the present time the fan delivers 90,000 cubic feet with a w.g., of 3.8 inches, running at 183 r.p.m. There is a standby, 20 by 42 inches Dixon steam engine connected to the fan shaft by a rope drive. The air is delivered through a staple pit, 11 feet 4 inches by 13 feet, and 40 feet deep, to a drift 74 feet from the circular shaft, to which it is connected. It will be recalled that this airshaft was sunk prior to the merger and before such a large development was contemplated. As a consequence, while the shaft is of ample dimensions for the requirements of the next ten or twelve years, nevertheless at some future date when the quantity of air required is considerably greater than it is to-day, a much larger shaft will be needed. When the larger air shaft is completed, a rock drift will be driven through to the staple pit and the ventilation diverted. The fan is amply big for all future demands.

As the air shaft is equipped with hoisting cages and is used during coal hoisting periods by officials and also for the lowering of certain materials, it was necessary to build an air lock at the shaft mouth. This consists of two chambers, each 17 feet 4 inches square. The section immediately over the shaft extends to a height of 33 feet 10 inches above the surface. The roof is pierced with two small openings for the passage of the hoist ropes. The height of the outer chamber is 11 feet 4 inches. Between the two chambers there is a ¾-inch steel raising door, 10 feet by 8 feet 6 inches, with a trap door 6 feet 6 inches by 2 feet. The outer door is a double one, 8 feet 6 inches by 6 feet, with a trap door inset. The air enters the shaft at a point 43 feet below the surface. At a short distance from the shaft bottom, the air is split into two main airways. These run parallel to the main haulage for a distance of 2,200 feet. At this point a connection is made with the main haulage road. One airway is continued to the face, the main haulage serving as a second main intake also. It is necessary that trolley haulage be operated only on intake air.

To prevent short circuit of the air to the coal shaft, an air lock was established on the main road, the doors being set 1,250 feet apart. This distance enables the motor trip to pass through the air lock without any appreciable reduction in speed. The doors are of wood, 7 feet 4 inches by 6 feet 5¾ inches, bedded in concrete. A smaller door, 6 feet 5¾ inches by 2 feet 6 inches, is set opposite the travelling way.

The total pressure on the main door is nearly 700 pounds. It is customary for the trapper, (when the locomotive is approaching), to open the small door and equalize the pressure on both sides of the main door before attempting to open the latter.

The leakage is sufficiently great to ventilate thoroughly the haulage road from the air lock to the shaft. The air is split into five separate ventilating currents, so that the return air from each working section passes directly into the main return airway. The main return air divides itself naturally between No. 1 shafts and No. 1-B coal shaft. At some future date the return to No. 1 shaft will be closed off, in which case all the return air will make its exit through No. 1-B coal shaft via the dumb drift. The area of the airways leading to the shaft and the shaft itself is sufficiently great to do this without adding undue resistance to the air.

It will be recalled that one object of the circular shaft was to provide an escapeway for the workmen in No. 2 colliery, in case of a disaster cutting off No. 2 mine shafts. Shortly after the circular shaft was sunk, a passage was driven between Nos. 1 and 2 collieries, 140 feet in length and 6 by 8 feet in section. In this passageway, doors were erected which effectively separated the ventilating currents of the two mines. These doors are referred to as "explosion doors". It is hoped, in the event of an explosion in either mine, that the doors may withstand the force of the blast and provide an escapeway for survivors.

There are four doors, located in pairs, two doors being hung on one frame. The distance between frame centres is 15 feet 9 inches. The frames are heavily constructed of cast steel and each is securely fastened into a heavy reinforced concrete ring. They are 23¼ inches thick on the bottom and 18 inches thick at the top, leaving room between the doors for a man when the doors are shut. The battered frame insures the door being shut by their own weight. The door opening is 2 feet 6 inches by 5 feet 6 inches. The doors are also of cast steel 1¼ inch thick, heavily ribbed and further strengthened by having their outside surface convex. The bearing surfaces between doors and frames are machined so that there is no air leakage between the mines. The door hinges are equipped with grease cups and open easily. The perimeter of the passageway between doors and for a distance of 5 feet on the outer ends is lined with concrete. A 4-inch pipe with a trap drains the water from No. 1-B into No. 2 colliery.

This colliery is designed to hoist 2,500 tons per 8-hour shift. It was officially opened June 20th, 1924. The maximum output raised in any one shift until the cessation of work due to the labour situation was 3,048 tons, on December 8th, 1924.

Marketing Nova Scotia Coals

A Suggested Investigation and Educational Campaign to Promote the Wider Use of these Fuels

H. A. Hatfield.

Maritime Representative, Babcock-Wilcox and Goldie-McCulloch, Limited

Paper read before the Maritime Professional Meeting of The Engineering Institute of Canada, at Halifax, October 8th, 1925.

According to Bulletin No. 630, published by the Mines Branch, Department of Mines, at Ottawa in 1925, the bituminous coal used in Canada in 1923 was, in round numbers, 29,600,000 short tons, of which the United States supplied 17,300,000, Great Britain 269,000, and all Canada about 12,000,000 tons. Out of this western Canada mined about 7,500,000, and Nova Scotia a little over 4,000,000 tons, of which approximately 1,250,000 went to Montreal and its vicinity.

Our mines can produce, (approximately), 7,000,000 tons, and to keep them working continuously we have to find a market along the St. Lawrence for an additional 3,000,000 tons. In the year referred to, Quebec and central Ontario used 16,400,000 tons of soft coal and 4,800,000 tons of anthracite, so it should not be difficult when we have the information needed by coal users and stoker manufacturers, to find a place in that market for all the coal Nova Scotia can produce.

Our coal is used successfully at many steam plants in the Maritime Provinces and in and around Montreal. Moreover, it is handled with all types of stoker equipment. In the Montreal district, competition with foreign fuels is close, so that users must get satisfactory results or they would not buy our coal.

Without doubt our furnace designs and firing methods can be improved by studying the plants which use the million odd tons of coal shipped up the St. Lawrence each year. On the other hand, by studying our coals we shall be able to furnish more reliable information about them, and the stoker manufacturers would be in a better position to supply the proper equipment to burn them.

To engineers in the coal fields the problem of keeping our mines busy is of great importance. One difficulty in keeping the Nova Scotia mines working is, that on account of winter interruption of St. Lawrence shipments, continuous operation means piling coal at the mines. The argument usually offered against the success of any such plan is that it costs too much to pile and reclaim the coal. That the cost of piling coal without proper facilities is high cannot be disputed. But figures from several large central power plants in the United States show costs varying from 15 cents to 25 cents per ton, where the work was done with drag scrapers or electric cranes.

In this part of Canada the cost has been 45 cents to 65 cents per ton, because the coal is usually dumped from the cars and spread by hand, and reclaimed in the spring with a locomotive crane. It is probable that after a thorough study of the problem of storage, and after installing the proper equipment, the cost could be cut to 30 cents per ton or less.

Moreover, our piled coal should have a better chance in the Montreal market, for it has been the experience of several large coal users in that city that Nova Scotia coal which has been piled for several months gives better results in a furnace designed for eastern American coals than our freshly mined coal. A reason for this is given in Bulletin No. 97, issued by the University of Illinois. The coals tested at Urbana had analyses very much the same as those from our Nova Scotia mines. It is explained that freshly mined coal has a large capacity for absorbing oxygen, which combines chemically with both the organic combustible and the iron pyrites present while the coal lies in the pile. When these constituents become saturated the coal does not give up its heat units as readily as fresh mined coal. On account of this characteristic, such coal is thought to have lost a large part of its heat, when as a matter of fact, it may have the same number of heat units, but a different rate of combustion. The difference can be off-set by a stronger draft, which will speed up the burning or oxidation process and a corresponding increase of efficiency will result. The correctness of this theory is borne out by the results shown in the following table, which is taken from page 37 of the University of Illinois Bulletin No. 97.

Table No. 1,—Results of Boiler Tests with Mission Field Fresh Coal and with Weathered Coal after Six Years in Storage.

Fresh Mission Field Coal			Weathered Coal			
Test No.	Boiler h.p. developed	Efficiency of boiler furnace and grate per cent	Test No.	Coal and county tables (5 to 10)	Boiler h.p. developed	Efficiency of boiler furnace and grate per cent
10	554.0	63.96	20	Nut—Sangamon	568.5	64.50
11	569.6	61.21	21	Screenings—Sangamon	557.2	63.05
12	572.7	60.67	22	Nut—Williamson	727.1	65.98
13	589.0	69.87	23	Screenings—Williamson	509.6	60.04
14	555.9	64.75	24	Nut—Vermilion	655.0	64.20
15	506.6	65.50				
16	644.0	60.84				

It is to be noted that the over-all efficiency of the weathered coal averages quite as high as that of the fresh screenings. The general summary covering the behaviour of weathered coal in steam generation after six years of storage, as set forth in Bulletin No. 78 of the University of Illinois Engineering Experiment Station, is as follows:

"1. Burning weathered coal is largely a question of correct handling and ignition. Under these circumstances it gives as good results as fresh screenings.

"2. Weathered coal required a little thinner fire and more draft than fresh screenings.

"3. When using weathered coal the fuel bed should not approach any nearer to the water-back than from 4 to 6 inches, otherwise trouble with clinker is experienced.

"4. Practically as high capacity was obtained with weathered coal as with the other coals used, and, if anything, the fuel bed requires less attention."

The bulk of the coal used in Montreal and district comes from Pennsylvania and West Virginia mines, and has a smaller percentage average volatile than our coals. It can be burned in a lower furnace because the flames are shorter, but it requires more draft. When our coals have been stored, they should be better suited to these conditions, but we have to find out if all kinds can be stored and the exact results with each.

If we are to supply all the Eastern Canadian market, it is necessary to teach the consumer the business of buying in the early summer and storing properly. Some large steam coal users understand this now, and it is not difficult to deal with them because they realize the loss if their plant shuts down for want of coal. But the majority of plants take chances on strikes and other troubles because they are able to get coal from the United States and England as well as from Nova Scotia.

Probably the next objection offered will be that there is a great chance for loss due to the coal heating while in the pile. This difficulty has been overcome by spreading the coal so that the larger pieces do not separate from the fine stuff. Each layer of the pile is rolled as it is spread, so that the whole pile is packed thoroughly from top to bottom, and the circulation of air is eliminated. One method of keeping the pile from scattering is to build a sealed wall on each side and one end. Unless the wall is used the loose coal at the sides of the pile must be carefully gathered up. This trimming can be done by the locomotive crane operator with his bucket. It is a factor in favour of coal that has been piled at the mines that it is very unlikely to give further trouble by heating. Buyers who have had trouble on this account should be glad to get stored coal when informed of this fact, and taught how to fire it and what draft to give it.

For the purpose of studying the plants using our coal and the requirements of each consumer in our prospective market, the Nova Scotia government might well send out a man who would visit all the steam plants in eastern Canada and obtain such data as:—The quantity of coal used in each plant; its characteristics; how it is fired; pounds burned per square foot of grate; draft at boiler damper; type of boilers; pounds of water evaporated per pound of coal.

While the field man is collecting information about the market, it is proposed to get experimental data about the various coals at the Nova Scotia Technical College, Halifax. By working in close co-operation it should be possible to settle questions of furnace design so that eventually the field man can advise each coal user as to the coal best suited to the particular requirements of his plant.

The field man would necessarily be a combustion engineer, well grounded in steam engineering generally, for in plants already established he would have to talk "shop" with the operating staff in order to get the correct information about their equipment and requirements, and to interest them in such a way as to lead to orders for Nova Scotia coal. He would keep in touch with all new work and advise power plant designers of the best Nova Scotia coal available for their particular purposes and the best type of furnace in which to burn it. He should be prepared to talk, and take opportunities to address meetings of engineers and manufacturers, in order to develop interest in the product of our coal mines.

Keeping in touch with new work is particularly important, for business gained that way will induce other concerns to build their new furnaces to burn our coal efficiently. Also it amounts to something each year. This year, for instance, one company has already built boilers for eastern Canada which will use between 325,000 and 350,000 tons of coal per year. If any of these consumers have arranged to buy foreign coal and have built their equipment to burn it, rather than our local coals, it will be just that much more difficult to get them to try our coal and to find one that will be satisfactory.

It is equally important that the field man be enthusiastic over the work and well posted on handling our coals, for he will have to explain and demonstrate to the users how to pile it and how to burn it. He will have to explain the effect of weathering while in storage, and prove that a stock of coal at the consumers plant is cheap insurance against shut-down. Fortunately, as explained before, there are good engineering reasons why Nova Scotia coal that has been piled is to be preferred by the consumer in Montreal and vicinity. The field man can get proof of this from the plants he visits.

It is necessary to put a man in the field who can answer every argument, because the coal users in our prospective market have an idea that all our Nova Scotia coals are high in ash and sulphur and they cannot expect good results from them. The information available in government reports has not controverted this idea. Take for instance the report of J. B. Porter, M.E.I.C., R. J. Durley, M.E.I.C., and others who made an "Investigation of the Coals of Canada with Reference to their Economic Qualities". This report of six volumes is deemed a classic, and is found in all technical libraries of any size. But these boiler tests were made about 1910, and since that time we have changed our ideas as to what quantity of water a pound of coal should evaporate. Table 8, on page 41 of that report, shows that the equivalent evaporation per pound as fired of the coals from this district averaged about 7.3 pounds. They used a Babcock and Wilcox boiler for their tests, which was set so that the front of the grates were 24 inches from the tubes. If a boiler set as high as the Babcock and Wilcox at the Nova Scotia Technical College, Halifax, had been used to test these coals, it is likely that the evaporation would have been at least two pounds greater per pound of coal fired. Therefore, although we can admire the work of any man who could get even such good results with a furnace built for hard coal, we should obtain and send out information which will prove that the furnace used for those tests was not high enough for any Nova Scotia coal to show to the best advantage.

The Mines Branch bulletin, from which we quoted in the first paragraph of this paper, says on page 14:

> "The coals of Nova Scotia vary greatly in character, some being high in ash, low in sulphur, and vice versa — others high in both ash and sulphur, and others low in both. The fusibility of the ash also varies."

This variation is looked upon as a disadvantage, whereas it might well be considered the opposite, because it means we can supply coals suitable for other purposes than for boiler fuel.

Even the steam coal market requires several kinds of coal, for in general we need to supply one grade for hand firing, one for chain grates, and another for underfeed stokers. The majority of the plants in Canada use small horizontal return tubular boilers. Of these the greater number are not equipped with stacks or fans to give sufficient draft, so they cannot use a poor grade of coal, or slack coal of any kind where the boiler is operated at rating. The chain grate type of stoker handles high ash coals to advantage and this is the grade which should be supplied to plants where they are installed. The underfeed stoker was designed for coals such as those from the eastern American mines, which have only about two-thirds the volatiles that our coals contain, and an ash with a high fusing point, so we should furnish plants where they are installed with such a grade.

It is not as though Nova Scotia were being asked to undertake something entirely new. The province of Alberta has done a great deal of work along similar but more elaborate lines. The Scientific and Industrial Research Council of Alberta has done much to gather the necessary information. The Alberta government, working through its Trade Branch, went directly after a bigger market for the sale of their coals. One move was to give each coal a trade name so that the buyer would be sure to get the same kind every time he asked for it by that trade name. Books of instruction on firing stoves, heating furnaces and small steam boilers, were printed and scattered all over Canada. These books were written in non-technical language so that any man could understand them. For the users of power boilers, Prof. C. A. Robb prepared a report on the "Combustion of Coal for the Generation of Power". In Winnipeg and other cities the firing of Alberta coals was demonstrated in furnaces of various types.

In this campaign they increased their market in the west for all kinds of coal and practically drove American anthracite out of the prairie provinces. They also made a very strong attempt to introduce Alberta fuels into Ontario against American competition. In fact, they might have been supplying that market to-day if freight rates could have been arranged.

We have a much better chance to get the Ontario market than Alberta has, for our coal can be carried a great part of the distance by water, and it can be arranged to take it westward from Montreal in the grain boats so that they will not go up the lakes empty. It would be difficult for Alberta to make regular deliveries in the fall because the railroads give grain shipments preference over everything else at that time when most householders are buying their winter stock of coal. Moreover, the cars used for coal would return empty so the railroads would only get one freight. By-product coke made from our coal can be supplied more cheaply, so that the actual cost for household and heating purposes during the year should be considerably less than if hard coal were used.

Part of our work in Nova Scotia is to find out how the data collected by other coal mining districts applies to our coals. We know we can get better efficiency with a horizontal return tubular boiler which is set well above the grates, but we do not know what the distance between the grates and shell should be for the greatest all-around efficiency. There is a good chance to make the necessary tests at Halifax. The horizontal return tubular boiler in the Mechanical Engineering Department of the Nova Scotia Technical College could be set so that the furnace is 10 feet high. It would then be fired from a movable platform, which could be raised or lowered as desired and by arranging the grates so that they could be set at any required distance from the shell, the efficiency at various heights of settings could be ascertained and the most economical setting determined.

The Babcock and Wilcox boiler in the same college is 12 feet to tube door, which is considered to be a good height for a hand-fired boiler. It could easily be arranged to raise and lower the grates to find out how that will effect the efficiency. The boiler can be stoker fired and later on it might be policy, both for the information that can be gained about our coals, and for the sake of students who want instruction in boiler testing, to install various types of stokers one after the other and make a series of tests with them. The meters and other equipment for boiler testing which is part of the mechanical engineering course, will, of course, serve for the coal tests.

In the field at the rear of the Technical College there is plenty of room to put all the bins necessary to store any coal which is to be subjected to tests to find out the effect of weathering.

After considerable study of the problem, the writer is of the opinion that in order to market more coal, we have to do two things immediately:

First, get more information useful to the coal users, so that they will know how to build furnaces and firing equipment which will make more steam for the dollar spent in the product of our mines than they will get from any other fuel.

Second, put one or more men in the field to see that such information is applied so that coal sales result.

THE

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Queen Alexandra

We record with deep regret the death of H. M. Queen Alexandra, which took place on Friday evening, November 20th, 1925.

The Toronto Meeting

The admirable policy of holding the Annual General and General Professional Meetings of *The Institute* in different large cities of the Dominion leads this year to Toronto, to which city the Annual General Meeting of *The Institute*, will be adjourned, after convening, in accordance with the By-laws, at Headquarters on Tuesday, January 26th, 1926; assembling at the King Edward Hotel, Toronto, on Wednesday, the 27th.

In accordance with the programme published elsewhere in this issue, the Annual General Meeting will be followed as usual by the General Professional Meeting, and it is gratifying to note that this year a particularly varied and important programme of papers will be presented for discussion.

In the Civil Engineering Section, water supply, sewerage systems and questions in connection with concrete will be discussed, while the Mechanical and Electrical Sections will consider matters connected with steam power plant design and operation, and European practice in electrical transmission engineering.

The general session which follows has an equally diversified programme, and the papers of the concluding session on the Fuel Problem in Canada will be particularly timely.

The Toronto Branch has displayed its well known activity and capacity for organization, and in laying out the programme has not omitted to allow time for recreation and visits. It is expected that there will be a large attendance of members from outside points, for whose benefit arrangements for reduced railway fares have been made with the Canadian Passenger Association.

All signs point to a successful meeting.

Special Railway Rates for the Toronto Meeting

DIRECTIONS FOR MEMBERS ATTENDING

Buy ordinary one way first-class ticket to Toronto. When doing so ask ticket agent for Standard Convention Certificate, (C. P. A. Form 24). On arrival at the King Edward Hotel deposit your certificate at the Registration Booth, for endorsation and validation, for which twenty-five cents is charged.

Before leaving Toronto obtain your validated certificate. This will entitle you to purchase a one way continuous passage ticket for your return trip at one half the ordinary rate.

It is necessary that one hundred and fifty certificates be validated in order that this plan may be effective.

Dates on which Standard Convention tickets can be obtained are as follows:

From points in British Columbia—Jan. 22nd to 26th inclusive.

From points in Alberta and all points West of Armstrong and Fort William, Jan. 23rd to 28th, inclusive.

All points East of and including Armstrong and Fort William, Jan. 23rd, to 29th, inclusive.

The return trip from Toronto must be commenced before midnight on February 2nd, 1926.

Portrait of the Late Peter Alexander Peterson

The gallery of portraits of Past-Presidents of *The Insiitute* at Headquarters has been enriched through the kindness of Mrs. P. A. Peterson, who has presented to *The Institute* a portrait of her late husband painted by Robert Harris, R.C.A.

The Council has expressed its appreciation of Mrs. Peterson's liberality and has directed that the painting be hung in the room in which Council meets.

Annual General and General Professional Meeting

King Edward Hotel, Toronto

January 27th, 28th, and 29th, 1926

PROGRAMME

(Subject to Revision)

Wednesday, January 27th.

9.00 a.m. Registration at King Edward Hotel. (Members register in Foyer, Second Floor; Ladies in Room 225).

10.00 a.m. Annual Business Meeting, in Banquet Hall.

1.00 p.m. Luncheon in Pompeian Room, at which the Mayor of Toronto will deliver an address of welcome. Complimentary to visiting members and visiting ladies.

2.30 p.m. Resumption of business meeting. Address of retiring President and presentation of Charter to Toronto Branch. Inauguration of incoming President.

5.00 p.m. Reception tendered by the Toronto Branch, on Parlor Floor for guests, members and ladies, (complimentary to all).

8.00 p.m. Smoker in the Crystal Ballroom, (complimentary).

Thursday, January 28th.

Professional Meeting, Civil Engineering Section

9.15 a.m.

Banquet Hall. Chairman, George A. McCarthy, M.E.I.C.

Deterioration of Concrete in Alkali Soils—Prof. C. J. Mackenzie, M.E.I.C., and Prof. T. Thorvaldson, University of Saskatchewan.

Design of East York Sewers and their Construction by Contract and Day Labor—R. O. Wynne-Roberts, M.E.I.C., consulting engineer, Toronto, and Grant R. Jack, A.M.E.I.C., township engineer.

The Water Supply of the Border Cities—William Gore, M.E.I.C., consulting engineer, Toronto, and J. B. Clark Keith, A.M.E.I.C., chief engineer, Essex Border Utilities Commission.

Reduction of Flexural Stresses in Fixed Concrete Arches—J. F. Brett, A.M.E.I.C., designing engineer, Montreal Water Board.

Professional Meeting, Mechanical and Electrical Engineering Section

9.15 a.m.

Room under Balcony of Ball Room. Chairman, Prof. R. W. Angus, M.E.I.C.

Steam Power Plant Design—Prof. A. G. Christie, Johns Hopkins University.

Generation of Explosive Gases in Electric Water Heaters and Boilers Operating on Alternating Current with Submerged Electrodes—Prof. J. W. Shipley, University of Manitoba and A. Blackie, National Testing Laboratories, Ltd., Winnipeg.

European Transmission Practice—A. E. Davison, transmission engineer, Hydro-Electric Power Commission of Ontario.

2.30 p.m. Inspection of new Hillcrest shops of the Toronto Transportation Commission.

Trips of inspection to certain other plants or works under consideration by the Committee will be organized, should they be found practicable.

2.30 p.m. Ladies will visit the Art Gallery and Hart House, University of Toronto.

5.00 p.m. Ladies will be entertained at tea at Government House.

7.30 p.m. Annual Banquet of *The Institute* in the Pompeian Room.

8.00 p.m. Theatre party for ladies.

Friday, January 29th.

Professional Meeting, General Session

9.15 a.m.

Pompeian Room. Chairman, George T. Clark, A.M.E.I.C.

The Influence of the Modern Highway—W. A. McLean, M.E.I.C., Consulting Engineer, Toronto.

Some Phases of Industrial Relations—Homer E. Niesz, Manager, Industrial Relations Department, Commonwealth Edison Co., Chicago, and President, Western Society of Engineers.

1.30 p.m. Ladies Luncheon, Y.W.C.A., McGill St.

Professional Meeting, General Session

2.30 p.m.

Pompeian Room. Chairman, A. D. LePan, A.M.E.I.C.

The Fuel Problem in Canada—Lesslie R. Thomson, M.E.I.C., consulting engineer, Montreal.

Methods of Fuel Production—J. L. Landt, consulting engineer, Buffalo.

Methods of Fuel Consumption—John Blizard, research engineer, Power Specialty Co., New York.

8.45 p.m. Supper-Dance, Crystal Ballroom.

Amendments to By-Laws

The report of the Legislation and By-laws Committee for 1925, which includes proposals for a number of important changes in certain By-laws, was submitted to the Council of *The Institute* at the regular meeting held on November 17th, 1925.

The report, together with suggestions from councillors, and from the Board of Examiners and Education, was then fully considered, discussed, and adopted.

In accordance with the By-laws the amendments proposed are herewith submitted to the membership and will come before the Annual Meeting for discussion. After such discussion the changes will in due course be submitted to the corporate membership for vote by letter ballot, as required by the By-laws. Particulars of the proposed changes follow:—

Section 8. Amend paragraph two to read:—

Every candidate who has not graduated from a school of engineering recognized by the Council shall be required to pass an examination before a board of examiners appointed by the Council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the Council if the candidate has held a position of professional responsibility for five or more years.

Section 9. Amend paragraph two to read:—

Every candidate who has not graduated from a school of engineering recognized by the Council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

Section 10. Amend to read:—

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the Council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the Council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

Section 16.

Line 13: Delete all words after "for their approval" to end of paragraph, and insert: "He, or in the case of his absence or inability to act, the Treasurer, together with any one member of the Finance Committee, shall have authority on behalf of *The Institute*, to draw, accept, sign, make and agree to pay all or any bills of exchange, promissory notes, cheques and orders for the payment of money."

Section 17. Amend paragraph two to read:—

He shall attend meetings of Council and shall prepare and present annually to the Council in time for the Annual General Meeting a financial statement, as of the 31st December, of the affairs of *The Institute*. He shall furnish from time to time such other reports as may be prescribed.

Section 30. Amend to read:—

On the admission of a candidate, he shall be notified by the Secretary and he shall then be entitled to the privileges of membership. Membership shall date from the date of admission.

NOTE:—This amendment to Section 30 seems desirable in order to agree with a recent decision of Council proposing that the entrance fees of applicants shall accompany their applications for admission. This will involve a re-arrangement of the admission forms, the present forms A and D being replaced by a new one containing the essential provisions of both. See also the proposed amendments to Sections 33 to 36.

Section 32.

NOTE:—In accordance with the recommendations of the Legislation and By-laws Committee and the advice of counsel, it is proposed to delete the matter now printed on pages 22 and 23 of the Year Book, following immediately after the Code of Ethics, and to embody the essential features of this material in an amended Section 32.

Section 32. Amend to read:—

Expulsion and Discipline

(*a*) The Council shall have the right to expel from *The Institute* any corporate or non-corporate member who may be convicted by a competent tribunal, of felony, embezzlement, larceny, misdemeanour, or other offence which in the opinion of the Council renders him unfit to be a member. Such expulsion shall be effected by causing the name of such member to be erased from the register of members, and such member shall not be entitled to receive previous notice of such expulsion, but upon such expulsion shall be notified in writing by the Secretary to that effect.

(*b*) If, in the opinion of Council, any corporate or non-corporate member be guilty of a breach of the Code of Ethics adopted by *The Institute*, or have acted in a manner unbecoming to a member of *The Institute*, or in a manner detrimental to the character, reputation or interests of *The Institute*, or adverse to the objects of *The Institute*, the Council may discipline such offending member by:

1. Censuring such member in writing by letter addressed to him by the Secretary or by having such member appear in person before the Council for the purpose of receiving such censure, or;
2. Suspending the membership of such member for such length of time as the Council sees fit, or;
3. Causing the name of such member to be erased from the register and thereby expelling him from *The Institute*.

Any enquiry or investigation with a view to disciplining a member as aforesaid, may be instituted by the Council at any time by its own action, or upon the complaint in writing of any member or members, addressed to the Secretary, who shall submit the same for consideration to Council at its next meeting, and such enquiry and investigation shall be conducted in such a manner and to such extent and at such time or times as the Council may in its absolute discretion decide. No verbal or anonymous complaint against any corporate or non-corporate member shall be considered or acted upon by the Council. If the Council be of the opinion that any complaint is trivial and not of sufficient gravity or importance to justify an enquiry, the Secretary shall notify the complaining member to that effect, and the Council shall not be obliged to take any further action in regard thereto and no further record shall appear in the minutes.

No disciplinary action as aforesaid shall be taken by Council unless the same has been approved by the affirmative vote of at least three-fourths of the members of the Council present at a meeting specially called for the purpose of considering the same, and at which at least twelve members of the Council are present. Should the complaining member or offending member be a member of Council, he shall not act as a member of Council at any such enquiry or vote on any matter relating thereto.

Any member, whose conduct or action is to be made the subject of enquiry with a view to disciplinary action as aforesaid, shall be entitled to be notified by the Secretary by registered letter addressed to his last known place of residence and specifying the nature of the charges against him, and before any such disciplinary action is taken by Council, such offending member shall be given a fair opportunity of being heard by Council, either by appearing in person before it, or, subject to the approval of Council, by submitting to the Council a sworn statement in writing addressed to the Secretary.

If the Council, after holding an enquiry, decides to take disciplinary action, the same shall be duly recorded and the offending member notified in writing thereof by the Secretary.

Section 33. Amend the first two lines to read:—

The entrance fees, payable at the time of application for admission to *The Institute*, shall be as follows:

New *Section 34.* Present Section 37 to be renumbered Section 34 and amended to read:—

Section 34. All annual fees shall be due and payable on the first of January for the calendar year then commencing, at which time a bill for the sum shall be mailed to each member, in accordance with the following Schedules of Fees:—

Present *Section 34* to be renumbered Section 35 and amended to read:—

Schedules of Fees

Section 35. The annual fees payable by Montreal Branch Residents shall be as follows:—

		If paid on or before March 31st.
Members	$14.00	$13.00
Associate Members	11.00	10.00
Juniors	7.00	6.00
Students	2.00	1.00
Affiliates	11.00	10.00

The annual fees payable by all other Branch Residents shall be as follows:—

Members	$11.00	$10.00
Associate Members	9.00	8.00
Juniors	5.00	4.00
Students	2.00	1.00
Affiliates	11.00	10.00

The annual fees payable by Branch Non-Residents and Non-Residents shall be as follows:—

Members	$ 9.00	$ 8.00
Associate Members	7.00	6.00
Juniors	4.00	3.00
Students	2.00	1.00
Affiliates	11.00	10.00

Honorary Members shall be exempt from annual fees.

In accordance with the above schedules, if paid on or before March 31st of the current year, a deduction of one dollar will be allowed on the annual fees of all grades.

Section 35. Present Section 35 to be renumbered Section 36 and amended to read:—

Section 36. Members elected after the thirtieth day of June shall be liable for only one half of the annual fees for that year, with a deduction of fifty cents if paid within one month of notification of admission.

Present *Section 36* to be renumbered Section 37.

Section 38. Amend the first paragraph to read:—

The Secretary shall notify any members whose fees become in arrears. No members shall be considered in arrears for any year until after the thirty-first day of March of that year. On the first day of January next following, six per cent per annum shall be added as interest on the subscriptions in arrears, and the same sum shall be added on the first day of January of each year until the said arrears are paid. No member who is in arrears after June thirtieth shall have the right to vote, nor shall he receive the publications of *The Institute.*

Section 52. Amend to read:—

Each Branch shall be managed by an Executive Committee which shall include:—

(*a*) A chairman, secretary and treasurer, and not less than three other members, all to be known as elected members and to be ballotted for by all members of the Branch entitled to vote at Branch elections.

(*b*) Those members of Council resident within the jurisdiction of the Branch, to be known as ex-officio members, and

(*c*) The immediate past-chairman and the immediate past-secretary of the Branch, to be known as members emeriti, these latter to be members for only the year immediately following their term of office.

Section 53. Delete the second paragraph beginning "The chairman" and ending "election".

Highway Development in Canada

The trend of the development of highways in relation to motor transportation has recently been the subject of addresses delivered to several Branches of *The Institute,* and is a matter of active public interest at the present time.

It will be dealt with in a timely paper to be presented at the forthcoming General Professional Meeting in Toronto, and is treated in a brief but comprehensive manner in Bulletin No. 7, recently issued by the Highway Branch, Department of Railways and Canals.

It is a commonplace to say that the progress and development of the country are intimately bound up with its transportation systems, and of these the network of improved highways and subsidiary roads which is gradually covering the country has perhaps the closest contact with the life of the general public. An idea of the magnitude of the financial questions involved may be gleaned when it is pointed out that in the open southern sections of Canada no less than 220,000 miles of earth roads remain unimproved. These alone involve an ultimate expenditure exceeding two hundred million dollars.

Since 1919, when the Canada Highways Act was passed, the primary highway systems in all provinces have been developed along definite lines, under the guidance of the Provincial Highway Departments, and with the co-operation of the Highways Branch of the Dominion Government. Federal contributions to Provincial Highway Funds during this time have aggregated approximately twenty million dollars ($20,000,000.), and the length of the main trunk and market roads, approved as being eligible for this aid, amounts to nearly twenty-five thousand miles.

The profound influence of highway development upon the daily life of the people has been manifested in many directions, among which, to cite only a few instances, may be named the rise and rejuvenation of villages located on primary highways; the improvement in rural education, resulting from the possibility of consolidating and thus improving rural schools; the marked reduction which has taken place in the cost of hauling farm produce to the shipping point, and the knowledge of their own country which is being obtained by the thousands of Canadians who use our newly developed highway systems for tourist purposes.

Members who were at the Banff meeting in July last were particularly impressed by the constant stream of cars, Canadian as well as American, entering and leaving the automobile camping ground close beside the E.I.C. camp.

The dissemination of authentic information on highway questions is an important function, not only of interested bodies like *The Engineering Institute of Canada,* the various Provincial Motor Leagues, and the Canadian Good Roads Association, but also of the Federal and Provincial Highways Departments.

OBITUARIES

William R. Butler, M.E.I.C.

Members of *The Institute* will read with regret of the death in England, of Professor W. R. Butler, M.E.I.C., for many years professor of civil engineering and architecture at the Royal Military College, Kingston. The late Professor Butler was born in England in 1852. He graduated from Kings College, Windsor, N. S., with the degree of Bachelor of Engineering in 1879. From 1880-1881 he was engaged as assistant engineer under Messrs. Watson, Smith and Watson of London, England on construction of the Swindon, Marlborough and Andover Railway. Coming to Canada again in 1881, he was elected professor of engineering at Kings College, Windsor, N. S., which position he held until he was appointed professor of civil engineering and architecture at the Royal Military College. Kingston, in 1897. Professor Butler retired from the Royal Military College in 1915 and returned to England where he remained until his death. The late Prof. Butler had been a member of *The Institute* since its inception, having been admitted as Member on January 20th, 1887.

Richmond Hersey Cushing, M.E.I.C.

Sincere regret is expressed at the death of Richmond Hersey Cushing, M.E.I.C., former city engineer of St. John, N. B., which occurred at his home in West St. John on December 7th, 1925. The late Mr. Cushing was born in St. John, N. B. on May 8th, 1854. After finishing his grammar school course in St. John he studied Civil Engineering at the Massachusetts Institute of Technology from 1871-1875.

During the years 1880-82 he was engineer of the Grand Southern Railway, now called the Shore Line, between West St. John and St. Stephen. He then joined the staff of the European and North American Railway, in Nova Scotia, being located on the Oxford-Pugwash branch in 1882 and the Patterson Pt. Pictou Branch the following year. In 1884 he was located in Prince Edward Island on the Cape Traverse Branch and the next year was employed with the Intercolonial Railway. In 1886 he did considerable work for the Moncton-Buctouche Branch line and during 1887 was construction engineer on the Pictou-Truro line. In 1888 he commenced his duties as Chief Engineer of the Oxford-New Glasgow Railway and continued in their service until 1893. On the completion of this line he moved to the state of Maine and was employed as construction engineer on the Bangor and Aroostook Railway, until 1899. During the two years following he resumed work with the I. C. R. being located in St. John, and it was during this time that he was engineer on the construction of the I. C. R. elevator and conveyor system, Long Wharf, and other terminal facilities.

RICHMOND HERSEY CUSHING, M.E.I.C.

In April 1901 he was appointed Director of Public Works of St. John continuing these duties for six years, during which time he superintended extensive improvements to the harbour, water-works, ferry, sewerage system, etc. In 1908 he was appointed Division Engineer on the Transcontinental Railway, being in charge of the construction of this line between Moncton and Edmundston, N. B. On the completion of this work in June 1913 he was employed until December 1913, on the Ocean Terminals at Halifax.

During the next five years he superintended the construction of several large dock improvements in and around St. John. In March 1921, he began his duties as right-of-way and claims agent for the New Brunswick Electric Power Commission and continued in their employ until the time of his death.

Referring to the death of Mr. Cushing the St. John Globe in its editional column, under the heading "A Public Loss" says in part:

"Much of the active life of R. H. Cushing, C. E., was given to the public service and most faithfully and loyally did he serve the public. As engineer in the Department of Public Works of the city he had an important part in planning and carrying to completion much of the harbor development work, particularly at West Saint John."

Major H. Graham Starr, A.M.E.I.C.

It is with regret that we record the death of Major H. Graham Starr, A.M.E.I.C., which occurred at Christie Street Hospital, Toronto, on Wednesday, December 9th., 1925. The late Major Starr was born at Maple, Ontario, on August 14th, 1883. He received his early education at Royal Military College, Kingston, from which he graduated in 1905, and the same year he was field draughtsman with the Canadian Pacific Railway Company. Three years after he was engineer in charge of the Gowganda and Montreal River Mines Limited. In 1909 he rejoined the Canadian Pacific Railway Company on the staff of the right-of-way department; the following two years he was with the Kettle Valley Railway, first as assistant locating engineer and later as resident engineer. He enlisted for overseas service in 1915 in the 84th Infantry Battalion, C.E.F., with which he was lieutenant. He later received his captaincy and was appointed adjutant in November of that year. He went overseas with the unit in June, 1916, and served with distinction in France and was wounded and invalided home in March 1918. The late Major Starr was admitted to *The Institute* as Student on January 11th, 1906, and was transferred to Associate Member on May 13th, 1913.

PERSONALS

T. M. S. Kingston, S.E.I.C., is located in Buffalo, N.Y., with the E. P. Muntz Company, engineers and contractors.

R. H. Cratchley, Jr. E.I.C., has accepted a position as draughtsman-designer with the Consumers Gas Company of Toronto.

J. D. Peart, A.M.E.I.C., of the Northern Electric Company has been transferred by the company from Montreal to their Winnipeg office.

F. H. Job, Jr. E.I.C., is located at Pittsburgh, Pa., on the engineering staff of the Koppers Construction Company. Mr. Job was for some time structural draughtsman with the Hamilton Bridge Works, Hamilton, Ontario.

C. F. Phipps, S.E.I.C., who graduated from McGill University in 1924, since which time he has been with the North Shore Power Company at Three Rivers, Quebec, has been moved to Shawinigan Falls, Quebec, with the Shawinigan Water and Power Company.

K. H. Smith, M.E.I.C., has resigned as chief engineer of the Nova Scotia Power Commission with which he has been connected since its inception. Mr. Smith's future plans are not sufficiently matured to warrant any statement at the present time.

Major Geo. A. Walkem, M.E.I.C., of Vancouver, formerly vice-president of *The Institute*, who has been nominated for the presidency of *The Institute* for the coming year, was elected president of the Association of Professional Engineers of the Province of British Columbia at the annual meeting in Vancouver this month.

Donald G. Robertson, Jr. E.I.C., who, since graduating from Queen's University in 1924, has been with the Southern Canada Power Company in connection with the construction of their power development at Hemmings Falls, Drummondville, Quebec, has joined the engineering staff of the Riordon Pulp Corporation at Temiskaming, Que.

S. C. Wolfe, A.M.E.I.C., is located at Detroit, Michigan with the C. O. Barton Company, general contractors. Mr. Wolfe was, for a number of years with Messrs. Lockwood Greene and Company of Canada, Limited, as office engineer in charge of design, draughting, and all office work on contracts, payments and records. He was also for a time engaged in contracting work in Montreal.

Thos. H. Winter, Jr.E.I.C., of St. John's, Newfoundland, who has, until recently, been located at Corner Brook, Newfoundland has joined the government engineering staff at St. John's. Mr. Winter is a graduate of Kings College, Windsor, Nova Scotia, and of the Nova Scotia Technical College, from which he received the degree of B.Sc., in 1923. At Corner Brook he occupied the position of chief assistant to engineer in charge of pipe line and forebay construction with the Sir W. G. Armstrong, Whitworth and Company Limited.

Institute Members on Hydrographic Surveys

The following members of the Canadian Hydrographic and Tidal and Current Surveys of the Marine Department have recently returned from a successful season's work in carrying on the charting of the coastal waters and trade routes on the Atlantic and Pacific seaboards, the headquarters at Ottawa and Victoria,—R. J. Fraser, A.M.E.I.C., in charge of the Survey Steamer "Cartier" and the Gulf of St. Lawrence transatlantic route; M. A. MacKinnon, A.M.E.I.C., and Norman Wilson, A.M.E.I.C., both connected with the same survey; J. L. Foreman, A.M.E.I.C., engaged in charting work along the coasts of Nova Scotia. H. D. Parizeau, A.M.E.I.C., of the Victoria Branch of *The Institute*, who has been charting for the past eight months with the Survey Steamer "Lilloett" on the Pacific, has laid up his vessel and is wintering at Victoria. Chas. A. Price, A.M.E.I.C., in charge of the automatic gauge division of the Hydrographic Surveys, has returned from a season's tour of inspection of gauging stations from Quebec to Port Arthur. H. W. Jones, M.E.I.C., in charge of the Atlantic tidal division, has recently completed two years' tidal work on the currents of the strait of Canso, and returned to Ottawa.

E. H. James, A.M.E.I.C., Enters Partnership

A. D. Swan, M.E.I.C., consulting engineer, Montreal, has announced that he has taken E. H. James, A.M.E.I.C., into partnership.

Mr. James has been resident engineer on the design and construction of new harbour works at Vancouver, B.C., during the last six years to the value of about ten million dollars, the work consisting of reinforced concrete piers, a drydock and the railway and vehicular bridge across the harbour. Mr. James previous to this has had extensive experience in dock and harbour, bridge and foundation work, including foundations under heavy air pressure, and has also had valuable experience in connection with arbitrations and legal proceedings involving engineering.

For the time being the name of the firm will remain as before.

A. D. Swan has had thirty years' experience in the design, construction and management of large public works. Many years ago Mr. Swan was resident engineer in charge of the design and construction of the new wet dock and graving dock at Avonmouth, England.

Mr. Swan was assistant chief engineer to the Montreal Harbour Commissioners from January 1909 to May 1913, and supervised the design and construction of new harbour works there during that period. In 1912 he reported on the general conditions and future development of the port of Vancouver, B.C., and prepared plans for same for the Dominion government and has since that time been continuously interested in work there. He was appointed consulting engineer to the Harbour Commissioners in February, 1914, and designed and supervised construction of the Ballantyne pier and other works.

Mr. Swan was one of a commission of three engineers appointed to select a site for a new drydock at Levis, Quebec. He was consulting engineer to the contractors for the new harbour works at Halifax, N.S., also at St. John, N.B., and other ports. During 1914, he was engaged by an English company to select sites, report on and prepare plans and estimates for three harbours and railway terminals on the west coast of South America. He prepared plans for new wharves and shipping facilities for handling pulp and paper at Newfoundland. He designed and constructed the drydock piers and basin for Canadian Vickers, at Montreal. He was retained as consulting engineer and prepared plans for a proposed new drydock at Halifax for Wm. Beardmore and Company, Glasgow.

For the last four years Mr. Swan has been consulting engineer for the contractors on the construction of the large new drydock at Esquimalt, B.C. He designed and supervised the construction of the new drydock works at North Vancouver, B.C., and is consulting engineer for the new drydock at St. John's, Nfld., now under construction.

He was consulting engineer and prepared designs for new wharves for the International Paper Company at Three Rivers, Quebec, and prepared complete schemes for new harbour development on behalf of the Marine and Fisheries Department at Three Rivers.

He was consulting engineer for a large railway and traffic bridge across the harbour at Vancouver, B.C., for the Burrard Inlet Tunnel and Bridge Company, Ltd., and has been engaged on many arbitrations and legal cases concerning dock works in different countries.

Harold S. Johnston, M.E.I.C., Appointed Chief Engineer

Harold S. Johnston, M.E.I.C., who has recently been appointed chief engineer of the Nova Scotia Power Commission, is a graduate of McGill University, from which he received the degree of B.Sc., and since graduating, has had extensive experience in hydro-electric development work in the provinces of Ontario, Alberta and Nova Scotia.

Mr. Johnston is a native of Gananoque, Ont., where he was born in 1885 and where he received his early education. Following graduation from McGill University in 1909, he was assistant engineer on the hydro-electric development at Nipissing, in the following January taking a similar position on the 19,500 h.p. plant for the Calgary Power Company and after four years with this company, he became engineer and superintendent of construction for the Department of the Interior on the installation of water mains and the design and installation of intake works in connection with storage propositions for the Department of the Interior and the Calgary Power Company.

HAROLD S. JOHNSTON, M.E.I.C.

In March, 1920, Mr. Johnston was appointed hydraulic engineer for the Nova Scotia Power Commission, associated with K. H. Smith, M.E.I.C., chief engineer, to whose activities the Nova Scotia Power Commission may be said to owe its existence, and from which same activities and his great executive abilities, the province of Nova Scotia has so much benefited.

Mr. Johnston has been intimately associated with the development of the Commission, and is responsible for the design and construction of the 5,550-h.p. and 6,580-h.p. Malay and Ruth Falls developments of the Sheet Harbour system, and other considerable hydro-electric developments in general.

Through the resignation of Mr. Smith, Mr. Johnston now becomes chief engineer, and will be most ably assisted by J. F. Lumsden, M.E.I.C., formerly electrical engineer, who has been appointed assistant chief engineer.

It is believed that an era is opening for Nova Scotia which will be marked by an increasing industrial development, in one department of which development at least,—the pulp and paper industry,—the Nova Scotia Power Commission may be expected to play a considerable part through the development of the province's hydro-electric resources. Mr. Johnston, therefore, enters upon his increased responsibilities, with a full sense of the foundation laid by the former chief engineer, and a belief that there will be increasing benefit to the province in the Commission's activities.

EMPLOYMENT BUREAU

Situation Vacant

TRANSITMAN

Wanted transitman for logging operations, technical graduate, single, under thirty, healthy, a worker experienced on bush surveys winter and summer, willing to learn logging operations and French. For such a man a well known company offers fine future. Apply box No. 149-V.

Situation Wanted

DESIGNING AND CONSTRUCTION ENGINEER

A.M.E.I.C., age 39, with extensive experience in design and construction of power transmission, mine and smelter installations, pulp and paper mill design estimating and sales of structural steel, desires position, full details of experience will be supplied on request. Apply Box No. 201-W.

ELECTIONS AND TRANSFERS

At the meeting of Council held on December 22nd, 1925, the following elections and transfers were effected:

Member

DARLING, Edward, B.Sc. (McGill Univ.), pres. and gen. mgr., Darling Bros. Ltd., Montreal, Que.

Associate Member

DICKENSON, George Newton, Brevet Capt., R.C.E., asst. works officer, Military District No. 6, Halifax. N.S.

Juniors

CUSHING, Richmond Hersey, Jr., transitman, N.B. Electric Power Commission, St. John, N. B.

GRAY, Maxim Theodore, i/c of constrn. engr. with Geo. C. Diehl Inc. of Buffalo, at Williamsville, N. Y.

Transferred from the class of Student to that of Associate Member

BIGGAR, Percival Elliot, B.Sc. (McGill Univ.), consltg. on development work to Attendu Engines (England), on loan from Eastern Engineering Company, Montreal, Que.

MAHAFFY, Herbert Laurence, B.Sc. (McGill Univ.), acting chief of inspection dept., J. T. Donald & Co. Ltd., Montreal, Que.

McCLINTOCK, George Arthur, B.A.Sc. (Univ. of Tor.), engr. for Keasberg & Mattison Co., Bell Asbestos Mines Dept., Thetford Mines, Que.

Transferred from the class of Student to that of Junior

BARRETT, Andrew Grant, B.Sc. (Queen's Univ.), field engr. for Canadian Johns Manville Co., Asbestos, Que.

CHISHOLM, Joseph Donald, B.Sc. (McGill Univ.), elect'l. design office, Nfld. Power and Paper Co. Ltd., Corner Brook, Nfld.

COPPING, Allan Blythe, B.Sc. (McGill Univ.), technical asst. to sulphite supt., paper mill technical work, tech. service dept., DeGrasse Paper Co., Pyrites, N. Y.

CRAWFORD, Robert Eric, B.Sc. (McGill Univ.), estimator, paper machinery and hydraulic turbines, Dominion Engineering Works, Montreal, Que.

GUSCOTT, Alfred George, B.A.Sc. (Univ. of Tor.), design and constrn. of water mains, sewers and sidewalks, Town of Leaside, Ont.

LESLIE, Roy Campbell, B.A.Sc., M.A.Sc. (Univ. of Tor.), dftsman., Canadian Bridge Co. Ltd., Walkerville, Ont.

WRIGHT, Joseph Agar, instr'man. on constrn., of Dunblane-Mower Branch, C.N.R., 162 Arlington Street, Winnipeg, Man.

The following students were admitted:—

ARCHAMBAULT, Ubald, 317 de l'Epée Avenue, Outremont, Que.
BOISMENU, Roméo, 419 De St. Valier, Montreal, Que.
CAMPAIGNE, Evan William, Niagara House, Niagara Falls, Ont.
COSTIGAN, James Percival McDougall, 494 Grosvenor Avenue, Westmount, Que.
DUCHASTEL de MONTROUGE, Leon A., 640 Dunlop Avenue, Outremont, Que.
HELWIG, Gerald Vincent, Strathcona Hall, Montreal, Que.
HUTTON, John Robert, 31 Carlton Street, Halifax, N. S.
JOHNSON, Edward Laurence, Strathcona Hall, Montreal, Que.
LALONDE, Jean Paul, 656 de l'Epée Avenue, Outremont, Que.
MATHIEU, Albert, 662 Cadieux, Street, Montreal, Que.

Effect of Size and Shape of Test Specimen on Compressive Strength of Concrete

Data of interest to those engaged in the testing of concrete will be found in Bulletin 16 of the Structural Materials Research Laboratory, Lewis Institute, Chicago, "Effect of Size and Shape of Test Specimen on Compressive Strength of Concrete" by Harrison F. Gonnerman. The report is reprinted from the 1925 Proceedings of the American Society for Testing Materials.

Tests were made on 1755 concrete specimens at ages of 7 days to 1 year in a study of the compressive strength of:

(1) Cylinders 1½ to 10 inches in diameter, 2 diameters long.
(2) Cylinders 12 inches long, 3 to 10 inches in diameter.
(3) Cylinders 6 inches in diameter, 3 to 24 inches long.
(4) Cubes, 6 and 8 inches.
(5) Prisms, 6 by 12 and 8 by 16 inches.

The relative strength of the different forms of specimen was compared with the strength of 6- by 12-inch cylinders from the same concrete.

ANNOUNCEMENT OF MEETINGS

Information may be secured from the secretaries of the various Branches, whose addresses will be found under "Officers of Branches" on page 2 of *The Journal.*

LETHBRIDGE BRANCH:—

Secretary-Treasurer, N. H. Bradley, A.M.E.I.C.

Jan. 9th. Illustrated address on "Technical Education in the Province of Alberta" by A. G. Carpenter.
Jan. 23rd. Illustrated address on "Architecture" by H. M. Whiddington.
Feb. 6th. Address on "Some Phases of the Art of Communication", by A. M. Mitchell, of the Alberta Government Telephones.
Feb. 20th. Address by E. Stansfield, M.E.I.C., of the Research Council of Alberta.

CALGARY BRANCH:—

Secretary-Treasurer, G. P. F. Boese, A.M.E.I.C.

Jan. 6th. Annual Dinner. Entertainment arranged by G. H. Patrick, A.M.E.I.C.
Jan. 28th. Address on "Hydro-Electric Operation Problems" by G. H. Thompson, A.M.E.I.C.
Address on "Turbine Rating Calgary Power Plant" by G. H. Whyte, A.M.E.I.C.
Feb. 9th. Address on "Winnipeg River Power" by C. H. Attwood, A.M.E.I.C.
Feb. 18th. Address on "The Present State of Oil and Gas Development in Western Canada" by S. J. Davis, A.M.E.I.C.
Mar. 2nd. Address on "Beet Sugar" by C. R. Wing.
Mar. 6th. Annual Meeting.

ST. JOHN BRANCH:—

Secretary-Treasurer, W. J. Johnston, A.M.E.I.C.

Jan. 21st. Address on "Radio Direction Finding" by Lt.-Commander C. P. Edwards, O.B.E., A.M.E.I.C., Dept. of Naval Service, Canada.
Feb. 19th. Address on "The Interconnection of High and Low Pressure Turbines" by J. D. Garry, A.M.E.I.C., N.B. Telephone Company.
Mar. 18th. Address on "Aerial Surveying" by A. M. Narraway, A.M.E.I.C., Topographical Surveys Branch. Illustrated.
Apl. 15th. Address on "The Elements of Photography and Correct Colour Rendering" by Prof. E. L. Harvey, M.A., University of New Brunswick.

OTTAWA BRANCH:—

Secretary-Treasurer, F. C. C. Lynch, A.M.E.I.C.

Jan. 14th. Annual Meeting of the Local Branch.
Jan. 21st. Annual Ball, Chateau Laurier.
Feb. 11th. Address "The Founders of Modern Science" by Dr. L. E. Parizeau, of Montreal.

VICTORIA BRANCH:—

Secretary-Treasurer, E. P. Girdwood, M.E.I.C.

Jan. 13th. Address on "Highways on Vancouver Island" by H. M. Bigwood, A.M.E.I.C., and W. P. Beaven, A.M.E.I.C.
Feb. 10th. Address on "Earthquakes" by F. Napier Denison, Supt., Dominion Meteorological Service.
Feb. 17th. Address on "World Flight" by Colonel Brome.
Mar. 3rd. Address on "Manufacture of Cement" by J. H. McIntosh, Jr., British Columbia Cement Co., Bamberton, B.C.
Mar. 9th. Address on "Logging Railways" by C. F. Cooke, A.M.E.I.C.
Mar. 31st. Address on "Pacific Great Eastern Railway" by Thos. Kilpatrick, Manager, Pacific Great Eastern Railway.
April 14th. Address on "Fraser Canyon Section" by Patrick Philip, M.E.I.C., Chief Engr., Dept. of Public Works, Prov. of B.C.
April 17th. Visit to Canada Cement Company, Bamberton, B.C.

MONTREAL BRANCH:—

Secretary-Treasurer, C. K. McLeod, A.M.E.I.C.

Jan. 7th. Address on "Features of Design and Construction of Isle Maligne Station," by W. S. Lee, M.E.I.C.
Jan. 14th. Address on "The Effect of Personnel on Industry", by R. A. C. Henry, M.E.I.C.
Jan. 21st. Address on "Some Problems in Connection with Construction Work at Lake Kenogami.
Jan. 28th. Address on "Pulp and Paper Industry", by H. S. Taylor, M.E.I.C.
Feb. 4th. Student Papers.
Feb. 11th. Address on "Pulverized Fuel" by H. G. Barnhurst, Advisory Engineer, Fuller Lehigh Co.
Feb. 18th. Address on "The History of the Locomotive", by W. A. Newman, Engineer Locomotive Design, C.P.R.
Feb. 25th. Address on "Outside Plant Construction of the Bell Telephone Co. of Canada", by W. H. Winter.
Mar. 4th. Address on "Paper on Metallurgy", by Messrs. Roast and F. Newell, M.E.I.C.
Mar. 11th. Address on "Vancouver Narrow Bridge" by E. H. James, A.M.E.I.C.
Mar. 18th. Symposium of Municipal Papers.
Mar. 25th. Address on "The South Shore Bridge", by P. L. Pratley, M.E.I.C.
April 1st. Address on "Synchronous Converters", by E. B. Shand, Westinghouse Company.
April 8th. Symposium of paper on Cost Accounting.
April 15th. Address on "Hemmings Falls Development", by J. S. H. Wurtele, M.E.I.C.
April 22nd. Address on "Television", by Dr. L. E. Pariseau.
April 29th. Address on "Belgian State Railways", by Mr. Van Bruyssel.
May 6th. Address on "Penal Conditions in Canada", by Col. R. de la B. Girouard.

The Association of Professional Engineers of the Province of British Columbia

ANNUAL MEETING

The Sixth Annual General Meeting of the Association of Professional Engineers of the Province of British Columbia opened on December 5th, 1925, at the Hotel Vancouver, Vancouver, B.C., with a well attended luncheon, at which an interesting address was given by Mr. Campbell Sweeny on the Early History of Engineering in British Columbia. Mr. Sweeny, as an old resident of British Columbia, dealt with the experiences of the early days, commencing with the first passage over the continent on foot, approximately seventy years ago. He brought out the fact of the separation between this part of the country and the eastern parts of Canada due to the Prairies and the mountain barriers further westward, and told how the first overland party left Fort Garry and made the passage by the Yellowhead Pass.

Later, a party of Royal Engineers came under the leadership of Colonel Newton, and many evidences of their work remain to this day. Following the Royal Engineers other men took up development of communications, and the Cariboo and Kootenay trails were opened, while further explorations were undertaken with a view to establishing railroad connections with the eastern parts of the country. This latter project, however, was the subject of long continued argument, but was eventually made one of the terms of confederation; and British Columbia entered confederation with a definite promise from the Central Government at Ottawa for the construction of a Transcontinental Railway.

This railway project was the subject of much controversy, and Alexander MacKenzie when Premier brought forward strong claims for the development of the various water routes with rail connections to form a continuous chain across Canada. This would have involved steamship lines to the end of the chain of Great Lakes, with further connections by way of the various great rivers and short isolated sections of rail, a project which by no means met with the approval of the residents of British Columbia. Shortly after this Sir John A. MacDonald returned to power as Premier, the construction of a Transcontinental Railroad was actually decided upon, and definite explorations and surveys were commenced with this complete scheme in view. Many engineers whose names have since become famous were connected with the project—Sanford Fleming being in charge, and having Collingwood Schreiber, Marcus Smith, H. J. Cambie, M.E.I.C., and many others as colleagues and associates. The original surveys for the line entered British Columbia by way of the Yellowhead Pass, a route which has always been admitted to be the best available, both from the view of construction costs and the lower operating costs offered by the easy grades of that pass. The Canadian Pacific Railway, however, was formed at about this time to undertake the construction of the road, and for reasons satisfactory to those in charge of the company, it was eventually decided to get as far south as possible, and the Kicking Horse Pass was selected as the route. The entry to this Pass is comparatively easy, but the great difficulty found in developing this route was in getting down out of it on the western side, and in the crossing of the Selkirk Range. For a considerable time the Selkirks offered an almost insuperable barrier. However, a route was at length found by Major Rogers and Walter Moberly through the Pass now known as Rogers Pass.

The speaker then outlined the rapid changes that followed the connection of the Western Coast of Canada by rail with the Eastern Cities, and dwelt on the opening up of the mining districts; the utilization of water power, both in the interior and on the coast; and the marvellous commercial development which has occurred in the Vancouver area as the terminal of the railways, favoured as it is with such a fine harbour as Burrard Inlet.

In concluding his address Mr. Sweeny paid a graceful tribute to the part played by the engineering fraternity in all these developments.

The Annual Business Meeting of the Association, which was held in the afternoon was presided over by Mr. Patrick Philip, M.E.I.C., Deputy Minister of Public Works of British Columbia, President of the Association. Mr. Philip in his opening address welcomed the out-of-town members and gave a general résumé of the work of the Association

Association of Professional Engineers of B.C.,— Officers and Council for 1925.

Sitting — Left to Right:

A. S. WOOTTON, M.E.I.C.; Engineer, Board of Park Commissioners;

FRANK SAWFORD, Member of Council 1923 and 1924; Vice-President of Council 1925; Consulting Electrical and Mechanical Engineer;

E. G. MATHESON, M.E.I.C.; First President of Association (1920), Member of Council 1921, 1922, 1923, 1924, 1925; Professor of Civil Engineering University of B. C.; Consulting Engineer;

J. F. FREW, M.E.I.C.; Consulting Engineer; Designing Plant Engineer; Vice-President 1926;

PATRICK PHILIP, M.E.I.C.; Member of Council 1923; Vice-President 1924; President 1925; Deputy Minister and Chief Engineer, Public Works Dept. (B. C.);

E. A. WHEATLEY, Capt. — M.C.; A.M.E.I.C., Registrar and Secretary-Treasurer.

Standing — Left to Right:

G. S. ELDRIDGE, M.E.I.C.; Engineer of Way, B.C. Electric Railway Co., Vancouver, B.C.

C. A. BANKS, Consulting and Metallurgical Engineer, representing the Selukwe Gold Mining & Finance Co. of London; Managing Director British Canadian Silver Corporation, Ltd.; President and Managing Director B.C. Silver Mines, Ltd.

J. MUIRHEAD, M.E.I.C.; Chief Inspector Electrical Engineering, Provincial Government; Member of Council 1921, 1922, 1923, 1924 and 1925; now Consulting Engineer, 630 Birks Bldg., Vancouver, B.C.

Absent:

E. E. BRYDONE-JACK, M.E.I.C.; Member of Council (1923 and 1925); President of Association 1924; Supervising Engineer, Department Public Works Canada, Western Provinces.

W. L. UGLOW, Ph.D.; Member of Council 1924-1925; Professor Mineralogy and Petrology, University of B.C.

Council during the past year. He referred especially to the Secretary's visit to centers in the interior of British Columbia, and to his attendance at the Western meeting of *The Engineering Institute of Canada* at Banff. He drew attention also to the very responsible duties of the Council and urged the membership to use care in their choice of those who are to fill the places of the retiring Council. He also reviewed the various amendments to the Engineering Act which have been passed through the Legislative Assembly during the past year, and extended the thanks of the Association to Mr. Geo. A. Walkem, M.L.A., M.E.I.C., a member of the Association, for his work as sponsor of the amendments.

The visit of R. J. Durley, M.E.I.C. Secretary of *The Engineering Institute of Canada*, was also referred to and Mr. Philip stated that there was a very happy tendency towards closer co-operation between the Association and *The Engineering Institute*. The Secretary has been authorized to attend a joint meeting of the Professional Associations early in the coming year. It is hoped that a closer co-operation between the various corporations throughout Canada will result from this conference.

The President also spoke of the good work done during the year by the Business Committee. He believed that the prospects for the future of the profession were now very encouraging and urged especially that all traces of professional jealousy between engineers should disappear and that all should work amicably together.

Kindly reference was made to late Colonel T.H. Tracy, M.E.I.C., and late H. M. Burwell, M.E.I.C., whose deaths occurred during the year.

Following the President's address, Captain E. A. Wheatley, A.M.E.I.C., Registrar of the Association was called upon to make his report.

Captain Wheatley stated that 1925 had been a memorable year in the history of the Association. The first four years of its operation had required great courage and persistence, but it was felt that at last something had been really accomplished, that the tide had turned, and that the Association was now on the way to more satisfactory recognition.

Captain Wheatley referred especially to the amendment to the Engineering Act which had recently been obtained, which, from a legal standpoint, had definitely changed the status of the profession.

As regards the Business Committee, with the new system of weekly meetings, it was now possible to get important business through in from two to three weeks, with the result of a great improvement in the general efficiency of the Association's operations.

The work of the Employment Department had been very successful during the year and he called upon the members to assist him in this branch of the Association's work by sending in enquiries and notifications of vacancies at as early a date as possible in the season.

In a forecast of the work which will require the attention of the 1926 Council, Captain Wheatley mentioned the forthcoming meeting of representatives of all the Professional Engineering Associations of Canada. A considerable amount of work was outlined also as coming before the Legislation Committee. This will include suggested amendments to the Electrical Inspection Act; the Interpretations Act; the Railway Act and to the Engineering Profession Act. Certain changes in the administration of the Association were brought forward as desirable, particularly the suggestion that members of Council should be elected for terms of two or three years, with an annual election,— thus only a part of the Council would retire annually, so that the Association would not suffer the loss of experience of the members of Council by a complete change in personnel each year as may easily be the case under the present system.

Captain Wheatley referred especially to the growth of what he called "Professional Consciousness" among the membership, which he described as the guidance of personal action by a sense of duty to the profession as a whole. The construction of the Pacific Highway, which is one of the largest pieces of work in hand at present in British Columbia, was cited as a special instance of this. Throughout this work, from location onwards, the entire project has been under the direction of qualified professional engineers, and those in charge of the work have not failed to draw the attention of the authorities in a tactful manner to the great advantages resulting from this careful supervision.

Great encouragement has also been given to students and engineers-in-training, for whom employment has been found, and who have expressed pleasure and satisfaction with the work of the Association on their behalf.

Following these two addresses, there was a general discussion of various subjects of interest, including the work of the Legislation Committee; questions of annual fees; qualifications for membership; and reciprocity with other associations. An official announcement was made of the elections for the ensuing year, — the elected members for the Council to be as follows:

President	— Geo. A. Walkem, M.E.I.C.,
Vice-President	— J. F. Frew, M.E.I.C.,
Council	— Chas. Brakenridge, M.E.I.C.,
	J. D. Galloway;
	G. S. Eldridge;
	A. S. Wootton, M.E.I.C.

The meeting concluded with a vote of thanks to the President and members of the outgoing Council, and to the Registrar.

The Electric Audiphone

The advances made in telephony during the past few years have been remarkable, not only for the distances spanned, but for the variety of uses to which audio-electrical science has been turned.

The telephone engineer has now turned his ingenuity to correcting subnormal hearing, and has promised a device which will enable the deaf to communicate responsively with their more fortunate fellows.

The appliance, in a general way, resembles the amplifier familiar to the radio fan, and is known technically as the Northern Electric Audiphone.

It is an electrical circuit, employing vacuum tubes with transformers designed for the audible frequencies. The apparatus, together with the required dry-cells, is packed into a small carrying case, in appearance like the box-type kodaks.

A microphone, hardly larger than a fifty-cent piece, built on the principles of the microphones used in broadcasting stations, serves to gather the sound and transmit it to the amplifier.

From the amplifier, the amplified sound is carried by a silk-covered wire to an ear-piece of novel design, molded from a plaster cast to fit exactly the crypt or small cavity of the ear. This renders it inconspicuous since it dispenses with usual head-band, and also, by its close contact with the ear excludes sounds other than those picked up by the microphone.

For those whose hearing is not so deficient as to require a high degree of amplification, a similar instrument is being made without the vacuum tubes and electric batteries.

At present there are only a few demonstration models of the instrument in existence, but if present plans mature, production on a commercial scale will begin in Montreal in the near future.

Abstracts of Papers read before the Branches

The New Diesel Electric Car

C. E. Brooks, Chief of Motive Power,

Canadian National Railways, Montreal, Que.

Ottawa Branch, November 26th, 1925.

Mr. Brooks referred to vicissitudes attendant upon railway transportation in these days. "In building railways," he said, "it is not always possible to go through the largest seats of population, or to follow the most favourable routes, owing to difficulties of land conformation."

One of the results referred to by Mr. Brooks was the springing up of bus lines between small towns and villages half a mile or so from the railroad. "These lines operate as long as it pays them, and then drop out of business, leaving local branch lines to handle the traffic. I do not think that the general public understands just what this sort of thing means to a railway. "The legislation which permits such companies, some of which I have referred to as wild-cat organizations, always is exceedingly busy in prosecuting the railways for any slight breach of regulations," Mr. Brooks complained. "There is no doubt that for general purposes most of our trains to-day are over-manned. Unit cars would solve this problem in many instances, and labor must realize the necessity of adopting this form of economy."

Mr. Brooks outlined some measures adopted to meet adverse considerations. He referred to criticism, much of it unjust, levelled at steam operation, particularly by those interested in electric engines. He admitted disadvantages of steam as a mode of transportation; loss of thermal heat, limitations of boilers, inability to carry around sufficient power to meet all hindrances.

As to a storage battery car, he referred to loss of time, which could not be avoided without serious damage to the expensive batteries.

The next attempt was an experiment with gasoline engines. Much had been accomplished by these, useful and efficient gasoline units having been employed with striking success in different places. Inability, however, on the part of the ordinary crews to handle efficiently these intricate gasoline electric units had brought about their gradual elimination.

Difficulty was also experienced with inferior quality and too high price of gasoline. In parts of the United States residual oils had been used with a certain amount of success.

A commission also was sent to Sweden, where it was found that the Diesel electric equipment had been successfully used. Here, however, it was discovered that too great weight proved a handicap. This formed the subject of investigation, and useful research work was done and had satisfactory results.

Mr. Brooks referred to encouraging results of the tests performed with Diesel cars. In spite of optimistic press reports, he did not think that the public yet were fully alive to the possibility of the cars. Much adverse criticism, most of which was unfair, had been published and the optimism warranted was not yet apparent.

"We have been able to cut down the cost of fuel to one-quarter of that under the old steam and coal method," he said: "The test recently completed was not with a view to publicity, but as an endurance test, purely and simply. We felt that if over that 2,900 miles we could demonstrate its practicability then the general public must be convinced."

Mr. Brooks quoted figures to show the relative cost of operating expenses of the steam engine with coal fuel and the new type of car, and these showed a tremendous saving; in addition to which Mr. Brooks explained that the staff could be reduced to an efficiency limit.

"Our experience has taught us," Mr. Brooks said, amidst laughter, "that the general public will stand a lot of vibration on the highway and even in their homes, but if they encounter it on the railroad there is the very devil to pay right away."

In conclusion, Mr. Brooks spoke optimistically of the future of the electric cars, and thanked the president and members of *The Engineering Institute* for the opportunity given him to explain the working advantages of the new type of car. He also expressed the opinion that, did the public understand the magnitude of the problem being tackled by the C.N.R. in a matter which concerned them so closely, they would be more helpful with sympathetic suggestions and constructive criticism than they had been in the past and less ready to heap abuse on the heads of the railroad officials.

Mr. A. B. E. Chorlton, representing Messrs. Beardmore, the designers of the new engine, then addressed the meeting. At the outset, he passed an eloquent tribute on the ability and public spirit of Mr. Brooks.

"You will find," Mr. Chorlton prophesied, "that the development in these cars proceeds far more rapidly than you dream of. Success has been so noteworthy that their future is assured."

Mr. Chorlton gave the credit of original discovery of the system of feeding and ignition which resulted in the modern engine to an Englishman named Akroyd Stewart, whose constant volume explosive cycle engine was really the forerunner of the new engine, although it was termed the Diesel engine. Development of the Akroyd Stewart car, however, was slow and it was only towards the end of the war that its value and practicability was established.

Operation and Maintenance of Lethbridge Northern Irrigation Project

P. M. Sauder, M.E.I.C., Project Manager,

Lethbridge Northern Irrigation District, Lethbridge, Alta.

Calgary Branch, November 26th, 1925.

In his remarks Mr. Sauder referred to a few statistics of the project, stating that there were 104,000 irrigable acres in all, 48,000 of which were irrigated up to the present. The water is taken from the Old Man river and delivered to the Keho reservoir, which latter has proved its worth as a balancing factor in the system on several occasions of excessive flood conditions. The dam at this headwork is 6½ feet high by 524 feet in length, and is constructed on a gravel bed. The main canal is designed to carry 800 cubic-feet per second, including losses by seepage and evaporation. The land is covered by 18 inches of water in an irrigating season, and the velocity of the flow in the main canals is 2.75 feet per second.

He dealt with his subject in a concise manner following out the different points from construction to operation very clearly. He referred to the concrete headgates with their "Stony" sluicegates which can be operated by one man; also the two river crossings of wooden stave syphons, 10½ feet in diameter, 3,000 feet and 950 feet long.

He then described the manner in which the district was served through main canals, branch, secondary, and distributing, comprising in all 600 miles of canals. There are 1,526 small wooden drops, and 1,196 delivery gates for farmers, 3,500,000 f.b.m. of lumber, 25 tons of nails, 50 tons of metal.

With reference to finance, he stated that 30-year bonds were issued by the province amounting to $5,400,000 yielding six per cent, also $140,000 short term debentures, to get this project under way.

There were three methods of delivering water, namely: continuous, rotation, and demand delivery. The work was designed for a rotation method which however generally entailed a supply on demand. He claimed that a fall irrigation assists materially in relieving an excessive load in June and July the following year, also that the problem of adequate drainage was a most serious one facing irrigationists to-day.

He detailed the organization and working of the system in full, and related the importance of literally selling irrigation to the farms, and would urge the governments to assist in every way possible in the matter of irrigated lands.

Modern Views on Matter, Energy and Radiation

Dr. J. C. McLennan, Professor of Physics, University of Toronto, Toronto, Ont.

Toronto Branch, November 26th, 1925.

Before the time of Dr. Black, the Scotch physicist, (1728-99), the general conception of matter, said Dr. McLennan, was summed up in the phrase "solid and continuous"; but to account for expansion under the influence of heat Dr. Black propounded the theory of discontinuity, i.e. that the component particles moved farther apart under the influence of heat. John Dalton (1766-1844) a man far ahead of his time, from these beginnings developed the atomic theory, which, with the theory of the Conservation of Energy, became the basis of physics and chemistry during the nineteenth century and was further developed by Lord Kelvin, Helmholtz and others.

Research work during the last twenty years had however caused the view to be held that even atoms were not solid, but were themselves the aggregates of large numbers of infinitely smaller corpuscles revolving at great speed in orbits about their common centre of mass like the planets of the solar system around the sun; and MASS was therefore but a quality or form of ENERGY, in the same way that sound, heat, light, electricity, magnetism, gravity, etc., were qualities or forms of energy. Conversely, all forms of ENERGY have MASS, the relation between them being $E = Mc^2$, where E = energy, M = mass, and c = the velocity of light, so that $E = M x 9 x 10^{20}$, i.e. a very LITTLE matter is equivalent to ENORMOUS energy.

Slides were shown indicating the relationship between the 92 known kinds of atoms that make up our universe, and outlining atomic numbers, molecular velocities, gas viscosities, etc., and it was shown that whereas the atomic weight of hydrogen is 1.008, that of helium is exactly 4.0. It was believed that four hydrogen atoms combined to make one helium atom, and since 1.008 x 4 = 4.032 there was a loss of mass in the transformation of .032, and a release of energy of $0.032xc^2$. As a matter of fact, there were certain stars, (whose temperature was well above 20,000 degrees), that showed the hydrogen spectrum, with a very faint helium spectrum, which suggested a "factory" where hydrogen was being converted into helium, the released energy being converted into heat. The explosion when hydrogen and oxygen united to form water was also, it was believed, due to lost mass; the lost mass being infinitesimally small, and unmeasurable.

As illustrating the almost inconceivable reservoir of energy in the atom, Professor McLennan gave the following examples:—

If one gram of hydrogen were turned into light, and the light absorbed as heat by lake Ontario, 200,000 tons of water would be raised in temperature one degree.

One ounce of hydrogen would heat 6,000,000 tons of water 100 degrees.

Professor McLennan, (if *he* disappeared), would heat four cubic miles of lake water to boiling point.

All engineering was founded on physics said Dr. McLennan. James Watt was at one time an assistant of Dr. Black, and put the physicists's theory of matter to practical use in the steam engine; the electrical engineer had done the same with the discoveries of Faraday. How many engineers to-day were following modern discoveries in energy and radiation? There were vast possibilities in these discoveries, and it needed the engineer to put them to practical use.

Ontario's Great Mining Northland

Hon. Chas. C. McCrea, Minister of Mines, for Ontario
Toronto Branch, November 19th., 1925.

ONTARIO'S GREAT MINING NORTHLAND.

Ontario's gold production, said Mr. McCrea, is to-day twice that of Mexico, more than half that of the combined United States, and equivalent to one ounce for every 6.8 ounces produced in the Transvaal; but whereas production in the Transvaal is declining, Ontario's production is rapidly increasing. The development of Ontario's gold mines dates from the discovery of the Porcupine gold field in 1909; previous to that year there was general disbelief that gold would ever be found in commercial quantities in Ontario, owing to the failure of previous developments. In fifteen years an industry has been built up that last year produced gold amounting to twenty-five million dollars, and that is expected to produce this year, thirty million dollars, and next year thirty-five million dollars.

Many engineering problems are involved, and some of the workings are now from 2,000 to 3,000 feet deep. If our geologists are correct, we shall eventually have shafts from 6,000 to 7,000 feet deep, and to ensure the safety of the miners, the Ontario government last year sent to South Africa, (where such depths are quite common), to obtain information as to the best methods of deep mining.

Silver mining in Ontario dates from 1903, when the Cobalt silver field was discovered. Since the fall of 1903, silver has been shipped to the value of 253 million dollars, and dividends paid amounting to 91 million dollars.

Nickel mining dates from 1883 when the Sudbury field was discovered. This field was at first worked for the copper without much commercial success, but the introduction of nickel-steel alloys, and the great demand for alloys during the Spanish-American and subsequent wars, put the industry on its feet. The increasing use of nickel for peace purposes has opened up a growing market for the nickle produced.

Mr. McCrea stated that no man could measure the future of the mining industry. If investments were wisely placed on the advice of competent engineers great results might be expected. Though the hardships were undoubtedly many, he did not know of any other field of activity which offered such scope and opportunity for young men, particularly graduates from our Canadian Universities. It was the duty of every Canadian to make Canada something more than a "back-yard from which materials might be drawn and fabricated in the United States."

See pages 22 and 23
for announcements regarding
The Annual Meeting

CORRESPONDENCE

A Field Method for determining Moisture Content and Bulking of Sand

Toronto 2, Ont., November 7, 1925.

The Editor,
The Engineering Journal,

Dear Sir:

Now that the water cement ratio theory is being applied to concrete mixes it seems to me that anything bearing on the application of this theory in the field is of possible interest to engineers. In working in the field one of the chief difficulties that has occurred is to determine quickly the quantity of water contained in the damp sand on the job and to determine the bulking of this sand due to its moisture content.

Of course, this can be done by measuring and weighing a quantity of wet sand, drying it, and measuring and weighing again, but to do this every day and change the mix accordingly is very defficult and tedious. Accordingly various quicker and more or less rough methods have been used by different engineers in the field. The following method seems to give more accuracy than most of them and to be easy to apply in the field; it is the result of a good deal of experimenting during the past season:

PRELIMINARY EXPERIMENT

Take a measure made of galvanized iron and containing, say 1/5 cubic foot and stand it inside a pail. Pour into the measure 80 fluid ounces of water measured by means of a graduated flask such as is used by photographers. Pour dry sand into the water until the measure is full, jarring the measure and pail from time to time so as to bring the water up to the surface. (If the water all soaks up into the sand before the measure is full, add more, but 80 ounces is usually found to be enough for 1/5 cubic foot of sand.) When the measure is full of inundated sand, jar it again and give it a little time for all the superfluous water to come to the surface, tip the whole apparatus a little to run all this water off into the pail, then remove the measure, pour all the overflowed (dirty) water from the pail into the flask and note its volume. If this be, for instance, 5 ounces and we began with 80, we know that it takes 75 ounces to inundate 1/5 cubic foot of this particular sand.

A precaution to be remembered is that one must always pour the sand into the water; never pour the water into the sand.

DETERMINATION OF BULKING

Fill the 1/5 cubic foot measure with the sand damp and loose. Empty this sand out on to a sheet of table oilcloth and keep it. Place the measure in the pail and pour into it the amount of water (e.g. 75 ounces) determined by the preliminary experiment. Pour the 1/5 cubic foot of damp sand into this water slowly and jar it as before. When it has a level surface under the water measure its volume by getting the depth from the top of the measure to the surface of the sand with a foot rule at various points. As the volume of the inundated sand is practically the same as that of dry tamped sand, this gives us the bulking of the damp sand.

DETERMINATION OF MOISTURE CONTENT

Continue adding more damp sand until the measure is full and measure the overflowed water precisely as in the preliminary experiment. This overflowed water will be the water originally contained in the sand (moisture content).

Suppose for instance, the sand were found to bulk 20 per cent and to contain 9 fluid ounces of water to the 1/5 cubic foot, (dry tamped measure), and that our mix is 1:3:4.

Instead of using 3 cubic feet of sand we must use 3 plus 20 per cent of 3 = 3.6 cubic feet, and the quantity of water per bag of cement that we should use if the sand were dry must be reduced by an amount calculated as follows: nine fluid ounces in 1/5 of a cubic foot equals 45 per cubic foot or 135 per bag, (3 cubic feet sand per bag). Divide this by 154 to bring it to Imperial gallons and we get 0.88 gallons.

The foregoing method saves all weighing and all evaporation after the preliminary experiment. Of course, the preliminary experiment must be repeated for each new type of sand, but, so long as the character of the sand on the job is constant, we need only make the determination for bulking and moisture and this can be done in fifteen minutes every morning. The method seems to be accurate within about 4 or 5 ounces of water per cubic foot and this error is negligible in practice.

Yours truly,
G. M. STEWART, A.M.E.I.C.

BOOK REVIEWS

The Theory and Design of Structures

Ewart S. Andrews, Consulting Engineer.
Demy 8vo.; 640 pages, fourth edition.
Price 13s. 6 d. Chapman & Hall, London.

The first edition of this book, it will be remembered, appeared some seventeen years ago. The present volume, like its predecessors, is intended for use in the class room and by practitioners in engineering offices as well. Graphical and analytical methods are both employed, the one best adapted to the problem in hand being apparently the one selected in any given instance. A feature of the book is the large number of illustrative problems scattered throughout the text intended to elucidate the related reading matter.

The author is on firm ground when, in his effort to meet the views of the practical man who scorns theory entirely, he asserts that it must not be forgotten that if theory be used at all, the best theory should be employed. Practical rules for use in designing, he states, are not necessarily sound simply because the structures resulting therefrom fulfil their function. In other words, correct theory considers all the facts in which case there can be no conflict between theory and practice.

The thing that impresses the reader perhaps more than anything else is the tremendously large field that the book attempts to cover. Within its covers one finds graphic and analytical statics, mechanics of materials, theory of framed structures, together with a treatment of each of suspension bridges, arches, masonry structures, reinforced concrete, retaining walls, dams and foundations. In consequence some of the discussions are very brief. To this last statement, however, the treatment of the beam and column, to cite two cases only, are exceptions.

The terminology is in places different from what we on this side of the Atlantic are accustomed to. One finds "core", "cleat connections", "notch" and "parallel flanges" where "kern", "beam connections", "cope" and "parallel chords" respectively would here be more familiar terms.

The book, like others by the same author, is well written, is sound in theory and although extended in its scope, apparently fills, judging by its reception in the past, an important place as a text for students and designers.

Peter Gillespie, M.E.I.C.

Tables for Reinforced Concrete Floors and Roofs

R. Travers Morgan with a foreword by E. Fiander Etchells, Past President of the Institution of Structural Engineers.
Demy 8vo.; 97 pages. Price 10s. 6d. Chapman & Hall, London.

This book is intended primarily for the busy man. It includes some 69 tables each giving the make-up in respect to thickness, and size and spacing of reinforcement, of a reinforced concrete slab capable of supporting an assumed live load, stated in pounds per square foot, across the various spans likely to be met with in ordinary construction. The tables are divided into three classes, the first pertaining to freely supported slabs and the second and third to slabs continuous at one and at two ends respectively. In the construction of the tables, bending moment coefficients of 1/8, 1/10 and 1/12 for the respective classes as above have been employed. Working stresses have been taken as 16,000 lb. per sq. in. for steel and 600 for concrete. As these are somewhat lower than those to-day generally favoured on this side of the Atlantic, the usefulness of the tables is somewhat lessened for American designers. Reference, however, is exceedingly simple and can be made very quickly. It is, for example, a matter of only a few seconds to ascertain that a 7-inch slab reinforced with ½-inch round rods spaced 4¾ inches centre to centre is one method of carrying a live load of 200 lb. per sq. ft. freely supported, over a span of ten feet. In addition to this, there are for the same problem, thirteen alternative solutions more or less desirable from which to select. To the American designer, it seems odd to find tables figured for live loads of 168, 224 and 336 lb. per sq. ft. The British "stone" of 14 lb. is doubtless the explanation of this.

A brief exposition of the theory of the reinforced concrete slab is given in the introduction.

The book is well gotten up, the press-work and binding being of excellent quality. For designers working under British specifications and for others also, but to a less extent perhaps, the book will be a valuable vade mecum.

Peter Gillespie, M.E.I.C.

BRANCH NEWS

Border Cities Branch

F. Jas. Bridges, Secretary-Treasurer.

The annual meeting of the Border Cities Branch was held Friday evening, Dec. 11th, in the Prince Edward hotel, Windsor.

After partaking of a splendid dinner the reports of the various committees were read. A. E. West presented the report of the Membership Committee and showed a net increase of 27 members or 30 per cent. The reports of the Papers and Entertainment Committee was presented by W. B. Pennock, Jr.E.I.C., The inactivity of the Advertising Committee was told of by W. J. Fletcher, A.M.E.I.C., F. Jas. Bridges, A.M.E.I.C., presented the reports of the secretary and the treasurer.

The meeting was then thrown open for nominations and election of officers for the year 1926. The result of the voting is as follows.—Chairman, A. J. M. Bowman, Vice-Chairman, L. McGill Allan, Secretary-Treasurer, W. H. Baltzell, Executive, Harvey Thorne, J. J. Newman, A. E. West. The ex-officio members of the Executive are J. Clark Keith, A.M.E.I.C., F. J. Bridges.

Entertainment for the evening was provided by two coloured entertainers who sang and recited many numbers which were well received.

Calgary Branch

G. P. F. Boese, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch-News Editor.

Members of the Calgary Branch gathered at the board of trade rooms Thursday evening, to listen to an address delivered by P. M. Sauder, M.E.I.C., of Lethbridge. The subject of Mr. Sauder's address was "The Operation and Maintenance of the Lethbridge Northern Irrigation Project"; a subject about which he is competent to speak, as he has been intimately connected with the project from its inception, both as division engineer on construction and now as manager. At the commencement he referred particularly to his renewal of acquaintance with members of the Calgary Branch of which he was a charter member.

As soon as Mr. Sauder was on his feet several of his classmates of early days at Toronto University gave him a welcome with the old college yell!

An abstract of Mr. Sauder's paper appears on another page of this *Journal.*

A. L. Ford, M.E.I.C., was in the chair, and thanked the speaker for a splendid paper. P. J. Jennings, M.E.I.C., proposed a vote of thanks and claimed that the paper might almost be taken as a treatise on the subject.

New members introduced during the evening were Lt.-Col. Parks engineer for the railway board; Lt.-Col. J. P. B. Dunbar, A.M.E.I.C., engineer for military district No. 13, and C. C. Ross of the federal mines branch.

On December 8th, a joint meeting of the members of this branch of *The Institute,* the Association of Professional Engineers of Alberta, and the Institute of Mining and Metallurgy took place. Commencing with a dinner at which some eighty persons sat down the programme consisted of a talk by the chairman, Professor R. W. Boyle, M.E.I.C., on "Natural Resources", and an address with lantern slides by Dr. F. A. Wyatt, professor of soils at the University of Alberta. Interspersed between these items were some humorous songs and community singing.

Natural Resources

Prof. Boyle mentioned that it was such meetings as this that did a great deal of good in furthering a better fellowship among engineers of the various societies. In his talk he dwelt in a general way on the natural resources of not only our own but every country from the point of view of an engineer. He grouped them into four classes:—

1. Nature's supplies of air, sunlight, and the earth's crust.
2. Reproducible resources, forests, fish, animals for clothing, and food animals.
3. Unreproducible resources, minerals, oil, gas.
4. Permanent resources, but limited.

He stressed his idea that there must be a rise and fall of industrialization, which in time must peter out and decay.

Alberta, he claimed had a super excellence of class one, including a wonderful soil, but systematic surveying and research must be carried out in regard to the latter. Conservation should be carried out by a more general use of bricks in building, thereby saving our timber.

In regard to class two, this showed a comparatively slow rate of production. The development of natural resources should not mean extermination. The consumption should not exceed the yearly supply of any one natural resource. If it does we should turn to suitable substitutes.

In class three he enumerated metals, coal, petroleum, and gas. Minerals and oil are being imperatively brought more in demand on all sides year by year. Mining, he said, is a wasting industry, as there is only one crop, and the most spectacular resource under this heading is that of petroleum. Petroleum makes history he declared, and the world is now being ransacked, especially by England and the United States, for new petroleum fields and is in the midst of a great experience concerning questions of supply. At present, he claimed, the supplies can only last a short time, relatively; we shall then have to turn attention to shales and sands for our oil supplies, and then at great cost.

In his reference to class four, namely, water power, he stated that here we have a great source of power, but the question will arise as to who really owns this resource. Most likely it will become the property of the people. Soil is an indestructible resource, but can very well be wasted. He claimed that this material is the maker of history, also, and the cause of wars and existence of people, adding that the supply will never again be equal to the demand. Eventually the soil must limit the world's population. Immigration, due to the over-saturation of the soils in proportion to the population, will take place from densely populated countries to Africa and North and South America. He believed that in thirty or forty years time immigration to Canada will have to be restricted. He also stated that this province will some day be a great workshop, when the population increases to the necessary point of about 1,000,000 people. It is obvious by the right plan for people all the world over to live near the productive soil areas, and as capital becomes saturated, like the people in any country, capital must emigrate. He surprised his audience by stating that to-day some three thousand million dollars of United States money was invested in Canada, and aptly concluded with the remark that the greatest resource of this country was its people.

Testing Alberta Soils

Dr. Wyatt gave a resume of the work being done by his department at the University in connection with soil surveys, tests, and research work. He referred to the co-operation existing between the university, the topographical branch of the Dominion government, and the province, the latter supplying the funds for carrying out the work. He claimed that we were twenty years behind the times in this work, in that it should really have been done before the homesteader arrived to take up the land. He produced samples of various soils, dividing them into heavier varieties such as clays, and lighter varieties such as sands, the proportion of which constituted the difference in the nature of the soils as we commonly know them. He explained the methods adopted in gauging the different classes varying from gravel to the finest sand forming the clays. These ranged from twelve grains per inch placed end to end, up to 5,000 particles per inch. He claimed that the soil of the western prairies was as good as anywhere else, all that was needed was the necessary water. His statistics showed that for every inch of rainfall on three of the large grain growing areas of Southern Alberta the returns in bushels per acre were practically identical. A very surprising though true statement. These results were gleaned from published results spread over a period of eighteen years.

Votes of thanks to both Prof. Boyle and Dr. Wyatt were suitably voiced by R. Mackay, A.M.E.I.C., and W. H. Snelson, A.M.E.I.C., and thanks proffered by the chairman to Dr. Wyatt for his able address. Mr. Snelson emphasized the great importance of this soil survey and investigation work and a proper understanding by the farmer of the nature and water-holding capacity of the soil on his holdings.

A pleasant evening was concluded by the thanks of Prof. Boyle to the Calgary committee, consisting of J. F. McCall, (chairman), G. H. Morton, A.M.E.I.C., Floyd K. Beach, A.M.E.I.C., and R. Mackay, A.M.E.I.C., for the splendidly arranged programme.

Cape Breton Branch

D. W. J. Brown, Jr.E.I.C., Secretary-Treasurer.

On Friday, October 2nd, Mr. Durley visited the Cape Breton Branch on his way to the Halifax Professional Meeting. The Executive had the pleasure of dining with Mr. Durley in the evening, after which a smoker was held at the branch rooms, where the members had an opportunity of meeting our new Secretary for the first time, and *Institute* matters of general interest were discussed.

Marketing of Cape Breton Coal

H. A. Hatfield, Maritime Representative of Babcock-Wilcox and Goldie McCulloch, Ltd., addressed a large meeting on the evening of November third, on the subject of the "Marketing of Cape Breton Coal". This paper was previously read by Mr. Hatfield at the Halifax Professional Meeting and will probably appear later in *The Journal.* The speaker suggested ways of increasing the sale of Maritime coal by means of making public reliable data concerning the different grades, and outlined a plan for procuring this data and making it available for the use of coal consumers. The subject seemed to hit those present in the right place, almost all taking part in the discussion that followed. The following motion, by W. S. Wilson, A.M.E.I.C., seconded by J. R. Morrison, A.M.E.I.C., was unanimously passed, "That the Cape Breton Branch of *The Engineering Institute of Canada* endorse Mr. Hatfield's suggestions outlined in his paper that the government of Nova Scotia take the necessary steps to bring users and producers of Nova Scotia coal into closer touch to their mutual advantage, with the prime object of increasing sales of Nova Scotia coal. To this end this branch offers what help it may be able to give."

Annual Meeting

The next gathering was the annual meeting, which took the form of a dinner, held in the Oddfellows' hall, Sydney, on the evening of December 8th. About thirty-five members and guests were present at this meeting, which opened at seven-thirty, when the chairman, S. C. Mifflen, A.M.E.I.C., asked the scrutineers to count the ballots for election of officers. While this was being done, the secretary read the annual report, which was adopted as read. The result of the ballot was that W. C. Risley, M.E.I.C., was elected chairman, and J. J. McDougall, M.E.I.C., of Sydney Mines, and J. R. Morrison, A.M.E.I.C., of Sydney, were elected as committeemen.

Mr. Mifflen, after a short address, in which he thanked the members for their co-operation during his term of office, and expressed the pleasure which he had derived in carrying out his duties as chairman, resigned the chair to Mr. Risley.

Mr. Risley assured the meeting of his appreciation of the honour being paid him and of his desire to make every effort possible to increase the benefit derived by the members of the branch. An excellent dinner was then served by the ladies of Rebekah Lodge, Sydney, interspersed with choruses, after which the following toast list was honoured:

The King, The Chairman.
Sister Societies, J. H. Fraser, A.M.E.I.C.
Response E. C. Hanrahan, Esq., Sec'y Nova Scotia Mining Society.
The Institute, J. J. McDougall, M.E.I.C.
Our Guests, A. L. Hay, M.E.I.C.
Response, Col. J. A. McDonald.

The speaker of the evening was Mr. H. J. Kelly, general manager, Dominion Iron and Steel Company, who spoke on "The Engineering Profession", stating to what great degree the operating man is dependent on the engineer and how necessary the engineer is to the successful carrying on of any industry.

A coloured orchestra provided entertainment in the way of popular musical numbers and vaudeville stunts. One of the orchestra inadvertently stepped on the toes (or rather the "cocoanut"), of another and they immediately clinched. Bill Wilson and Charlie Ross manfully separated the combatants in an effort to maintain the peace. "Razzers" being unobtainable, two pairs of gloves were produced and "Charlie" refereed a couple of rounds until honour was satisfied.

Many individual vocal efforts were well rendered and applauded, but the feature of the evening was the spirit with which (or should I say "by"), everybody joined in the choruses. They went in with both feet and raised the roof. The chairman even found difficulty in getting a motion of adjournment through as the wee sma' hours approached.

London Branch

E. A. Gray, A.M.E.I.C., Secretary-Treasurer.

Motor Trip

A motor trip was held to Stratford, on Saturday, October 24th. The party of twenty members, on arrival at the Stratford city hall, were met by City Engineer A. B. Manson, M.E.I.C. The locomotive repair shops of the C.N.R., city sewage disposal plant, and waterworks plants were inspected and proved most interesting to those present.

Following dinner at the Queen's Hotel, the party adjourned to the Chamber of Commerce rooms where speeches were delivered by General Superintendent of Motive Power, Roberts, Ald. Mone, Commissioner Garner, and City Engineer Manson. Chairman Mille extended to the speakers a vote of thanks on behalf of those present for the many kindnesses shown them.

Regular Meeting

The regular monthly meeting was held in the board room of the Public Utilities Commission, on Wednesday, November 25th. After the consideration of routine business, the subject "The desirable radius in rounding street intersections, (curb radius), was informally discussed, the consensus of opinion being that the radius was entirely dependent upon local conditions."

A dinner meeting was held in the drafting room of the Public Utilities Commission, Wednesday, December ninth.

Diesel Engines

Following the dinner, Chairman W. C. Miller, A.M.E.I.C., called on Mayor-elect J. M. Moore, M.E.I.C., who delivered a most interesting address. The paper "Diesel Engines", by E. V. Buchanan, M.E.I.C., was presented by V. A. McKillop, B.A.Sc., owing to the illness of Mr. Buchanan, the paper proved most instructive and interesting as Mr. Buchanan has investigated the subject personally both in America and Europe. Considerable discussion ensued following the reading of the paper.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
Stanley A. Neilson, A.M.E.I.C., Branch News Editor.

Stress Analysis by means of The Photoelastic Method.

Dr. P. A. Heymans, professor in the Physics Department of the Massachusetts Institute of Technology, read a paper on the above subject before the Montreal Branch on November 19th, 1925.

After an introduction in which he derived equations for the principal stresses in a structure under load, Prof. Heymans went on to tell of some of the applications of the theory of photoelasticity.

Celluloid models are used and the specimen to be tested is placed in the path of a beam of polarized light. Under different stresses a variety of colour combinations are observed. A simple specimen is first tested under known loads and a calibration thus obtained. Sections of unsymetrical form or with holes in them are then tested and the colour combinations obtained give a measure of the distribution and intensity of the stresses set up.

Prof. Heymans showed some slides illustrating work that had been done on gear pinions. Some interesting theories were developed in the laboratory relative to the shape of the fracture of gear teeth when subjected to destruction, either by being driven too tightly on a tapered shaft, or, by being overloaded by repeated heavy blows on the side of one of the teeth. These theories were fully borne out when full sized specimens, in metal, were tested under the conditions named.

Two interesting examples, the deck of an airplane mother ship, and, the structure of the illfated dirigible, the Shenandoah, were also dealt with.

Dean H. M. Mackay, M.E.I.C., took part in the discussion which followed, telling of some of the work done in the McGill laboratories where mirror extensometers were used to measure the strain produced by various loads. Prof. E. Brown, M.E.I.C., brought up the question of specimens composed of two materials with different moduli of elasticity such as reinforced concrete.

Dr. L. E. Pariseau, with a few well chosen words, in which he referred to Prof. Heymans' enviable war record, proposed the vote of thanks which was tendered to the speaker by the chairman, F. P. Shearwood, M.E.I.C.

Prior to the meeting the Executive of the branch entertained Prof. Heymans at dinner at the University Club.

Aviation and Modern Engineering Practice

Possibilities in the future development of aerial work, especially with reference to Canada, were described by Wing Commander E. W. Stedman, O.B.E., on November 26th, 1925 during the course of an address on "Aviation and Modern Engineering Practice," to the members of the Montreal Branch.

Exploration, surveying, transportation of goods and passengers, geological work, fishery patrols, city planning, commercial photography, railway surveys, timber cruising, plant "dusting", forest fire protection, and fire fighting were among the tasks now undertaken by aircraft, and big developments were ahead.

The address was illustrated by a large number of aerial and other photographs, showing various phases of the use of aircraft, many of which were of un-exampled beauty, and brought forth spontaneous applause from the members present.

Another statement, that was warmly greeted by the audience, was that in which he said that the Vickers "Vedette", specially designed by Canadian Vickers and produced at their Montreal works was the finest seaplane of its size in the world.

In the transportation of passengers and goods by aircraft, ground organization, such as aerodromes, beacons, signals, was just as necessary as good air organization, he continued. Good aerodromes were needed for the aeroplane just as much as good roads for the automobile, and this meant such an expenditure that it seemed the future of aerial transportation was intimately connected with the railroad and steamship business.

After describing the operation of the United States night and day air mail and the development of the "air taxi" service in Europe, Commander Stedman turned to aviation in Canada. He referred to the work done by the Quebec Dominion Air Exploration Company, for several industrial firms and to the survey of the watershed of the Hamilton river in northern Quebec, where the use of aircraft resulted in the transportation of 12,000 pounds of goods into the heart of the country, thus eliminating 24 portages, one of which was 10 miles in length, and doing in three weeks the work that had previously taken three months. By this means also the usual losses attendant on canoe transportation of goods were all avoided.

With a series of photographs taken from the air Commander Stedman showed how the camera could help the surveyer by giving the details of huge stretches of country in one photograph that could otherwise only be obtained by weeks of toil. In the United States, city surveys were being done by aircraft and city tax revisions were being governed by the photographs in some cases. Aerial photographs also showed the lay-out of industrial plants, city traffic, harbour works, water power developments, and flood control work. The aerial photograph was being used in railway surveys, in timber cruising, in ascertaining the various types of timber in a district, and in connection with the developments of factories, bridges, dams, wharves and piers. He also showed "without comment" five photographs of the Port Nelson terminal of the Hudson Bay Railway. No ice was visible in the pictures but the general impression gathered was one of deadly desolation.

After telling of the aeroplane's work in fighting the boll weevil pest in the cotton growing regions of the United States, the speaker went on to deal with the forest fire protection work now being done in various parts of Canada.

Prof. J. B. Porter, M.E.I.C., Dr. R. A. Ross, M.E.I.C., and Mr. Wilson, the secretary of the Air Board, took part in the discussion that followed. The question of an air harbour for Montreal was discussed and it was suggested that it might be opportune for the Montreal Branch to go on record in this connection. It was pointed out by J. L. Busfield, M.E.I.C., however, that the matter of establishing an air harbour was really a commercial business and not one in which the branch had any concern.

The vote of thanks was proposed by Dr. H. T. Barnes, A.M.E.I.C., and tendered to the speaker by the chairman, P. S. Gregory, A.M.E.I.C.

Students Evening

The evening of December 3rd, was given over to the Student Section of the Branch; the entire proceedings being in their hands. It was unfortunate that the weather man was not kind for the Students acquitted themselves nobly.

Scientific Principles Applied to Dwelling House Construction

The above title was rather formidable for the very clear and precise paper which H. A. Gauvin read. He first described the general problem of heating houses and pointed out where and how the largest part of the heat was lost.

He then told of a series of tests which had been made at the University of Saskatchewan, Saskatoon, in which model houses built to different specifications were heated by electricity throughout two winters. Some interesting tables were prepared showing the relative cost of heating the various types.

Mr. Gauvin then went on to describe in detail the construction of a number of houses built according to the ideas which had been developed. The house is essentially a frame structure, stucco on the exterior, plaster on the interior but with the space between filled with some insulating material such as mineral wool, shavings, or best of all granulated cork.

Automatic Control for Railway Substations

E. Gray-Donald, S.E.I.C., was the second speaker and read a very interesting and instructive paper which described in detail the function of the new substation which the Toronto Hydro-Electric Commission have recently installed in North Toronto.

Mr. Donald's paper is among those entered for Student's Prizes.

J. F. Rutherford, A.M.E.I.C., moved the vote of thanks which was tender to the speakers by the Chairman F. E. Winter, S.E.I.C.

J. L. Busfield, M.E.I.C., chairman of the Branch, complimented the Students on the excellence of the papers, and on the manner in which the whole meeting had been conducted.

Transmission Towers

Transmission Towers was taken as the subject of a lecture given by C. M. Goodrich, M.E.I.C., to the members of the Montreal Branch, on December 10th. Mr. Goodrich, who is designing engineer and manager of the transmission tower department of the Canadian Bridge Co., has had twenty years' experience in designing and fabricating all types of transmission towers and radio masts for erection in all parts of the world, which enabled him to give a particularly interesting talk, illustrated with lantern slides.

Pictures of towers and poles, both four square and triangular, conveyed a clear impression of the various forms that he had previously described. At the same time the defects and advantages of each were shown up and pointed out. Mr. Goodrich tinged all his explanations and anecdotes with a quiet humor that added greatly to the pleasure derived from his comprehensive address.

Towers in Canada were the chief subject for his photographs, although several other portions of the globe were shown.

The chairman for the evening was G. A. Wallace, A.M.E.I.C.

Annual Meeting

On December 17th, 1925, the annual meeting of the Montreal Branch, was held; J. L. Busfield, M.E.I.C., the retiring chairman, conducting the meeting.

The minutes of the last meeting were read and adopted after which Mr. Busfield gave his address, the report of the year's activities. As this report will be published in the February issue of *The Journal* no comment will be made on it here.

K. B. Thornton, M.E.I.C., moved the adoption of the report with fitting remarks. Prof. H. T. Barnes seconded the motion of adoption.

The report of the scrutineers was then read, the following being successful in the last election.

Chairman: C. J. DesBaillets, M.E.I.C.

Vice-Chairman: C. V. Christie, M.E.I.C.

Members of the Executive Committee: A. Duperron, A.M.E.I.C., A. R. Ketterson, A.M.E.I.C., J. A. McCrory, A.M.E.I.C.

The meeting was then thrown open for general discussion and some interesting suggestions were made.

Each of the incoming executive were then called upon to say a few words. Both Mr. DesBaillets and Professor Christie assured the members of the branch that they would do their best to try and keep up the good work which the retiring executive had done.

Messrs. McCrory, Ketterson and Duperron in turn moved a vote of thanks to the Publicity Committee, the Reception Committee and the Press respectively.

Geo. R. MacLeod, M.E.I.C., spoke of the fine work of the branch secretary, and K. B. Thornton, M.E.I.C., eulogized the retiring chairman's attainments.

The meeting then adjourned for refreshments which were served by a number of the Students under H. Massue, A.M.E.I.C., the Chairman of the Reception Committee.

Prior to the meeting Mr. Busfield entertained the outgoing executive at dinner.

Future Meetings

The programme of meetings for the spring term of 1926 is given on another page of this issue. The members will note that the branch is fortunate in obtaining some very eminent and well known speakers. Messrs. Henry Lefebvre, Newell, Pratley, Wurtele, Dr. Pariseau and Col. Girouard need no introduction. The mere mention of their names as authors is a guarantee of an interesting evening.

W. S. Lee, M.E.I.C., who is to talk to us on January 7th, is the chief engineer and vice president of the Duke interests. He is perhaps best known in Canada by his work in the Isle Maligne district.

H. S. Taylor, M.E.I.C., is well known as an engineer, specializing on pulp and paper plants. One of his most interesting recent works has been in connection with the Eddy Company at Ottawa.

W. A. Newman of the C. P. R., has specialized in the design of locomotives and is an outstanding authority.

E. B. Shand, is a McGill graduate, who has made a name for himself with the Westinghouse Company, with whom he is connected in a consulting capacity.

Dr. Van Bruyssel is a special representative in this country of the Belgian State Railroad, his paper will give us some very interesting facts with reference to the experience of government owned railroads in Europe.

Niagara Peninsula Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

This month the activities of the Branch were confined to a single dinner meeting held at the Welland Inn., St. Catharines. A good attendance was more than rewarded by having the pleasure of meeting R. J. Durley, M.E.I.C., and also of listening to a most instructive address by Professor C. R. Young, M.E.I.C., of the University of Toronto.

The Art of Bridge Building

Professor Young spoke on the subject of the art of bridge building and his lantern slide illustrations of notable—and remarkable—bridges undoubtedly emphasized the development which has taken place during the last century. One of the most interesting features was the comparison between American and European ideals, tending to show that the latter were the more inclined to boldness and individualism in their design.

Mr. Durley was on his first official trip as general secretary of *The Institute.* He spent the day with us and was given glimpses of the work on the New Welland ship canal and the hydro-electric power house at Queenston. Much of his time however was taken up in asking rather searching questions as to the activities of the branch and as to the feeling of its members on matters affecting the welfare of *The Institute.*

Engineers are discovering that the present stage of construction work on the ship canal is worthy of study. Lately a number of prominent Quebec engineers have paid us a visit, notably O. O. Lefebvre, M.E.I.C., chief engineer of the Quebec Streams Commission and de Gaspé Beaubien, M.E.I.C., and J. L. Busfield, M.E.I.C., consulting engineers of Montreal.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

The New Diesel Electric Car

"A minute quantity of fuel oil,—less than one drop in volume,—is injected into each of eight cylinders and exploded,—or burnt,—144 times every second in the newly developed oil-electric car which recently made such a successful transcontinental trip of 2,000 miles without the engine being once stopped."

This was the practical explanation given members of the Ottawa Branch of *The Engineering Institute* at their luncheon at the Chateau Laurier on November 26th, by C. E. B. Brooks, chief of motive power of the C.N.R. Montreal, and by Mr. A. B. E. Chorlton the inventor, of the outstanding success from economical and serviceable standpoints of the new so-called Diesel electric car, which, it was stated, will revolutionize railway transportation, will effect extraordinary economy, and will solve many of the most difficult problems which have confronted railway officials in the past.

Noise and vibration, the chief existing difficulties, were stated by Mr. Brooks to be rapidly nearing elimination, whilst Mr. Chorlton explained that the fuel, being slow burning and being injected into the cylinder at the end of the stroke was exceedingly safe, and that power and length of continuous service had been achieved by lightness of construction, which enabled the expert manufacturers to build an engine which weighed less than 12 pounds per unit of horse-power instead of 200 or 300 pounds per horse power, as did the old type of engine.

The steel superstructure of the Diesel cars which have stood such conspicuously successful tests was all manufactured by the Ottawa Car Company and so the Capital City shares in the glory of the new achievement.

"We are in the midst of an experiment, and it is difficult to talk at such a time, said Mr. Brooks. But on pressing invitation of Mr. Craig, and other officers of your association, and also because many incorrect rumours have been given publicity, I decided to brave the somewhat difficult task of talking to an audience in this seat of oratory."

A. E. Macallum, M.E.I.C., chairman of the Ottawa Branch was in the chair. There was an excellent attendance and both speakers received warm ovations, the cleverness of the discovery and the courage with which it had been put into practical use eliciting unbounded admiration from a group of scientific men who understood the value of the new discovery. An abstract of Mr. Brooks' paper appears on another page of this *Journal.*

The Ascent of Mount Logan

How a slender willow wand probably saved the lives of the expedition attempting the ascent of Mount Logan, second highest mountain on the North American continent, situated in the extreme southwestern corner of the Yukon Territory, was told on the evening of December 8th, by H. F. Lambart, B.Sc., D.L.S., A.M.E.I.C., before a joint meeting of the Ottawa Valley Graduates' Society of McGill University, and the Ottawa Branch of *The Engineering Institute of Canada.*

At four o'clock on the afternoon of June 23rd, the climbing party of eight attained what was thought to be the summit of the huge mountain, only to find that the real peak was three miles farther on across a thousand-foot valley, said Mr. Lambart, who was second in command of the expedition.

After a brief stay at the final summit, where record was left of the magnificent achievement and a flash of motion picture taken with the compact miniature camera, the party commenced the return to their supplies at their last camp. At midnight they were unable to find the return trail, so burrowed into the snow, being saved from probably fatal frost bites by a heavy fall of snow. As it was, all suffered frozen hands and feet that made their position, together with their weakened condition, due to the rarified atmosphere, very perilous.

To find the return trail that led down to their last camp and provisions, the willow wands that were placed every hundred feet to mark the trail after winds and snow had obliterated it, had to be located. Bundles of these had been carried in the ascent to guide the party as they proceeded, but had given out as they neared the goal.

"It looked as big as a telegraph pole, and very welcome," said Mr. Lambart, in speaking of the finding of the first willow wand that led them back to safety.

Mount Logan is 19,850 feet high, said Mr. Lambart, and not only is the highest mountain in the Dominion of Canada, but is the highest in the British Empire with the exception of some in the Himalayan chain. It is a colossal mass, probably the largest in the world, covering an area of 100 square miles at the 10,000-foot level.

Though visible from the sea as a distant ridge beyond the great coastal ranges, it was not observed nor named until 1891 when an expedition attempting the ascent of Mount St. Elias, in that region, saw the outline of the king of peaks in the distance. To the east of Mount Logan in the Yukon is an area 60 miles square, said the speaker, which is quite unknown to man, an unmapped chaos of mountains and glaciers.

No expedition ever attempted a similar task with better equipment, said Mr. Lambart, paying tribute to certain local firms that had contributed, and to the topographical maps supplied them by the Topographical Surveys from material collected by the International Boundary Survey of 1913.

"Andy" Taylor, one-time citizen of Ottawa, who acted as trail guide to the party, was warmly referred to by Mr. Lambart, who said that the members probably owed their success, if not their lives, to the judgment, sagacity and work of this veteran.

Mr. Lambart did not speak of the personal hardships or experiences of the members of the party to any extent. Of the climbing party of eight, two were forced to return as the more difficult sections of the ascent were reached.

The meeting was under the joint chairmanship of A. F. Macallum, M.E.I.C., chairman of the Ottawa Branch, and Dr. J. T. Basken, chairman of the Ottawa Valley Graduate's Society of McGill University.

Economic Phases Entering into the Adjustment of Vehicular Traffic to Steam Railways

R. A. C. Henry, M.E.I.C., director of the Bureau of Economics, Canadian National Railways, delivered an address on some economic phases entering into the adjustment of vehicular traffic to steam railways before a large and representative gathering of members of the Ottawa Branch, and men connected with transportation, at the Chateau Laurier, December 15th.

The speaker was introduced by A. F. Macallum, M.E.I.C., chairman of the local branch, and outlined in a comprehensive manner the various modes of transportation, their operating cost and the important part they played in the economic life of the nation.

He stated that the transportation of people and commodities was a vital factor in the economic structure of Canada and the United States, much more so than in other countries owing to the long distances involved. Figures were submitted bearing on the operating cost of electric, steam and motor vehicle transportation, which brought to light the fact that the cost per mile of electric freight and passenger transportation was 30 cents, and the cost of steam freight and passenger transportation was 14 and 30 cents respectively.

He pointed out that it was difficult to compare the cost of steam and electric transportation with motor vehicle transportation owing to the lack of standardization in the latter field, but $25 to $30, per diem would approximately cover the operation of a five-ton truck. It was apparent that Mr. Henry considered that operators of vehicular traffic had distinct advantages over those engaged in other modes of transportation, as they did not pay for the upkeep of roads, had terminals furnished them gratis, and were more elastic in their range of operation.

From the viewpoint of the tourist, busses provided greater scenic attractions than the electric railway, especially when speed was not considered a serious factor. Mr. Henry considered that trucks were of great advantage operating beyond a three-mile limit and in the vicinity of terminals and that they should be fostered in these spheres. At the same time, he felt that the time had arrived when vehicular traffic should operate under regulations somewhat similar to those pertaining to steam and electric transportation systems, that is, they should have uniform regulations to ensure continuous service and should contribute to the upkeep of roads and other facilities they are at present using without expenditure on their part. Instances were cited where considerable damage was done by trucks operating on roads only suited in their present shape to ordinary automobile traffic.

Mr. Macallum, on behalf of the Ottawa Branch, extended a vote of thanks.

Mr. Charles O'Reilly, during the course of the luncheon, rendered some much appreciated selections on the piano.

Peterborough Branch

Paul Manning, A.M.E.I.C., Secretary.
W. E. Ross, A.M.E.I.C., Branch News Editor.

Annual Banquet

The Peterborough Branch held their annual banquet on the evening of Tuesday, November 24th, at the Empress hotel, when members and friends to the number of eighty gathered around the festive board spread by host Graham.

Among the guests were Sir Alex Bertram, M.E.I.C., treasurer of *The Institute;* Professor H. E. T. Haultain, M.E.I.C., R. J. Durley, M.E.I.C., general secretary; Fraser S. Keith, M.E.I.C., W. H. Munro, M.E.I.C., F. S. Lazier, M.E.I.C., and others.

A. L. Killaly, A.M.E.I.C., chairman of the branch, presided in his usual cheery manner, making everyone feel at home; and in welcoming the guests and proposing a toast to them, paid a particular tribute to Sir Alex Bertram as the able financial head of *The Institute.*

In proposing the toast to *The Institute*, Mr. Killaly declared that a hard task had been set him to follow in the footsteps of the seven capable past presidents of the branch who had preceded him. He said in part that he had hopes that his own efforts would be judged with charity and paid tribute to the good work of his predecessors in office.

Sir Alex Bertram spoke briefly in reply, and indulged in some reminiscences of his early associations with Peterborough which go back as far as thirty-five or forty years ago. In referring to *Institute* affairs, Sir Alexander rather deprecated his own activities, stating that he had been treasurer for a number of years and could not understand why he could not be allowed by this time "to go and sit on the shelf and watch affairs from there." He spoke of the excellent services rendered *The Institute* by Fraser S. Keith, M.E.I.C., during his tenure of office as general secretary and lauded the members of the financial committee for their good work.

Mr. Durley also spoke in reply to the toast to *The Institute* opening his remarks by stating that in making his first bow to Peterborough Branch, he was somewhat subdued to find that he was addressing captains of industry and other high officials in the world of affairs, stating that he felt something like a lion in a den of Daniels. He paid a tribute to the work of his predecessor in office, stating that this was the first opportunity on which he had been able to express that sentiment in Mr. Keith's presence. In taking over the secretaryship he found that he had a highly trained and organized staff for which all credit was due to Mr. Keith. Mr. Durley said that he was at present making a survey of conditions in Canada, and stated that there were twenty-four autonomous and largely self-governing branches, which were capable of dealing with local conditions, and he emphasized the fact that this autonomy carried with it the responsibility of encouraging the growth of *The Institute* by securing new members, stating that the onus of increasing the membership rests entirely with the branch committee.

During his remarks, Mr. Durley said that in his opinion there should be some modification in the method of sending or interchanging papers between branches, and suggested a central agency for this purpose. He also spoke in reference to the relationship with young members, which relationship, he stated, should be improved.

Professor H. E. T. Haultain, M.E.I.C., replied to the toast to "Professional Engineers", but, as he had previously stipulated that he would only speak for one minute, his remarks were brief. Notwithstanding his self-imposed time limit, he succeeded in that time, in characteristic vein, in replying to the toast and also in conveying the good wishes of the Toronto Branch.

F. S. Lazier, M.E.I.C., conveyed the greetings of the Niagara Peninsula branch and complimented the Peterborough organization on the enthusiastic spirit of their meetings.

W. H. Munro, M.E.I.C., who is an old resident of Peterborough, now connected with Vickers Limited, amused the "banqueteers" when he stated that he was a reversal of the usual order of things, in that instead of being an Englishman making good in Canada, he was a Canadian Engineer who had at least succeeded in making a living in England.

The toast to the "Sister Professions" was replied to by the Reverend J. W. Gordon and Mr. V. J. McElderry, who replied for the Ministry and the profession of law respectively.

Other speakers were, R. B. Rogers, M.E.I.C., E. R. Shirley, M.E.I.C.; R. L. Dobbin, M.E.I.C., all of the local branch, and Mr. F. H. Dobbin, a non-member, but a close friend and always welcome guest at branch affairs.

The irrepressible "Sextette" were, as usual, in evidence, and perpetrated a couple of alleged musical numbers in which they took liberties with members and guests with the utmost impartiality, although the victims appeared to enjoy it. The "Sextette" consisted of Paul Manning, A.M.E.I.C., A. B. Gates, A.M.E.I.C., L. Dickieson, A.M.E.I.C., T. E. Gilchrist, A.M.E.I.C., and J. H. Johnson Jr., E.I.C., with Mr. I. McKenzie at the piano.

Reclamation of Lands in Western Canada

A regular meeting was held on Thursday, December 10th, in the Chamber of Commerce, when E. L. Miles, M.E.I.C., county engineer, and superintendent of roads for the county of Victoria gave a paper on the above subject.

A. L. Killaly, A.M.E.I.C., was in the chair, and in opening the meeting expressed the pleasure of the branch in having a paper from a branch member and reminded those present that Mr. Miles was eminently qualified to speak on the subject which he had chosen, since he had spent some ten years engaged in engineering work in the west, five years of which were in private practice and five years with the Department of the Interior.

Mr. Miles, in his introductory remarks, said that the presentation of a paper on the subject of the reclamation of western lands before a branch in this part of the country might seem somewhat superfluous, but that a knowledge of the necessity for, and the operation of some of the departments at Ottawa, with respect to the civil service and national development might not be amiss in these times.

He pointed out that the Department of the Interior might very appropriately be termed the Department of Research and Science, and briefly outlined the scope of it's activities. Referring particularly to the "Water Powers Branch" the speaker said, that this branch has as one of its subdivisions the Reclamation Service which covers all irrigation and drainage projects and developments. The two terms drainage and irrigation, being inseparably connected under the heading of reclamation as the term is applied to land.

Mr. Miles referred to the power of the Department by virtue of the "Irrigation Act" of 1894 for the North West Territories and "The Act Respecting Irrigation" of 1906, and described fully how these acts were administered by the department for the benefit of the two prairie provinces. Speaking of irrigation it was mentioned that in India over 40,700,000 acres are under irrigation, the largest area in the world; in the United States, in 1920, a total area of 19,191,716 acres were under irrigation; Argentine has 1,000,000 acres, and Japan about 7,000,000 acres under irrigation. In Canada, we have 50,000,000 acres of land in Alberta and Saskatchewan that need irrigation, but much of this area is too high and rough for practical irrigation, therefore, the actual irrigable area is 4,000,000 acres.

The speaker quoted figures indicating the actual areas irrigated by the various projects and the cost thereof, and speaking particularly of the western section of the Canadian Pacific Railway, Department of National Resources, which has an area of 122,000 acres irrigated, at a cost of about $16.000,000. he stated that according to the 1923-1924 report 10,050,000 bushels of wheat were harvested from this area, with a value of 71 cents per bushels to the farmer or a total value of $7,135,-500.

There was a very good attendance of members and friends at this meeting and the lively discussion, and the many questions which Mr. Miles was called upon to answer at the conclusion of his address were clear evidence of the interest and appreciation which his address had evoked.

E. R. Shirley, M.E.I.C., formally condensed this into a vote of thanks which was very heartily endorsed by all present.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

A meeting of the Saint John Branch of *The Engineering Institute of Canada* was held on the evening of November 19th, 1925 at the New Brunswick Telephone Company building and was addressed by K. H. Smith, M.E.I.C., of Halifax speaking on the subject of World Power Conference-Scandinavian Tour. The address was illustrated by a large number of very fine slides showing water power and scenic views of several European countries, W. R. Pearce, M.E.I.C., was chairman of the meeting and tendered a vote of thanks to Mr. Smith on motion of Geoffrey Stead, M.E.I.C., and G. G. Murdoch, M.E.I.C.

On December 11th, 1925, the members of the Branch, were addressed by Gordon Kribs, M.E.I.C., on "The Calculation of Short Transmission Lines". This paper had been recently read at Maritime Professional Meeting at Halifax in October but some of the members had not previously heard it. A number of slides were shown on the screen in explanation of various points brought out in the paper W. R. Pearce, M.E.I.C., presided and a vote of thanks to Mr. Kribs was moved by Geoffrey Stead, M.E.I.C., and F. P. Vaughan, M.E.I.C.

The papers of Mr. Smith and Mr. Kribs have been previously published in *The Journal*.

A resolution of condolence was passed by the branch at the death of R. H. Cushing, M.E.I.C., and a copy ordered to be forwarded to the family of the late Mr. Cushing.

Toronto Branch

C. B. Ferris, A.M.E.I.C., Secretary-Treasurer.
J. W. Falkner, A.M.E.I.C., S. G. Salman, A.M.E.I.C.,
Branch News Editors.

The regular weekly meetings have been of particular interest this month on account of the variety of the subjects dealt with by outstanding men.

Ontario's Great Mining Northland

It was a great pleasure to welcome on November 19th, the Hon. Chas. S. McCrea, minister of mines for Ontario, and a speaker of authority on the present mining developments in Ontario's northland. An abstract of Mr. McCrea's paper is given in this issue of *The Journal*.

At the close of Mr. McCrea's address, moving pictures were shown of typical Ontario gold, silver, and graphite mines, and illustrating in detail the underground workings of a gold mine and the process of recovery of gold from the ore.

Modern Views on Matter, Energy and Radiation

Dr. J. C. McLennan, professor of physics, University of Toronto, addressed the branch on November 26th, and held members spellbound for over an hour while he described in language that all could understand the revolutionary changes which the last two decades have seen in our conception of matter, energy, and radiation. The meeting was held in the Physics Auditorium of the University of Toronto to enable suitable apparatus to be used, and to accommodate the large number of members who wished to be present. An abstract of Dr. McLennan's address appears elsewhere in this issue.

Geneva

After hearing of such strife and turmoil in the breast of an atom, post-war Europe would almost seem peaceful!

At the monthly luncheon on December 3rd, the branch had the pleasure of welcoming Sir Robert Falconer, president of the University of Toronto, as their guest. Sir Robert had not long returned from Europe, and gave the members present a delightful word picture of that beautifully situated city,—Geneva, and the work being done there by the League of Nations. Ideally located for ease of access from all the European capitals, hospitable to all who visited her, intellectually second only to Paris as a centre of French culture, yet unprejudiced and open minded as regards international politics, Geneva was pre-eminently suited to be the headquarters of the League; and the unseen and unheralded work done there during past years had made possible the more spectacular news-items of the Dawes plan, and of Locarno. Canadians should be exceedingly proud, said Sir Robert, of their representation at Geneva; and of such men as Senator Dandurand, Chairman of the Annual Assembly, and Sir Herbert Ames, Treasurer of the League.

The closeness with which Sir Robert's address was followed was an indication of its great interest to those who had the good fortune to be present.

Brazil

On December 10th, an open meeting was held, addressed by F. J. Mulqueen, of the Brazilian Traction Company, and many members of the general public, as well as students from the University of Toronto, availed themselves of the invitation to be present.

Mr. Mulqueen's address was profusely illustrated with lantern slides, and surveyed the early history of the country, and its present geographical, economical, and sociological character. Although lacking coal and oil, Brazil has become a country of great possibilities, and is to-day in an analogous position economically to that of the United States fifty years ago.

Members present were specially interested in details of the large modern hydro-electric generating stations and transportation systems, controlled by the Canadian company with which Mr. Mulqueen is connected, and which supply Rio de Janeiro and Sao Paulo with light and power; and excellent slides were shown of these magnificent cities and the surrounding country. Mr. Mulqueen had evidently gone to great trouble in the preparation of his address, and that it was much appreciated was shown by the numerous questions put to him at the close, and the evident desire of members to hear still more of this republican neighbour to the south.

Standards of Admission and Grades of Membership

On Thursday, December 17th, a meeting was held at Hart House, devoted to the discussion of standards of admission and grades of membership in *The Institute;* Professor T. R. Loudon, M.E.I.C., being in the chair. While the attendance was not as large as had been expected, members had the great pleasure of welcoming R. J. Durley, M.E.I.C., the general secretary of *The Institute*.

J. A. Knight, A.M.E.I.C., led the discussion, and explained that a letter had been received from the Saskatchewan Branch in March, 1925, stating that "members of that branch felt that the present system of classifying members was not satisfactory". A committee had been studying the matter, and on their recommendation, that evening had been set apart for discussion.

Mr. Knights' first question was: "Are our standards of membership high enough?" and by comparing the standards of admission and grades of membership in the E. I. C. and kindred societies, he showed that the E. I. C. requirements were higher than those of many other societies, and that members were justified in accepting them as being satisfactory. In only one instance might an objection be raised,—that was, to the maximum age limit of thirty-three years for Juniors.

As regards the interpretation of the by-laws there was however in one case a wide divergence of opinion—as to the meaning of the term "Professional Responsibility". Some engineers held that when a man was in a position where he might be asked to do original design or layout work, he was in a position of professional responsibility. Others felt that unless a man were *personally responsible* for the safety and efficiency of the engineering project on which he was working, he was *not* in a position of professional responsibility. Then again, as regards the term "responsible charge", was the designing engineer, the resident engineer, or the chief engineer the responsible party; or were they all responsible? Although these were minor difficulties, it would be a good thing if a uniform interpretation could be secured throughout *The Institute.*

Mr. Knight felt that our real troubles were chargeable against ourselves, and not to the constitution, and that we should try to develop more "esprit de corps" by (1) Assuming responsibility in the affairs of the society; (2) Attending and taking an interest in the branch meetings; (3) Offering CONstructive, but not DEstructive criticism of *The Institute,* and *The Journal,* and (4) contributing to the engineering literature of Canada, instead of to the literature of some other country.

Each corporate member of the society, said Mr. Knight, is liable to be named as sponsor by some applicant for admission or transfer, and at such times the reputation of *The Institute* is in his hands, since the members of Council can only rely on the recommendations of the five sponsors, and the local branch executive. The reputation of *The Institute* was established by its members, and one inferior member might do more to lower that reputation than many worthy members. If there was the slightest doubt as to an applicant's qualifications, give the society the benefit of the doubt—not the applicant. The applicant could apply again, but it was a serious if not impossible step for *The Institute* council to cause a member to revert to a lower grade.

The discussion which followed was taken part in by George T. Clark, A.M.E.I.C., Professor C. R. Young, M.E.I.C., George A. McCarthy, M.E.I.C., R. B. Young, A.M.E.I.C., A. C. Oxley, A.M.E.I.C., R. O. Wynne-Roberts, M.E.I.C., and William Storrie, M.E.I.C., following which refreshments were served in the Great Hall.

Mr. Durley was then called upon, and in humorous and yet serious vein gave a summing up of the whole discussion from the point of view of the general secretary. Members present were particularly interested to hear that the only reason that the transactions were not now being issued was a financial one, and that the Council were anxious to resume their publication when they were able.

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

Ascent of Mt. Logan

An audience of about four hundred people, assembled on November 24th, 1925 in the Chamber of Commerce auditorium, heard the history of one of the great adventures of the age when they listened to Colonel W. W. Foster's narrative of the Mt. Logan expedition successfully carried through in May and June this year.

Colonel Foster told the story in the simplest possible language, without any rhetorical flourishes. But it was tremendously impressive, the very absence of elaborate description leaving the listener's imagination freer play with the facts.

Col. Foster hurriedly sketched the history of the Mt. Logan expedition from the inception of the idea in 1913 down to the carrying out of Capt. McCarthy's reconnaissance in 1924, and the final achievement in the early summer of the present year. A chart, photographs and his own unembellished narrative furnished an excellent description of the surrounding country and approach to the ice-girt mountain. Generous tribute was paid to the reconnaissance party last year, when Colonel Foster said that he attributed the success of the enterprise to the work of Capt. McCarthy and the packers who had gone in then and established supply bases in readiness for this year's expedition.

The main party left Seattle in the latter part of April this year, on May 6th, reached Cordova, Alaska, and on May 12th, started up the Chitina river.

Early in the proceedings the expedition experienced the difficulty of travelling over moraine, at first carrying heavy packs which they gradually reduced as they realized the disadvantage of weight. Within ten miles of the point selected for their main camp they came upon the main cache established the previous year, and from here supplies were relayed to the base. Weather conditions had to be studied continually. The day at that latitude was from twenty-two to twenty-three hours long. Great variations of temperature were experienced at 8,000 feet altitude, from which the main climb began. On the snow the temperature might be about freezing point, and four or five feet above one's feet the temperature would be eighty or ninety degrees.

Up to May 31st, when they established their base camp at the foot of Mt. Logan, the weather had been beautiful throughout, and the schedule had been strictly adhered to. But difficulties were to present themselves later. A deep cleft between Mt. King and Mt. Logan was not anticipated, photographs taken from a distance having represented this as a continuous shoulder.

Colonel Foster described the feeling of the explorers when they came to what it was feared was an impasse, but from which Mr. McCarthy found an exit through the fortunate discovery of a narrow gateway through a mountainous block of ice. The weather, hitherto friendly, became violently stormy at this last difficult point in the expedition, and at that great altitude, where nearly all of the climbers experienced some difficulty in the mere act of breathing, they were weather-bound for four days, dense snow clouds cutting off the light. This fact, coupled with the great velocity of the wind, made it dangerous to attempt climbing. They began to suffer fromfrostbite. June 16th, they were still some distance from the summit, and felt that the situation was rather desperate. The temperature had dropped to 25 below zero, there was only food at this point for another twenty-four hours, so the frost-bitten members were sent down to Col camp. Captain McCarthy and Colonel Foster made a rush for what they thought was the summit of Mt. Logan, only to find that they had made a mistake. After eighteen days from their camp they were still four miles from the highest peak, well-nigh exhausted. They returned to the King Col camp once more. Two other attempts had to be made before they finally attained their objective.

The summit of Mt. Logan offered little room for description, being a narrow plateau about three feet in width and seventy feet long. Such a terrific wind was blowing that they had to lean on their ice-picks in order to keep a foothold. The strain of the twenty-three days' climb had proved almost too much for them; they were suffering from fear of delusions, delusions of comfortable homes and barns which became so insistent during the descent of the mountain that Colonel Foster himself was half-prompted to stop and tell a spectre of his imagination that it was very bad weather in which to paint a barn.

Still they encountered storms and terrific cold. Without tents and unable at one point to make any progress owing to the gale, they cut holes in the ice and huddled together in these for twelve hours. One member of the party, unable to walk because of frostbite, had to be carried, which made the descent still more tedious and difficult. It took them six days to get down from the summit of the mountain to the camp at King Col. There were hardships still ahead of them, even then, but a fine spirit was shown even by the worst sufferers. One man with feet so badly frozen that the bone protruded, walked a distance of fifty miles without complaint. Twice they discovered that their caches had been rifled by bear.

Even after reaching the river their troubles were not at an end. Two rafts were built to take them down to McCarthy. One accomplished the eighty-eight miles in safety; the other one, on which Captain McCarthy and Colonel Foster travelled, was swept away a short distance from its starting point, and it took them five or six days to make the remaining seventy miles on foot.

"This expedition was not just for the purpose of climbing Mt. Logan," said Colonel Foster in conclusion, indicating something of the valuable information which it had given to science through its disclosure of meteorological conditions, geography, geology and the fauna and flora of the country. All this was adding to the store of human knowledge. The expedition, moreover, was carried out in a spirit of adventure which was a characteristic of the Anglo-Saxon race, a spirit which had been greatly responsible for the building of the Empire.

This idea was emphasized by Mr. Ford and Mr. Lindley Crease in the vote of thanks which they accorded the speaker at the conclusion of the proceedings. G. B. Mitchell, chairman of the local branch, presided.

Joint Luncheon of the British Columbia Professional Engineers

On November 19th, the Victoria Branch held a joint luncheon meeting with the Association of Professional Engineers of British Columbia. At this meeting the principal speaker, F. A. Wheatley, A.M.E.I.C., registrar of the professional association, gave a very interesting address on the work of the Association.

The
Annual General
and
General Professional Meeting
will be held in
Toronto, January 27th, 28th, and 29th, 1926

Preliminary Notice

of Applications for Admission and for Transfer

December 19th, 1925

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in January, 1926.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council, shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering with special reference to the branch of engineering in which he has been engaged. This examination may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects: geography, history, (that of Canada in particular), arithmetic, geometry, euclid (books I, IV and VI), trigonometry, algebra up to and including quadratic equations.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed successfully an examination equivalent to the final examination of a high school or the matriculation of an arts or science course. He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination equal to that prescribed for admission to the grade of Junior in the foregoing section and he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BENNETT—STEWART GORDON, of 121, Spadina Rd., Toronto, Ont. Born at Toronto, Ont., May 20th, 1892. Educ., B.A.Sc., Univ. of Toronto, 1914 one term Oxford University; four summers with Dept. of Public Wks., Toronto; 4½ yrs., Capt. Royal Engineers; then with Canadian Johns-Manville Co., acoustical engr., until Nov. 1919, when taken on staff of Faculty of Applied Science and Engr'g. Univ. of Toronto; 1920, lecturer in commercial engr'g., and asst. secretary; 1921 to date, lecturer and secretary, University of Toronto, Toronto, Ont.

References: C. H. Mitchell, P. Gillespie, T. R. Loudon, H. E. T. Haultain, A. D. Campbell, F. A. Gaby, A. H. Harkness, C. S. L. Hertzberg.

BERRY—EDWARD WILSON, of Ottawa, Ont. Born at Fermoy, Ireland, Aug. 26th, 1881. Educ., Hon. Grad., S.P.S., Toronto, 1910; D.L.S.; 1908 (summer) township outline, Ontario; 1909 (summer) asst. topogr., geological survey; 1920 (May-Dec.), articled pupil, D.L.S.; 1911-12, D.L.S. asst. to C. F. Miles, Inspr. of Surveys; 1913-14, asst. to T. H. Plunkett, D.L.S., base line surveys; 1912-13, surveys of township outlines and misc. surveys in Northern Manitoba; 1914 to date, i/c precise levelling parties except for two years overseas; at present, surveys engr., Grade 3, Geodetic Survey of Canada, Ottawa, Ont.

References: E. P. Bowman, R. H. Montgomery, W. H. Norrish, W. C. Murdie, O. Inkster, F. B. Reid.

BURKET—LESLIE HOWARD, of 165, Bedbrook Ave., Montreal West, Que. Born at Montreal, Que., July 5th, 1889. Educ., private tuition; 1904 to date, with Dominion Bridge Co., as follows:—1904-08, dftsman. in drawing office; 1908-13, checker, checking drawings of all kinds of steel structures; 1913-15, squad leader i/c of drawings of buildings and bridges; 1915-23, designing office, making designs of highway and railway bridges, hotels, office bldgs., apartments, theatres, churches, mill bldgs., transmission towers, water tank towers, oil tanks, electric signs, etc.; Sept. 1923 to date, i/c city designing office, superintending design of all building structures, Dominion Bridge Co., Ltd., Montreal, Que.

References: F. P. Shearwood, P. L. Pratley, LeRoy Wilson, D. C. Tennant, Jas. Robertson, L. R. Thomson.

CONNOR—HERBERT ARTHUR, of Calgary, Alta. Born at Winnipeg, Man., Sept. 28th, 1900. Educ., 1 yr. Arts and Science, Univ. of Alberta; 1920-22, chainman, C.N.R., Edson Divn.; 1923 rodman, and 1924 to date, rodman, C.N.Rlys., Edson and Calgary Divisions.

References: W. S. Fetherstonhaugh, H. W. Tooker, H. A. Bowden, A. J. Gayfer, C. V. Hope.

COOTE—JAMES ALEXANDER, of Pointe Claire, Que. Born at Oakville, Ont., July 25th, 1882. Educ., B.Sc. McGill Univ. 1914; Previous to and during college course, engrg. work as follows: 2 years, Westinghouse shops; 6 mos. switchboard operation; 2 or 3 years electr'l. constrn.; 1916 to date, mech'l. dept., McGill University, Montreal, as follows: 1916-17, demonstrator; 1917-23, lecturer and 1923 to date, assistant professor.

References: H. M. MacKay, C. M. McKergow, A. R. Roberts, C. V. Christie, C. J. Desbaillets, C. S. Saunders.

CRAIG—STEPHEN E., of Toronto, Ont. Born at Brampton, Ont., Jan. 31st, 1882. Educ., B.A.Sc., University of Toronto, 1911. 1911-12, d'ftsman, Dom. Bridge Co.,Lachine1;912-14, mech. supt., Ritchie & Ramsay, New Toronto, i/c of machinery, small power plant and pumping station; 1914-16, inspr., bridges and tanks, C.N.R.; 1917-19, chief inspr., representing Internat. Shipbuilding Co. at Detroit and Rochester, and Manager, Hamilton District for Canadian Inspection Co.; 1919-24, district mgr., for Canadian Inspection Co.; 1924-25, asst. laboratory engineer for H.E.P.C. of Ont., and at present, asst. laboratory engr., i/c of inspectn. of all materials of construction except concrete, H.E.P.C. of Ont.

References: W. P. Dobson, R. B. Young, R. J. Marshall, W. D. Walcott, C. P. Disney, Thos. Taylor, Fred. Newell.

DOBIE—ROBERT, of Peterborough, Ont. Born at Osnabruck, Ont., June 16th, 1863. Educ., Norman School, Milton, Ont. Tech. School, Grand Trunk Ry., Montreal; 1880-1895 — 5 years ap'ticeship, locomotive shops, 3 years ap'ticeship, dfting office, G.T.R.; 2 years firing locomotive express, then back to shops for 2 years. Afterwards in dfting office for 3 years; 1895-1900, chief dftsman., Royal Electric Co., Montreal; this company purchased by Can. Gen. Elec. Co. 1900-03, mech'l. supt., when transferred to same position in Peterborough. Still occupying position as mech'l. supt., Can. Gen. Elec. Co., Peterborough, Ont.

References: R. B. Rogers, R. L. Dobbin, A. Bertram, A. L. Killaly, H. O. Fisk.

DUFFY—ROB ROY, of Chicoutimi, Que. Born at Hillsboro, N.B., Mar. 27th, 1889. Educ., B.Sc. in Arts, Acadia Univ., 1910, B.Sc., McGill Univ., 1913; 1912 (summer), rodman on plant extension, Dominion Bridge Co., Lachine, Que.; 1913, levelman on rly. location, St. Lawrence Pulp & Lumber Corpn., Chandler, P.Q.; 1914, engr. i/c logging rly. location and constrn., Chandler, P.Q.; 1915-19, overseas, Lieut. Can. Engrs.; 1919-23, outside mgr. and vice-pres., W. H. Duffy Sons, Ltd., gen'l. merchants and lumbermen, Hillsboro, N.B.; 1923-24, logging divn., Bathurst Co., Bathurst, N.B.; 1924 (Feb.-Nov.) logging divn., Brompton Pulp & Paper Co., East Angus, Que.; Nov. 1924 to date, with Price Bros., at first in the engr'g. divn., Kenogami, then from June 1st as asst. land surveyor, Chicoutimi, Que.

References: H. W. Racey, H. L. Trotter, A. A. MacDiarmid, J. A. Dickinson, C. C. Lindsay.

EDDY—HARRISON PRESCOTT, of Newton Center, Mass. Born at Millbury, Mass., U.S.A., April 29th, 1870. Educ., B.S. in Chemistry, Worcester Polytechnic Institute, 1891; 1891-92, supt., sewage treatment works, Worcester, Mass.; 1892-1907, supt., Worcester Sewer Dept., Worcester, Mass.; 1907 to date, partner, Metcalf & Eddy, 14, Beacon Street, Boston, Mass. Acted as consltg. engr. on water works, sewerage, sewage and waste disposal problems for various municipalities and mfg. interests, and served as expert witness on various cases having to do with "nuisance", pollution and constrn.

References: C. H. Rust, F. A. Dallyn, W. Gore, W. L. McFaul, I. H. Nevitt, R. DeL. French, F. A. Barbour, R. S. Weston, G. F. Swain.

HIBBERSON—ROBERT WILLIAM, of Hampshire Road, Oak Bay, Victoria, B.C. Born at Blackpool, England, Dec. 28th, 1882. Educ., 3 years (1899-1902) Victoria University, Manchester, England; 1902-05, i/c design and constrn., also mtce., 6 miles street rly., Blackpool, England; 1905-08, i/c design and constrn. large portion of ditch, Spanish Lake to Bullion for Guggenheimer interests; 1908-20, head of firm Hibberson Bros., during which time designed and constructed flumes and logging rly. for Shawinigan Lake Lumber Co., Burkholder Interests of Kansas, Merchants Bank of Canada at Gold River and Dorr Kootenay, power survey for Merchants Bank at Kyoquot, logging rly. location for British American Lumber Co., etc.; 1920 to date, president, Ryan, McIntosh, Hibberson, Blair Timber Co., Ltd., i/c estimates, surveys, topographic work, reports, etc., also cruising and valuating all Crown grant timber in B.C. for Prov. Govt.

References: M. P. Blair, E. E. Brydone-Jack, A. E. Foreman, Geo. M. Tripp, Patrick Philip, F. W. Knewstubb, J. B. Lambert.

KALBHENN—JOSEF, of New Waterford, N.S. Born at Ershausen, Germany, Apr. 28th, 1885. Educ., M.E., Aachen University, 1913; previous to 1907, general coal and metal mining underground; 1913, mining engr., Allgemeine Tiefbohr and Schachtbau, Germany; 1914, mining engr., exploring expedition, Belgian Congo, Africa; 1915-21, general mining underground, Dominion Coal Co., Limited, Glace Bay, N.S.; 1921 to date, asst. ventilation engr., Dominion Coal Co., Ltd., Glace Bay, N.S.

References: A. L. Hay, W. Herd, S. C. Mifflen, J. A. Fraser, J. R. Morrison, W. S. Wilson.

KIRBY—DEREK CAMERON, of Calgary, Alta. Born at Norwich, England, July 24th, 1900. Educ., Norwich Secondary School. 1920 (Apr.-July) student, Norwich Electric Street Rlys.; 1920-21, student, Norwich City Power Station; Feb. 1922 to date, chainman, C.N.R., Calgary, Alta.

References: W. S. Fetherstonhaugh, H. W. Tooker, D. Shaw, A. M. Bremner, L. S. Daynes.

KIRCHER—PAUL, of 234 Strathearn Ave., Montreal West, Que. Born at Chicago, Ill., July 27th, 1890. Educ., B.A., 1911, B.Sc., 1912, C.E., 1918, Univ. of Illinois; Member, Am.Soc.C.E.; 1910 (summer) with City & County Surveyor, Chicago; 1911 (summer), asst. engr., office City Engr., Chicago Heights, Ill.; 1912-13, rodman, dftsman. and instr'man., Ill. Central R.R., on prelim. survey and constrn. work; 1914-16, bridge designer, Ill. Central R.R.; 1916 and 17, asst. engr. i/c trouble work and war concrete barge design, Universal Portland Cement Co., Chicago; 1917 to date, in various engr'g. capacities with Massey Concrete Products Corpn., Chicago, i/c design and company's specifications, engr'g. standards and policy; at present, vice-pres., Canadian Concrete Products Co., Ltd., res. mgr., Union Switch & Signal Co., and engr'g. advisor to pres., Massey Concrete Products Corpn.

References: F. W. Cowie, H. T. Hazen, G. P. MacLaren, J. E. Armstrong, R. P. Jennings, W. H. B. Bevan.

KIRSCH—HARRY, of Cap Madeleine, Que. Born at Montreal, Que., Sept. 4th, 1900. Educ., B.Sc., McGill Univ., 1925; 1921-22 (5 mos.) shops, Canada Car and Foundry; 1923-24 (7 mos.), dfting. room, Bell Telephone Co.; 1 year and six months to date, dftsman., St. Maurice Paper Co., Cap Madeleine, Que.

Reterence: C. E. Jetté, S. W. Slater, C. M. McKergow, A. R. Roberts, J. E. A. Warner.

MADDOCK—CHARLES ORVILLE, of 404 Duplex Ave., Toronto, Ont. Born at Inwood, Ont., Nov. 27th, 1896. Educ., B.A.Sc., Univ. of Toronto, 1918; 2 mos., dfting. on reinf. concrete, with W. F. Sparling Co., Toronto; 6 mos., cadet, Candn. Engrs.; 11 mos., dfting. and survey work for James, Proctor & Redfern, Toronto; 6 mos., asst. to chief engr., Toronto and Yorks Road Commn.; 3 mos., foreman on bridge constrn., with McNiven Bros., Toronto; 2 years, detailer and designer on hydro-elec. power development, with Kerry & Chace, Ltd., Cons. Engrs., Toronto; 1 year and 9 mos., partner, Scott & Maddock, constrs. on reinf. concrete bridges and sidewalks; 4 mos., res. engr., on bridge constrn. with the County of Lambton, Ont.; 1 year and at present, building valuation engr., i/c detailed reports and estimates of bldgs., with the Sterling Appraisal Co., Ltd., Toronto, Ont.

References: A. T. C. McMaster, L. A Badgley, E. M. Proctor, P. Gillespie, C. R. Scott, H. P. Heywood.

STARLEY—BERNARD, of Kakuri, N.P., Nigeria, West Africa. Born at Coventry, England, March 6th, 1891. Educ., 1908-11, Articled to Messrs. Holbeche & Son, Birmingham, England. Passed Intermediate Exams. Surveyors Institute, and elected P.A.S.I.; 1912, asst., with above firm; 1913-14, chainman, C.P.R.; 1916-19, overseas, Lieut., Royal Engrs.; June 1919, appointed asst. engr., Nigerian Eastern Railway Construction Survey, engaged on centre staking and location until April 1922. To end of 1923 i/c of erection of bungalows, etc., at Enugu. 1924-25, i/c simultaneously and consecutively, mtce., tracklaying, erection bridges and culverts, assembly and launching of girders, erection of various buildings, etc.

References: R. D. Thexton, B. H. Hughes, C. Collingwood, C. Flint, F. H. Midgley, V. Topping, R. H. Stenhouse.

THOMAS—ARTHUR STANLEY, of 53 Roseberry Ave., Ottawa, Ont. Born at Kingston, Ont., Dec. 2nd, 1888. Educ., B.Sc., Queen's Univ., 1911; 1908, rodman and timekeeper, City of Kingston; 1909-10, Creighton Nickel Mine, Ont.; 1911, asst. i/c of field operations for 2nd year students of university; 1911 to date, with Dept. of Interior, Ottawa, as follows — 1911-13, dftsman. and compiler, topographical surveys, 1913-16, principal dftsman., Forestry Branch of same; 1916-22, i/c dfting. room, Forestry Br., made forest surveys at Petawawa, Ont., 1917-18; 1922-23, asst. office engr.; 1924 to date, asst. engr., under O. S. Finnie, D.L.S., director of N.W.T. & Yukon Branch, supervising of dfting. room, office work in conn. with compilation of coal mine surveys, etc.

References: O. S. Finnie, J. D. Craig, T. H. G. Clunn, S. S. Scovil, R. D. Macdonald, T. S. Mills.

WOLSEY—MAUNSELL, of 25 Lowther Ave., Toronto, Ont. Born at Toronto, April 16th, 1900. Educ., B.A.Sc., Univ. of Toronto, 1924; 1919 (summer) rodman, with Speight & Van Nostrand, surveyors, Toronto; 1920 (summer) rodman and computation work for estimates and reports with H.E.P.C., at Queenston-Chippawa canal; 1921-23, with Canadian General Electric Co., as follows: — 1921 (summer) moulder's helper in foundry, Davenport Works, Toronto; 1922 (summer) machine shop cutting transformer iron, etc., and asst. to electrician; 1923 (summer) in warehouse auto accessories dept.; 1924-25, electrician's asst., rigger and pipe man, H.E.P.C.; May 1925 to date, in engr'g. cost office of Goodyear Tire & Rubber Co., New Toronto, Ont.

References: T. R. Loudon, C. R. Young, A. C. D. Blanchard, J. B. Carswell, R. W. Downie.

WOOLLCOMBE—EDWARD MICKLE, of Montreal, Que. Born at Ottawa, Ont., Nov. 24th, 1901. Educ., B.Sc., McGill Univ., 1923. Grad., Royal Naval Coll. of Can., 1920; 1921 (summer) instr'man. on constrn., Connaught Rifle Range, Ottawa; 1922 (summer) production dept., Dominion Engineering Works, Ltd., Lachine; after graduation, 1 year with Montreal Engineering Co., Ltd., on hydro-elec. investigations, etc., Montreal; 1924 (8 mos.) res. engr. on constrn. work for Foundation Co. of Canada, Ltd., Montreal; at present in woods engr'g. dept., Riordon Pulp Corpn., Ltd., Montreal.

References: W. Blue, G. A. Gaherty, R. E. Chadwick, W. Griesbach, C. M. McKergow.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO MEMBER

JAMES—EDWARD HENRY, of 416 Phillips Place, Montreal, Que. Born at Farnham, Surrey, England, Dec. 30th, 1886; Educ., Assoc., City and Guilds Inst., London, Eng., 1906; Assoc.M.Inst.C.E. 1913; 1907-09, dfting., design and erection of steel bridges and structures, A. Handyside & Co., Derby, Eng.; 1909-10, dfting, estimating and design of temporary works, Easton, Gibb & Son, Ltd., Rosyth, Scotland; 1910-13, with same company i/c of sinking monoliths, entrance and main outer wall of basin, H. M. Dockyard, Rosyth; 1913-14, with Foundation Co., Ltd., Montreal, asst. supt., at Little Current, Ont., on rly. terminals and timber docks, Bear River, N.S., on bridge foundations; 1914 (Aug.-Nov.) on design of extension of No. 1 Elevator, Montreal, with J. S. Metcalf Co., Ltd.; 1914-19, overseas, Lieut.; 1919-20, with A. D. Swan, M.E.I.C., i/c of design of Ballantyne Pier, Vancouver, and a graving dock in Vancouver; 1920-25, res. engr., i/c of all work in B.C. for Mr. Swan; at present partner with A. D. Swan, M.E.I.C., Consltg. Engr., Montreal.

References: A. D. Swan, H. Holgate, F. P. Shearwood, H. Rolph, W. J. Bishop.

LEFEBVRE—JOSEPH ALEXIS, of Vallee Street, Beauport, Que. Born at Maskinonge, Que., August 1st, 1884. Educ., Polytech. School; Passed exam. Can. Soc. C.E. 1915; Previous to 1915, supt. of gravelling branch, and from 1915 to date, head of district, Roads Dept., Province of Quebec, responsible for road constrn., mtce., repair and traffic supervision.

References: A. Fraser, J. O. Montreuil, A. Larivière, A. B. Normandin, R. Savary, T. E. Rousseau, C. C. Piché, I. Vallée.

MILLS—THOMAS STANLEY, of Ottawa, Ont. Born at Kingston, Ont., Jan. 26th, 1889. Educ., B.A. 1910, B.Sc. (C.E.), (Honours), 1911, Queen's Univ.; D.L.S. 1915; 1910, res. engr., highway constrn., Niagara River Blvd.; 1911, res. engr., water supply constrn., St. Thomas, Ont.; 1913, asst. city engr., Prince Albert, Sask.; 1914, prin. asst., misc. surveys on D.L.S. in B.C., Alta. and Sask.; 1915, asst. engr., 1916-18, acting head office engr., 1919, acting chief highway engr., 1920 to date, asst. chief engr., Dominion Parks Branch, Dept. of the Interior, Ottawa, Ont.

References: J. Murphy, S. S. Scovil, J. M. Wardle, J. H. Marshall, G. H. Herriot, G. F. Horsey.

STERNS—FRANK ERNEST, of St. Catharines, Ont. Born at Charlottetown, P.E.I., Dec. 15th, 1879. Educ., M.Sc., McGill Univ., 1903. 1902-03, demonstrator, McGill Univ.; 1903-05, dftsman., C.P.R., Montreal; 1905-06, dftsman., Robins Conveying Belt Co., N.Y.; 1906 (May-Aug.) designed and detailed a travelling dock crane for Locomotive & Machine Co., Montreal; 1906-07, 8 mos. leading dftsman., and 6 mos. res. engr., on constrn., with Henry Goldmark, Consltg. Engr., Montreal, on improvements to plant of Canadian Locomotive Co., Kingston, Ont.; 1907-12, asst. engr., design of lock gates, etc., Panama Canal; 1912-13, asst. engr., Welland Ship Canal; 1913-17, designing engr., genl. and detail design of locks, dams, weirs, etc.; 1917-18, design'g. reinf. concrete barges and ships with J. L. Weller, Cons. Engr., St. Catharines, and Cummings Structural Concrete Co., Pittsburgh; 1918-19, prin. asst. engr., with Henry Goldmark, New York, design of lock gates, etc., for Inner Harbour Navigation Canal, New Orleans; May 1919 to date, designing engr., design structures and equipment, Welland Ship Canal, St. Catharines, Ont.

References: A. E. Dubuc, A. J. Grant, H. Goldmark, J. L. Weller, D. W. McLachlan, E. G. Cameron, L. Sherwood, C. N. Monsarrat.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

LANCTOT—JEAN JACQUES, of 9, Haldimand, Quebec, P.Q. Born at Montreal, Que., Oct. 20th, 1891. Educ., McGill Univ. and Ecole Polytechnique de Montréal, enlisted before completion of course; admitted by exam. to Corp. of Professional Engrs., Quebec, 1923; 1913 (summer) asst. to E. A. Evans, C.E., estimate of cost of constrn. of projected rly. (North Rly.) between James Bay and Nottaway Village; 1914 (summer) asst. to C. E. Lemoine, L.S., surveys of rivers and lakes in Northern Abitibi; 1915 (summer) testor and inspr. of steel and tools, Ross Rifle Factory of Quebec; 1916 (summer) asst. to J. Fortin, C.E., constrn. hydro-elec. power on Ha Ha River for Chicoutimi Pulp & Wood Co.; 1917-19, R. F. Corps.; 1920, gen. supt. of roads constrn., etc., Provincial Building & Engr'g. Co. of Montreal, and also for P. C. Costo et Frère, contracting firm of Montreal; 1921, road inspectn., for Ministry of Roads, Prov. of Quebec; 1921 to date, divnl. engr., for Ministry of Roads, Prov. of Quebec, Quebec, P.Q.

References: A. Fraser, J. A. Lefebvre, A. B. Normandin, A. Larivière, T. E. Rousseau, F. X. Ahern, J. M. H. Cimon.

PRIEUR—HENRI, Apt. 3, 173 St. Joseph Boulevard, Montreal, Que. Born at Montreal, April 17th, 1893; Educ., 1 yr. and 7 mos. Polytechnic School. Private study. Admitted to Corpn. of Prof. Engrs. of Quebec by Exam. 1925; 1911-12, rodman, field work, dftsman., municipal works, with Boucher & Demers; 1912, instr'man., chief of staff on surveys, etc., with Austin & Chapdelaine. (Sept.) rodman, dftsman., sewer dept., City of Montreal; 1914 to date, with the City of Montreal — 1914-18, northern divn., asst. engr. on sewer constrn. and design, and 1918 to date, asst. engr., sewers branch.

References: deG. Beaubien, G. R. MacLeod, E. Fusey, J. G. Caron, H. A. Gibeau.

TURNBULL—AUBREY ARNOLD, of 40, Crown Street, St. John, N.B. Born at Digby, N.S., Aug. 30th, 1896. Educ., B.Sc., N.S. Tech. Coll., 1922, engr'g. course Dalhousie Univ.; 1916-19, Lieut., 4th Batt. Can. Machine Gun Corps.; 1920 (summer) with res. engr., on hydro-elec. development, St. Margaret's Bay, N.S.; 1921 (summer) instr'man., on hydrographic and power surveys in the Provinces of Nova Scotia, New Brunswick and Prince Edward Island, for Dom. Water Power Branch; 1922-23, telephone engr. student, and 1924 to date, plant engr., with The New Brunswick Telephone Co.

References: W. R. Pearce, A. R. Crookshank, G. G. Hare, W. J. Johnston, W. F. McKnight.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

AHERN—ARTHUR WESTON, 404 Quebec Power Building, Quebec, Que. Born at Quebec, Que., Aug. 1st, 1896. Educ., B.Sc., McGill Univ., 1922. 2 years R.M.C.; operating in refrigeration plant for Standard Chemical Iron & Lumber Co., Montreal, and inspr. in Milton Hersey Co.'s paving dept., during summer holidays. Subsequently asst. supt. on constrn. of golf course and club house, for Quebec Golf Club; April 1924 to date, vice-pres., James Ruddick Constrn. Co., engaged in gen. constrn. work, bldgs. and street rly. work, also assisting James Ruddick, M.E.I.C., in consltg. work, (chiefly hydro-electric).

References: J. Ruddick, A. E. Doucet, F. T. Cole, H. E. Huestis, T. L. Tremblay.

BURTON—HARRY ROBERT, of Edmonton, Alta. Born at Dundas, Ont., Feb. 21st, 1896. Educ., B.A.Sc., Univ. of Toronto, 1921; 1913 (4 mos.), timekeeper, Campbell & Lattemore; 1915 (4 mos.), shell inspr., Massey Harris Co., Toronto; 1916-19, military service; 1920 (4 mos.), rly. survey, Canadian light railways, Northern Ontario; 1921-23, inspr., Canadian Inspection Co., lab., mill and field inspn.; 1923 (July-Nov.), plan examiner, City Architect's Dept., Toronto, Ont.; March 1924 to date, with Canada Creosoting Co. Ltd., at Trenton, Sudbury and Edmonton plants as treating helper, and May 1925 to date, retort foreman, i/c treating at Edmonton plant.

References: O. C. Steinmayer, P. M. Thompson, R. J. Marshall, R. W. Downie, J. M. Breen, R. A. Crysler.

DUNBAR—PROSPER GERALD, of 1963 Leslie Avenue, Detroit, Mich. Born at Leamington, Ont., April 3rd, 1898. Educ., B.A.Sc., Univ. of Toronto, 1922; 1917-19, overseas, Can. Engrs.; 1920 (summer), machine shop work, Pere Marquette Railroad shops, St. Thomas, Ont.; 1921 (summer), machine shop, furnace, gas producer, mill, and screen work, with the Shale Brick Co.; Cooksville, Ont.; 1923, dftsman., of field drawings on special machinery, Morgan & Wrights, Detroit, Mich.; 1924, layout dftsman., Hupp Motor Car Corpn., Detroit, Mich.; 1925, layout dftsman., mech'l. dept., Smith, Hinchman & Grylls, Arch'ts. and Engrs., Detroit, Mich.

References: R. W. Angus, C. N. Young, J. A. Denovan, J. C. Keith, F. J. Bridges.

EADIE—THOMAS W., of 127 Drummond Street, Montreal, Que. Born at Ottawa, Ont., July 26th, 1898. Educ., B.Sc., McGill Univ., 1923; 1920-21-22 (summers) dftsman., and instr'man., for S. E. Farley, Ottawa; 1923 to date, with Bell Telephone Co. of Canada as follows — 1923-24, fundamental engr'g. divn.; 1924-25, outside plant engr'g. divn.; 1925 (June-Nov.) outside plant and station mtce., Montreal Divn.; at present, engr'g. practices section, outside plant divn., supervisory work.

References: A. M. Mackenzie, H. M. MacKay, E. Brown, S. E. Farley, G. M. Hudson, J. L. Clarke.

ELLIOT—GERALD BURTON, of 29 Crescent Street, Montreal. Born at Westmount, Que., Nov. 24th, 1895. Educ., B.Sc., McGill University, 1923. 1922 (Sept.-Nov.), elec. steam boiler designing, Dominion Eng. Works; 1922-23, asst., maintenance dept., Ground Wood Mill, Laurentide Co., Grand'Mere, Que.; 1923-24, foreman, erecting control gate machinery, Shawinigan Engineering Co., La Gabelle Power Development; Apr. 1925 to date, sales engr., mech. refrigeration engr'g., Montreal Office, Refrigerating Engineers, Limited.

References: C. M. McKergow, A. R. Roberts, F. Peden, R. DeL. French, H. M. MacKay.

HICKS—ALVA, of 52 Mortlake Avenue, St. Lambert, Que. Born at Picton, Ont., August 30th, 1898. B.Sc., Queen's Univ. 1923; Since graduation employed by the Northern Electric Company, until Oct. 1923 in the install'n. dept., on install'n. of Grover Automatic Exchange in Toronto, and from Oct. 1923 to date, tech. enrg., tech. dept., Montreal, reporting to W. H. Eastlake, A.M.E.I.C.

References: W. H. Eastlake, D. M. Jemmett, L. T. Rutledge, W. G. Tyler, H. J. Vennes, N. L. Morgan, H. H. Vroom.

HOLMAN—JOHN LONGMAID, of 262 St. James Str., St. John, N.B. Born at St. John, N.B., May 20th, 1903. Educ., B.Sc. in E.E., Univ. of N.B., 1924; June 1924 to date, traffic engr'g., traffic dept., New Brunswick Telephone Co., Ltd., St. John, N.B.

References: W. R. Pearce, F. P. Vaughan, G. Stead, G. G. Hare, G. G. Murdoch, W. J. Johnston.

HOLT—ERNEST WILLIAM, of 16 Lorne Avenue, Montreal, Que. Born at Montreal, Feb. 7th, 1897. Educ., B.Sc., McGill Univ., 1922; 1922-24, dfting., estimating and designing, Dominion Bridge Co.; 1925 (summer), designing and dfting., Canadian Mead Morrison Co., Ltd., Welland, Ont.

References: A. Peden, F. Newell, F. J. McHugh, T. A. Chubb, R. H. Findlay, E. E. Weibel.

LEBARON—KARL SHURTLEFF, of Dryden, Ont. Born at Sherbrooke, Que., Sept. 10th, 1897. Educ., B.Sc. McGill Univ. 1923; 1919 (8 mos.), dftsman., Seaboard Airline Ry., Portsmouth, Va.; 1920 (summer) E. G. M. Cape & Co., at Sherbrooke, Que.; 1923 (6 mos.), engrg. staff, St. Lawrence Paper Mills, Three Rivers, Que.; 1923-25, asst. engr. in charge of power, and from Feb. 1925 to date, chief engr., Dryden Paper Co., Dryden, Ont.

References: J. S. Wilson, F. O. White, R. L. Weldon, A. R. Roberts, C. M. McKergow.

MILLER—WILFRID LAVERNE, of 135, Sanford North, Hamilton, Ont. Born at Lawrence Station, Ont., Oct. 8th, 1896. Educ., B.A.Sc., University of Toronto, 1923; 1923-25, app'tice. course, assembly and testing of various forms of elec'l. machinery., Canadian Westinghouse Co.; May 1925 to date, transformer designing engr., Canadian Westinghouse Co., Ltd., Hamilton, Ont.

References: W. F. McLaren, G. M. Bayne, J. C. Nash, R. W. Angus, J. R. Cockburn, C. R. Young.

MITCHELL—GORDON, of Orient Bay, Ont. Born at Hamilton, Ont., Sept. 28th, 1893. Educ., B.A.Sc., Univ. of Toronto, 1915. 1913 (summer) foreman (concrete) Hillview Reservoir, Board of Water Supply, New York City, for Keystone State Construction Co., Philadelphia, Pa.; 1914 (summer) i/c gatehouse constrn., Silver Lake Reservoir, Staten Island, N.Y., Bd. of Water Supply, New York, for Beaver Engineering & Contracting Co., N.Y., and 1915 (summer) same; 1916-18, Capt., Royal Engineers, France; 1919 (summer) structural design with Harkness, Loudon & Hertzberg, Toronto; 1919-20, i/c constrn. reinf. concrete reservoir, Glastonbury, Conn., U.S.A., for Beaver Engineering & Contracting Co., N.Y.; 1920-24, i/c all concrete work on power house, Queenston-Chippawa Development for H.E.P.C. of Ont.; at present, supt. i/c constrn., Virgin Falls Dam, Thunder Bay system, for Hydro Electric Power Commn. of Ontario.

References: H. G. Acres, T. H. Hogg, A. V. Trimble, W. Jackson, A. McLaren, J. N. Stanley.

NUTTER—JACK C., of Groveton, N.H., U.S.A. Born at Sherbrooke, Que., Dec. 17th, 1895. Educ., B.Sc., McGill Univ., 1921; 4 years to date as elect'l. engr., and at present elect'l. engr. and asst. to chief engr., Groveton Paper Co., Inc. — work entails full responsibility of generation, distribution and maintenance, as well as any changes to improve economy of system.

References: G. D. MacKinnon, H. M. MacKay, C. M. McKergow, J. B. Porter, A. Stansfield.

SCHERMERHORN—HENRY LEWIS, of Napanee, Ont. Born at Township of Richmond, Ont., May 2nd, 1895. Educ., 2 years Faculty of App. Sci. (civil), Queen's Univ., 1919-21, at present taking course in structr'l. engr'g. from Wilson Engr'g. Corpn., Cambridge, Mass.; 1919-20 (summers) rodman, Dept. of Highways, Napanee; 1921-22, rodman, Ontario Dept. of Highways; 1922-24, instr'man, same dept. at Napanee, Ont.; 1924 (June-Aug.) i/c of sewer constrn., Town of Napanee; Aug. 1924 to date, instr'man. with the Ontario Dept. of Highways.

References: G. Hogarth, R. M. Smith, A. A. Smith, T. A. McGinnis, W. F. Noonan.

SMITH—WALTER MAXWELL, of Brantford, Ont. Born at Brantford, Ont., Nov. 27th, 1896. Educ., B.A.Sc., Univ. of Toronto, 1921; (summer) 1915, foreman with Massey Harris, Toronto; 1916-19, overseas, 1st. Can. Div. Signal Corps., as meterman, electric light outfit operation, lineman, etc.; 1920 (summer) foreman i/c of assembly and test, Robbins and Myers Co., Brantford, Ont.; at present, electrical engr., i/c of assembly and test, Robbins & Myers Co. of Canada, Ltd., Brantford, Ont.

References: K. C. Berney, F. P. Adams, C. A. Waterous, C. Robertson, A. M. Jackson, G Marston.

Automatic Gauge Division of Hydrographic Office

The engineering profession in general, and more particularly those parties seeking precise information in regard to water surface elevations, of the Great Lakes and St. Lawrence river, for scientific investigations, water power developments and navigation interests, especially during the present low stages of the waterways, should be acquainted with the following facts,—namely, that there is an Automatic Gauge Division, of the Canadian Hydrographic Office, whose special province it is to obtain and record precisely the hourly fluctuations in the levels of the Great Lakes and St. Lawrence waterways.

In 1906 the work of recording in a reliable and systematic manner the hourly levels of water surfaces of the Great Lakes during the season of navigation was begun in a small way by establishing self-registering gauges at three locations,—one at French River Village, one at Collingwood, and one at Toronto.

The results, from this small start, proved so gratifying that urgent requests, for further and more extensive data of the same nature provided by the preliminary investigation, came from scientists and engineers along the whole fifteen hundred miles of the waterways extending from Quebec harbour to Port Arthur. Since 1906 the work has expanded and has covered forty-eight locations between Quebec harbour and Port Arthur. At present there are thirty-eight gauging stations maintained, thirty-two of which are operated during the entire year because of the demands for precise information in connection with special ice and hydraulic investigations by both Canadian and international commissions. Although this special work has become of international scope its administration remains entirely under the Canadian Hydrographic Office.

During the present year there was inaugurated the issuance of a monthly bulletin to all interested parties on both sides of the international border. This bulletin, issued before the 10th of each month, gives the mean elevation, of each of the Great Lakes, and the St. Lawrence river at Montreal, for the preceding month as computed by hourly readings from automatic gauge records. A further feature of the bulletin is comparative statements of the then reported stages, of water levels, to similar data since 1860.

Requests for information of the above nature should be addressed to, Captain F. Anderson, M.E.I.C., chief hydrographer and director of Tidal and Current Surveys; or to The Canadian Hydrographic Office, Department of Marine and Fisheries, Ottawa.

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The Trend of Steam Power Plant Development

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Professor of Mechanical Engineering,
The John Hopkins University, School of Engineering, Baltimore, Maryland.

Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

Introduction

One of the remarkable developments of the past decade has been the improvement in the economy of steam power plants, particularly of the large central stations. This is made evident by noting the performance of typical American plants of 60,000 k.w., and higher. Stations put in service in 1915 required about 20,000 B.t.u. per kilowatt hour of net station output while some of those initially operated in 1925 required only 15,000 B.t.u. per kilowatt hour. This represents a decrease of 25 per cent in coal consumption in ten years. While further gains are still possible, other factors which have increased in relative importance, particularly increasing fixed charges, may delay any great decrease in coal consumption. Much interest is manifested in power station development both for central stations, and for industrial plants and any discussion of the trend of development is helpful and stimulating in inducing further study of possible economies. The trend presented in the following paragraphs is based on present progress and on probable developments and has been written largely with Canadian conditions in mind.

The uses of electric power are increasing at a rapid rate. The records of growth of any public service system indicate the expansion in power demands. For instance, your Hydro-Electric Power Commission of Ontario had a load of 77,000 horse power in 1914. In 1924 the Commission was distributing 700,000 horse power, including exported power. Canada has abundant good coal supplies only in Nova Scotia, Alberta, and British Columbia. Coal must be imported or shipped to other districts and is high in price. Fortunately in many sections water powers, with quite steady flow are available for the cheap development of hydro-electric power, and most of these have been put to use. In certain parts there are few sites capable of cheap development that are not utilized. Furthermore, your hydro-electric systems have developed sharp load peaks of a relatively few hours duration per year due largely to lighting loads. These low-load-factor peaks can be carried by developing expensive water power sites which remain idle during the rest of the year, and which consequently involve high fixed charges on the power system as a whole. Steam stand-by stations can often be built for much less than an equivalent hydro-electric plant and long transmission line, and in consequence thereof with lower fixed charges per kilowatt-hour. Several of the large hydro-electric power systems of California and of the southeastern states have found it advisable to install steam stand-by stations for contingencies, peak loads and low water periods. It is quite probable that low-cost stand-by steam stations for similar purposes will soon fill an economic need in Canada.

Load Factor

Load factor has a great influence on steam station design. It may be expressed in several ways as daily, monthly or annual. The influence of each of these on costs is not always well understood. These influences may be stated briefly as follows:

(a) Daily load factor and the form of load curve affect fuel costs.
(b) Monthly load factor affects labour and fuel costs.
(c) Annual load factor affects fixed charges.

All of these influences must receive careful consideration in the plant design. It also follows that careful studies must be made of expected load conditions throughout the life of the plant in order to estimate accurately the value of these various load factors.

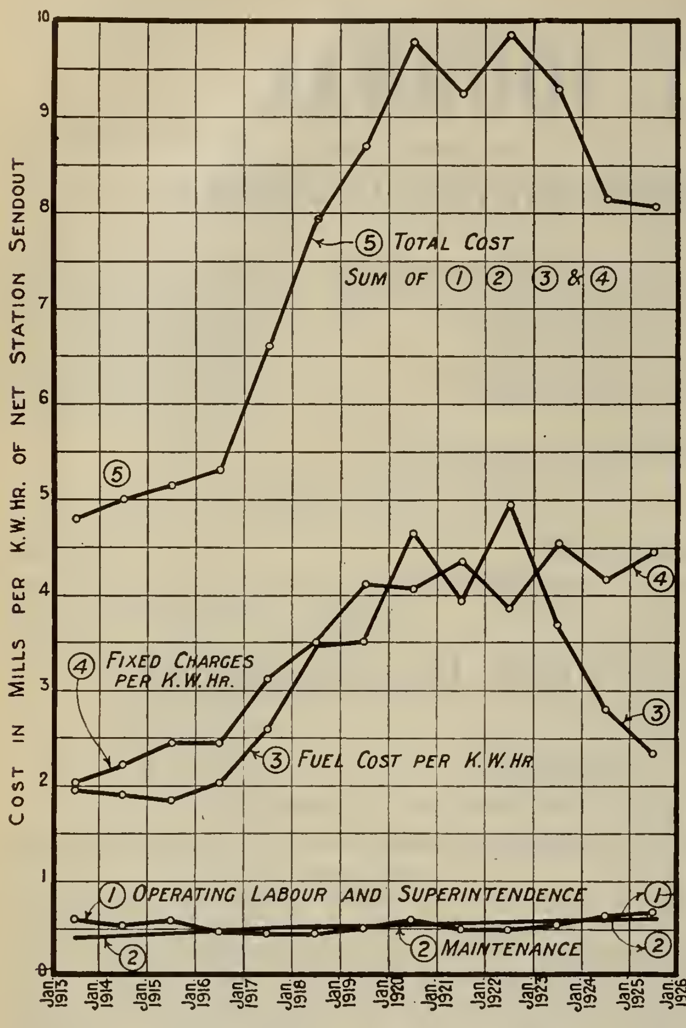

Figure No. 1.—Trend of Operating Costs and Fixed Charges for Typical Stations of 60,000 k.w. Capacity and Higher, Plotted against Date of Initial Operation of Stations.

High annual load factors will warrant considerable refinement and higher investment costs to secure the increased station economy. On the other hand, very low annual load factors warrant only a low cost station because fixed charges constitute a larger item in power costs while fuel costs in such cases are relatively lower. Engineers have in the past been prone to use too high values of annual load factor for the useful working life of machinery. Much special equipment has been installed the use of which was not economically justified by the actual operating life of that part of the plant. The actual relations between load factor and working life have been fully discussed.* The relation of load factor to plant design is now better understood and fewer mistakes are made than in earlier designs. However, certain so-called "base-load plants" are still being built, although it is evident that these can only remain base-load plants until some newer and more economical equipment is installed. The art of steam power plant design is still developing rapidly and it is reasonable to expect that further progress will be made. In such a case, the life of a station on base-load cannot be long, when supplying power to growing communities.

*"Obsolescence a Factor in Power Plant Design", Peter Junkersfeld, *Power*, June 12th, 1923.

The cost of power includes items for fuel, maintenance, operating labour and fixed charges. The trend of these separate items of cost and of total cost is shown in figure No. 1, which is reproduced from the 1925 Report of the Committee on Power Generation of the American Institute of Electrical Engineers. These curves indicate a definite upward trend for fixed charges while fuel cost shows a downward trend due partly to the increasing efficiencies of the newer stations and partly to reduced coal prices. The last points on the curves indicate that fixed charges are almost double fuel costs per unit of output. These considerations indicate that the foremost problem confronting designers to-day is the reduction of initial investment in the plant so that the trend of the curves for fixed charges and for total cost may be turned downward. This desire to reduce fixed charges should have a modifying effect on the trend of steam station design, particularly in endeavours to secure increased output out of standard designs of equipment and to reduce building volume.

Location of Steam Stations

The steam station should naturally be located as near the centre of load as possible to cut down distribution losses and fixed charges. It is seldom so placed on account of other factors that enter the problem. For instance, much cheaper and more land may be favourably located at another place where the saving in first cost will overbalance the capitalized additional transmission losses. Modern steam turbines require enormous quantities of cooling water in their condensers so that a waterside location is necessary. Cooling towers are used only when natural supplies of water are unavailable. The plant must be easily accessible from trunk lines of railroads to assure steady coal deliveries, particularly in the winter months. It is also desirable to provide if possible for water delivery of coal. Coal unloading devices and ample coal storage must be provided. Much coal enters Canada in the summer and is stored for winter use. Means must be provided to cheaply store and reclaim this coal even when frozen or covered with snow. Central Canada gets most of its coal from Pennsylvania. It would be in the interests of Canada's National economy to furnish as much as possible of this coal from Nova Scotia by boat through the proposed St. Lawrence Deep Waterways. In certain cases the disposal of ash introduces problems. Central station location will thus be influenced by suitability and cost of land, available water supply, coal handling and storing facilities.

Local conditions may favour the addition of a central heating load to a stand-by steam power station. This service would ensure the steady and economical operation of the boiler house and the presence of an active operating force throughout the winter. The short demands for electric power during peak loads on the system, could be met in considerable part by forcing the boilers to higher ratings. The heating service would bear a proportionate part of the fixed charges of the boiler plant. This would prove one effective way to lower fixed charges on the electrical output of such stations.

Theoretical Factors in Steam Station Design

The design and selection of steam station equipment is governed by two factors which have been most effective in securing high efficiency. These are the utilization of the available heat head and the heat balance.

A certain amount of energy is thermodynamically available for work when steam is expanded from steam line pressure and temperature to the given exhaust

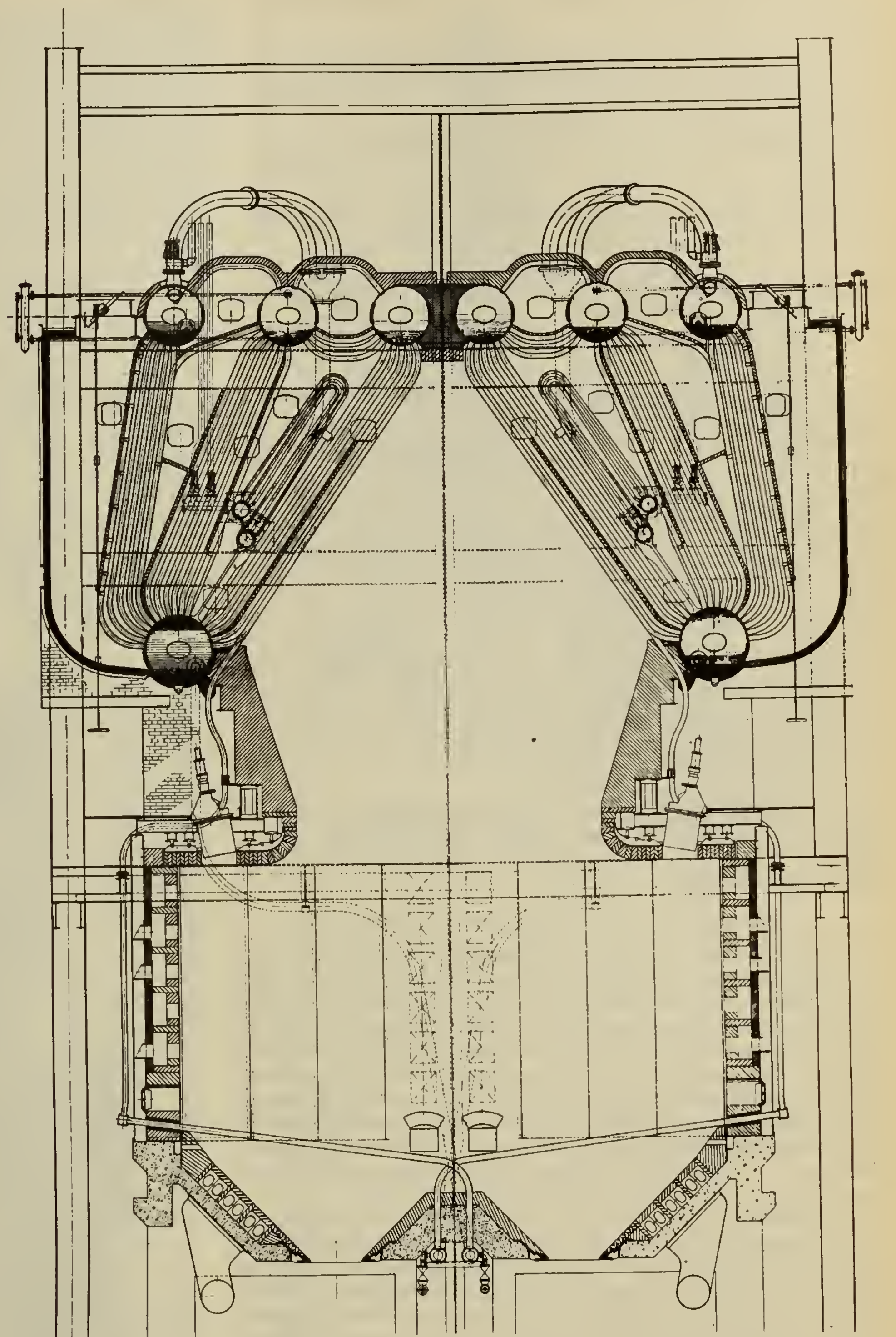

Figure No. 2.—Section of Duplex Stirling Boiler and Furnace at the Lake Shore Station, Cleveland Electric Illuminating Company, Cleveland, Ohio.

Heating surface in boiler 30,600 sq. ft.; in water screen, 835 sq. ft.; in superheater 4,520 sq. ft. Furnace volume above water screen, 26,000 cu. ft. Each boiler has an economizer of 22,080 sq. ft.

pressure. The greatest amount of this available energy should be converted into useful work in the station. The main turbines are the most efficient elements in a central station. If heat head alone were considered, then all energy transformations should take place in them and all auxiliaries should be driven by electric power from the main generators. In practice this ideal is modified by such considerations as first cost, increasing efficiency of small steam turbines, reliability against shut-down, and space requirements. Such equipment as steam-driven boiler feed pumps for starting up the station and for stand-by reserve, steam-driven circulating pumps for reliability, and steam-jet air pumps for low cost and small space requirement, are examples of departures from the ideal maximum utilization of heat head. In all new stations such departures will be closely scrutinized and must be amply justified before they are incorporated in the plant design. Heat head has been fully discussed in another paper.*

The heat balance is more comprehensive than heat head utilization. It implies a study of the plant design as a whole so that the greatest economical amount of

*"The Utilization of Heat Head", A. G. Christie, *Power*, Dec. 2nd, 1924.

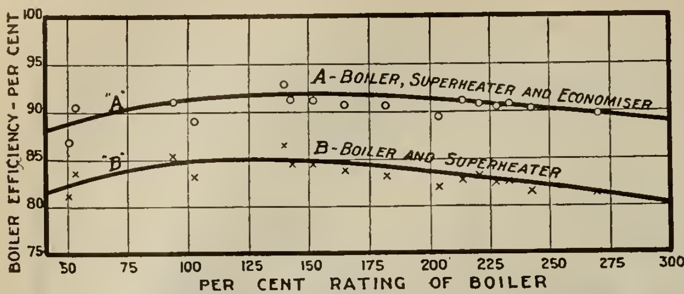

Figure No. 3.—Test Efficiencies of Various Ratings of 30,600 sq.ft. Boiler, Lake Shore Station, Cleveland Electric Illuminating Company, Cleveland, Ohio.

(a) Boiler, Superheater and Economizer. (b) Boiler and Superheater.

heat energy in the coal may be delivered as electric power to the feeders leaving the station. Due regard must be given to costs of obtaining such performance and all gains must be balanced against the increased cost of securing such improvements. This study has to do not only with the utilization of available heat head but also with economical boiler operation and with the economy and reliability of all auxiliary services necessary in the plant such as condenser operation, feed water heating, pump and other auxiliary drives, coal handling and preparation, and all other services. Heat balance studies have resulted in the use of higher steam pressure and temperatures, reheating of steam, powdered coal, air preheaters, bleeder heaters for feed water, evaporators, and the various systems of electric drives for auxiliaries. Improvements in station performance can still be secured by careful heat balance studies.

The modern trends of steam station design may be defined as attempts to apply these two theoretical principles, viz., conservation of heat head and economical dollar heat balance.

Steam Pressure and Temperatures

The first steam central station started in New York, in 1882, carried 120 pounds steam pressure with no superheat. By 1920 steam pressures had risen to 300 pounds and steam temperature to 700° F. Rapid advances have been made in the last five years so that there are several stations in the United States with pressures between 550 and 600 pounds. A 1,200-pound boiler is going into operation in one station, while in England an experimental boiler with 3,200 pounds steam pressure has been in operation. Steam temperatures have however increased only to 750° F.

The writer has for several years urged the desirability of increased steam temperature, and demonstrated the economic possibilities of higher temperatures in a recent paper.* Increased steam temperature involves increased expense only in the superheater, the main steam header and valves, and in the early stages of the turbine. Higher boiler pressure requires increased expense for all equipment from the boiler feed pump practically to the turbine exhaust.

The steam consumption will be decreased by either higher steam pressure or higher temperature and smaller pumps, boilers, superheaters, piping, and condenser equipment will be required. Such decreases will offset a portion of the increased expense due to higher pressure or temperature. The net increase of fixed charges on this more expensive equipment must be balanced against the reduction in fuel costs at the assumed annual load factor before one can decide whether it will pay to go to the higher pressure or temperature. At the present time power plant designers look to the metallurgists to develop steels suited for higher temperatures than 750° F. Some hold that carbon steels can be safely used. Others think that there is hope in the chrome steels, for these oxidize slowly. In the meantime the general tendency is towards higher pressures, although eventually higher temperatures than 750° F. will also be used. Boilers for 425 pounds are now made in standard sizes, 600 pounds is being used and some 1,200-pound plants may be in operation in the United States within a few years.

Structural Features of Design

Building and foundations may account for one-fifth to one-third or more of the total cost of the plant. These afford much room for competent design as they are more controllable on a given site with given requirements than steam or electrical equipment. These facts are among the least appreciated and least understood by central station managers and often by designers as well.

Many variables such as size and shape of available ground, soil and flood conditions, circulating water supply and levels, rail service, etc., are encountered with every power house site. It is seldom, if ever, possible to build

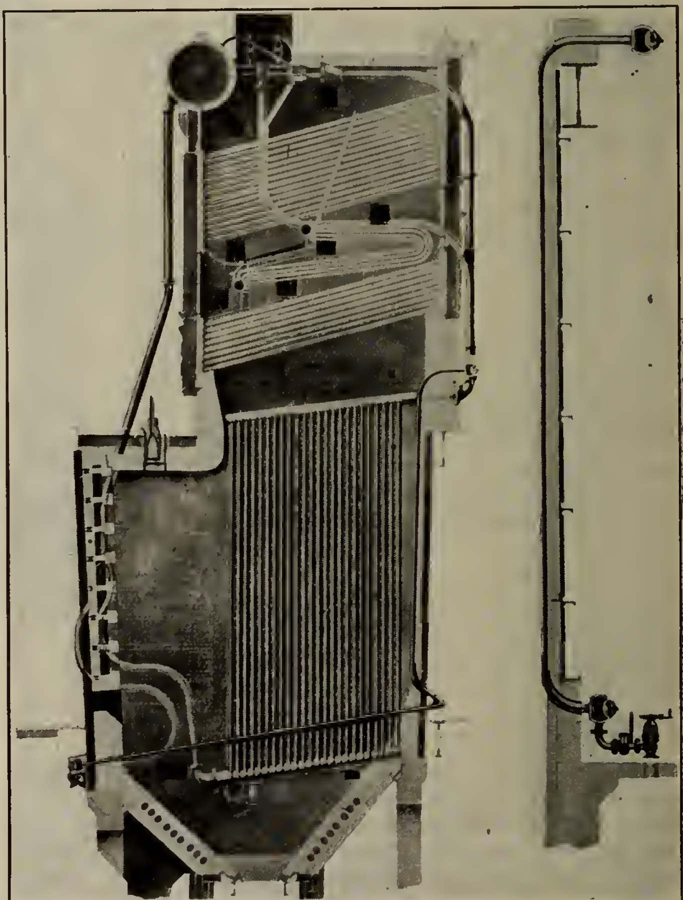

Figure No. 4.—Phantom Section through Boiler No. 11 and Furnace at Cahokia Station, Union Electric Light & Power Company, East St. Louis, Ill.

Heating surface in Babcock and Wilcox cross-drum boiler 18,010 sq. ft.; in water screen and fin-tube side walls 1,888 sq. ft.; furnace volume above water screen 13,500 cu. ft.; furnace for pulverized coal firing. Section of fin-tube side walls also shown.

*"Higher Pressures or Higher Temperatures", A. G. Christie and D. C. Turnbull, Jr. Report of Prime Movers Committee, National Electric Light Association, on Higher Steam Pressures and Temperatures, July, 1925.

two power plants in different locations from the same design. The arrangement of apparatus depends on whether the location is on a small city site or in the country where plenty of land is available and also on the foundation conditions at the two locations. It is generally necessary to restrict the floor area in the city location on account of the cost of land, while in the country, if good soil for foundations is available, the plant may be spread over considerable ground. Each of these types requires different structural design. Skilful arrangement of equipment is necessary to reduce building costs in any large measure.

Volume is the more generally accepted unit for the comparison of plant designs. Much thought is now devoted to studies of means to reduce power plant volume. Breechings have been placed on the roofs of boiler houses to reduce their roof heights. Fans and even air preheaters may also be placed above the roof if no other space is available. Efforts will be made to reduce furnace volumes with powdered coal which would tend to reduce the volume of the boiler house. Considering boiler plants as now built, there appear to be possibilities of further developments in design and of reduction in total volume and cost of the structures.

Turbine room height and width are fixed by the requirements of the condenser and its auxiliaries, and by the clearances necessary to lift covers and remove rotors from turbines and generators. The turbines may be placed end-to-end or cross-wise in the turbine room and the possibilities of each plan must be carefully studied. The usual arrangement is to place the turbine on steel or concrete foundations above the condenser with the axes of turbine and condenser at right angles to one another. The height of the turbine room cannot be greatly reduced when this arrangement is used. It has been suggested that vertical condensers would permit reductions in roof height and lessen turbine room volume.

Much of the electrical equipment formerly housed inside the building is now placed outside and this has decreased building expense. It is sometimes possible to find room in the lay-out for engineers' offices, laboratories, emergency bed-rooms, wash rooms, a lunch room, locker rooms, store rooms, machine shop, and pipe shop, by utilizing otherwise unoccupied space.

Inside ornamental brick facings together with outside architectural elaboration involve added first cost. The trend now is towards simple plain low-cost designs and in some cases reinforced concrete has been used in place of structural steel and brick. Much money may be needlessly spent on the station structure and careful study of this feature can often effect large savings in total plant cost.

Boilers

Modern boiler plants have four outstanding characteristics, namely, increased boiler size, high ratings in operation, new furnace designs and automatic control.

Boilers with 30,600 square feet of heating surface and 835 square feet additional in the water screens, are in operation at the Lake Shore station of the Cleveland Electric Illuminating Company, Cleveland, Ohio, one of which is shown in figure No. 2. This is fired with pulverized coal as shown. Formerly 20 feet was considered the limiting length for straight water tubes for boilers. Boilers with 24-foot and 25-foot tubes are now in service and longer tubes are quite probable as these provide increased furnace volume and increased low-cost heating surface, both of which are necessary for high ratings. There is a definite trend towards larger and fewer boilers in power stations.

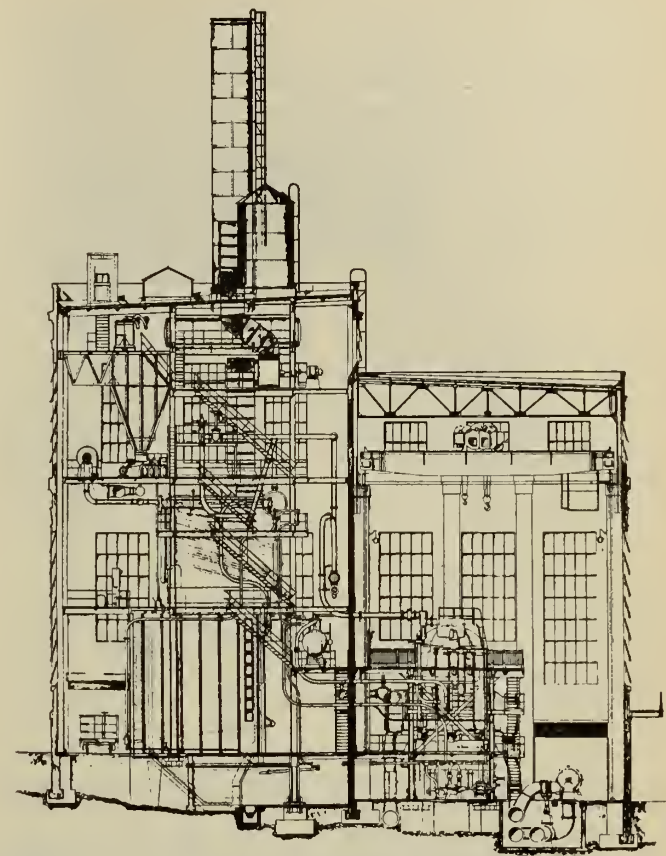

Figure No. 5.—Cross-section of Holtwood Steam Station of the Pennsylvania Water and Power Company, Holtwood, Pa.
Two 12,500-k.w. turbines; three boilers with 14,050 sq. ft. heating surface; pulverized coal furnaces with induced draft with provision for air preheaters to be added later.

Increased boiler ratings are now possible through improved furnace designs which produce higher efficiency over a wide range of load. Figure No. 3 shows the combined boiler, superheater, and economizer efficiencies as found by tests on the boiler illustrated in figure No. 2. This curve is remarkably flat over a wide range of load. Few boilers are now operated continuously at ratings above 300 per cent. Air preheaters tend to flatten the boiler efficiency curve so that operation at peak-load at much higher boiler ratings than 300 per cent does not require much sacrifice in fuel economy.

The motive in developing boilers for high ratings is largely a matter of investment costs. The cost of furnace and setting, air preheater, and forced and induced draft fans, will be increased when high ratings must be carried. The plant as a whole can operate with fewer boilers installed and these increased auxiliary costs are small compared with the costs of complete additional boiler plant. High boiler ratings therefore tend to lower the first cost of plant and are often justified on this basis for the given load conditions.

These higher ratings are only possible with improved furnace designs. Powdered coal has been successfully applied to boiler firing within the last few years. General statements on the relative cost of pulverized coal systems and stokers are dangerous to make because other factors must be considered besides the mere item of first cost of this equipment alone. When all factors are considered the differences in cost become small and may favour either system depending on local conditions. Unit pulverizers are, under the same conditions, less costly than

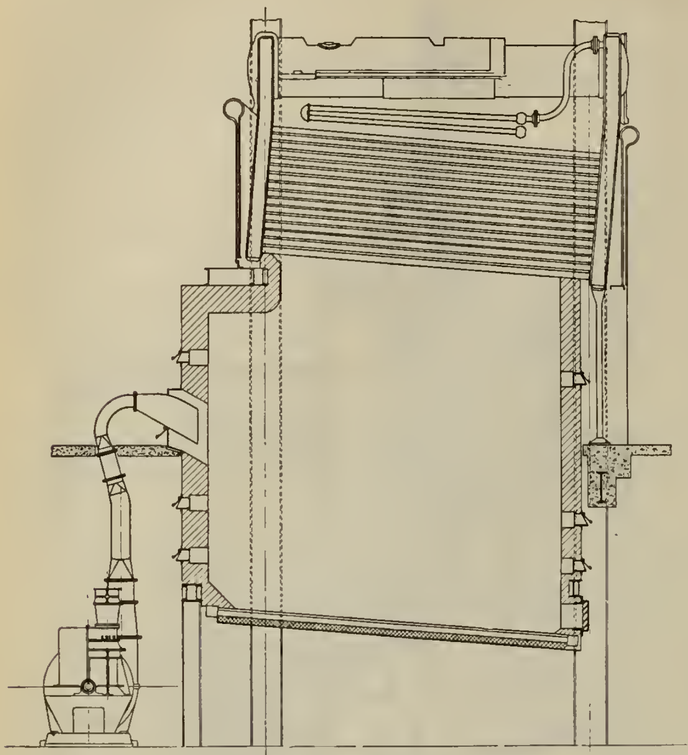

Figure No. 6.—Arrangement of Boiler, Furnace and Unit Pulverizer for Boiler No. 19 Ashley Street Station, Union Electric Light and Power Company, St. Louis, Mo.

Heating surface in Edgemoor boiler 5,580 sq. ft.; refractory faced Bailey side walls and Bailey bottom with cast iron facing; heating surface of Bailey side wall and bottom 789 sq. ft.; furnace volume 5,230 cu. ft.

central pulverized coal systems. Powdered coal equipment requires more auxiliary power than stokers. On the other hand, it gives a higher efficiency over a wider range of boiler ratings and is more independent of the grade of coal than the best stokers. Powdered coal more nearly approaches test efficiency in daily operation and has lower stand-by losses and lower maintenance costs than stokers. These factors have warranted its installation in many stations. The use of pulverized coal is a new art and is developing rapidly. Improvements in pulverizer design and in furnaces, should all tend to lower first cost and increase simplicity and efficiency. The use of pulverized coal is increasing and it must be given serious consideration in designs of new plants.

When powdered coal was first used, it was soon found that solid walls of the best grade fire-brick would not always stand the increased furnace temperatures. Air-cooled brick side walls were tried with considerable success with certain good coals, while with other coals the spray of liquid ash on these side walls, particularly of ash high in iron, caused the walls to wash badly and resulted in rapid erosion of the fire bricks. Studies of furnaces* indicated that the benefits of the radiant heat developed in the flame were not fully realized when brick walls were used. It was suggested that the furnace be wholly enclosed by water-cooled walls to absorb the greatest possible amount of radiant heat. Figure No. 4 shows such a furnace setting in the Cahokia station of the Union Electric Light and Power Company of Illinois. Water-cooled walls of the fin-type are provided for both sides and rear walls as shown, with a water screen above the ash-pit. A detail of the side wall construction is also shown.

With water-cooled furnaces, the entering air should be preheated and furnished in slight excess, (10 to 15 per cent), over theoretical requirements. This combination of water-cooled furnace walls and an air preheater seems in practice to offer the most economical combination. The rates of heat absorption by radiant heat in the water-cooled furnace walls are so great, — from 40,000 to 75,000 B.t.u. per square foot per hour, — that much of the heat generated in the furnace will be transmitted to the boiler in this way. Future boilers may be built *around* the furnace rather than entirely *above* it. These may be radically different in design from present types, will probably have less heating surface per unit of performance and hence should cost less than present day standard designs.

Some refractory lining seems to be required in certain furnaces such as those burning pulverized coke or anthracite. This may be of the standard air-cooled brick-and-tile design, now in use in some pulverized coal plants, or may consist of a refractory lining on water-cooled walls. Figure No. 5, is a cross-section of the Holtwood station of the Pennsylvania Water and Power Company, where furnaces with air-cooled side walls were installed to burn either a good grade of powdered bituminous or powdered anthracite coal. This station is interesting as it is one of the newest of the steam stand-by stations to a water-power development. It straddles the dam at McCall's Ferry, Pa. Two 12,500-k.w., turbines, with condensers, regenerative feed water heating, evaporators, pumps, etc., have been installed together with three 14,050 square feet Babcock and Wilcox cross-drum boilers, one of which is a spare. These boilers operate at 385 pounds pressure and for the present at 560° F. steam temperature, but this will be increased later. Induced draft fans furnish the draft. The turbines are designed to float on the system at peak load and to carry loads in excess of the hydro plant capacity. They may at times be motored during fluctuations in load. This plant has been in satisfactory operation for several months.

It is not always economical to entirely supersede an old station which may be favourably located. Such stations generally have stokers with small furnaces and hence operate at relatively low boiler efficiencies. Increased boiler ratings, reduction in smoke, and at the same time increased efficiency have been secured by rebuilding such furnaces for powdered coal. Figure No. 6 shows such a rebuilt furnace under a 5,580 square feet boiler at the Ashley Street station of the Union Electric Light and Power Company, St. Louis, Mo. This is equipped with a Simplex Unit Pulverizer of 8,000 pounds per hour capacity. Increased boiler ratings, less smoke, and greatly improved boiler efficiency resulted from this change.

References have been made to preheated air. Wherever the cost of coal warrants the saving of a portion of the heat in the flue gases leaving the boiler, air preheaters or water economizers should be installed. From a heat balance point of view for the whole station, the lowest heat consumption would be expected by the use of stage bleeding of the main turbine to heat the feed water and of air preheaters to recover some of the losses in the flue gas from the boilers. Preheated air raises furnace temperature and greatly increases the rate of radiant heat emission which results in increased boiler efficiency.

*"The Influence of Radiant Heat on Furnace Design", A. G. Christie, *Power*, May 29th, 1923, also, "Boiler Furnaces for Pulverized coal", A. G. Christie, *Mechanical Engineering*, August, 1925.

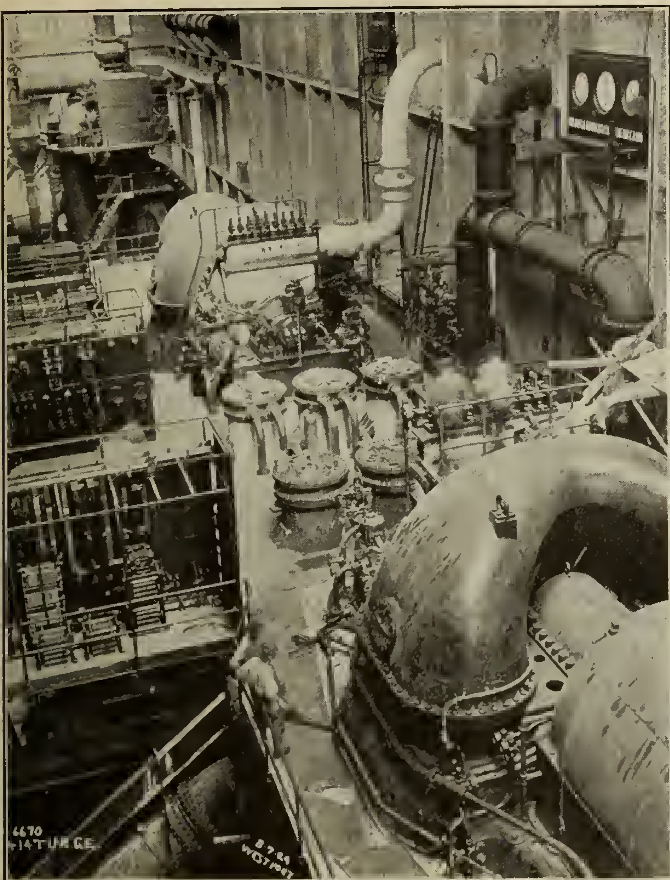

Figure No. 7.—Interior View of Westport Station of the Consolidated Gas, Electric Light and Power Company of Baltimore.

Boilers cannot be operated at high ratings on natural draft unless very high chimneys are provided. Where ratings over 250 per cent are desired, induced draft fans are generally necessary. These assume large proportions when very high ratings are desired. Forced draft fans are needed where air preheaters are used. Considerable study must be devoted to the best choice of number and size of fans for these purposes and to their arrangement and location. The fan builders should do further development work in order to produce smaller-sized fans for this purpose.

Ample light should be furnished to all parts of the boiler room. Cleanliness is an essential requirement and provisions for keeping the whole plant clean, particularly the boiler room and pulverizer room, should be incorporated in the design.

Powdered fuel firing lends itself admirably to full automatic control for which several systems have been developed. These control systems have maintained the average daily boiler efficiency on varying loads within a few per cent of test efficiency. Such performance should warrant their consideration in all new stations.

These and other developments to be described indicate that a high order of intelligence is needed in the operators of a modern boiler plant.

Feed Water

Careful study is now given to the treatment and heating of boiler feed water. Surface condensers are generally installed with all large steam turbines and the condensate, being pure distilled water, can be returned to the boiler as feed water. Troubles with boiler corrosion and oxidation of blading in steam turbines, have been traced to the presence of free oxygen in solution in the feed water. Hence the feed is de-aerated and kept in a closed system out of contact with air on its way to the boiler. De-aeration may be accomplished in the condenser itself or in separate de-aerator-heaters specially provided for this purpose. De-aeration accomplishes two results: it removes the undesirable oxygen and other gases from the feed water and this results in higher vacuum in the condenser.

Make-up water should be supplied from evaporators after such preliminary chemical treatment as the raw water may require. Low pressure evaporators are used to conserve heat head and may be single or multiple effect, depending on the source of steam and the heat balance arrangement. The heat balance is generally planned so that the condensate from the main condenser serves as cooling water in the evaporator condenser and thus returns the evaporator heat to the boiler.

The most efficient method of heating feed water is by means of steam, bled at several stages from the main turbine. This provides progressive heating by steps with steam whose heat head has been most economically utilized. The heaters are of the closed type, generally horizontal, and may be located either under the turbine or elsewhere as desired. Vertical closed heaters of the hair-pin type, first used at the Westport station of the Consolidated Gas, Electric Light and Power Company of Baltimore, are of a later design. Figure No. 7 shows this installation in the centre of the picture. The advantages claimed for these heaters over horizontal heaters are lower first cost and greater accessibility. While it is desirable to heat the feed entirely with bled steam, every other source of waste heat in the plant should be utilized in heating feed water. Such waste heat may be recovered from the steam-jet air pumps, steam leakage from main turbine glands, the evaporator condenser, any steam driven auxiliaries and in some cases, the main turbo-generator cooling air and cooling oil.

Centrifugal pumps for boiler feed are generally provided with one steam driven pump for starting up and for emergency service while the others are motor-driven. Only steam-driven pumps have been installed in some new stations to secure lower first cost and greater reliability. These pumps may be provided with automatic control. The feed to the individual boilers is usually governed by automatically controlled feed water regulators.

Steam Turbines

The capacity of individual turbines has increased rapidly during the last few years. Units of 30,000 k.w., are common and turbines with outputs of up to 60,000 k.w., are in daily operation. A 75,000-k.w. turbine has been ordered for the Crawford Avenue station, Chicago, and an 80,000-k.w. unit for Hudson Avenue station, Brooklyn.

The capacity of individual turbines depends on the size and character of the connected load, and the nature of other generating units available on the system. Large units with no spares may be installed in a new station if older stations on the system can serve as stand-by and absorb the load should a generator in the new station be out of service. A new station built solely for stand-by service to an hydro-electric plant may also have no spare units. A central station for public utility service and also for industrial plants, where load must be carried

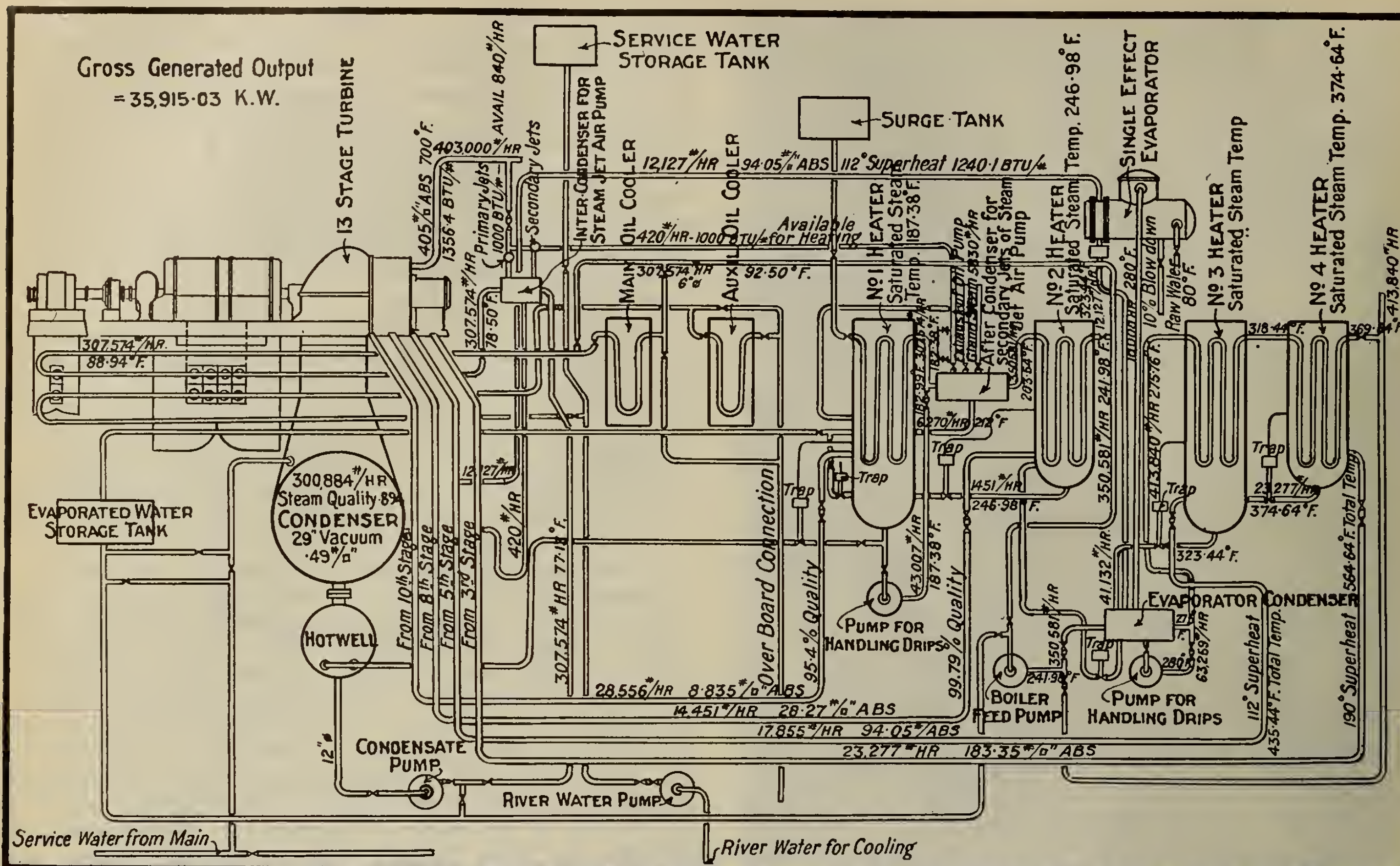

Figure No. 8.—Flow Sheet Showing the Heat Balance Arrangement and Bleeder System for the New Gould Street Station of the Consolidated Gas, Electric Light and Power Company, Baltimore, Md., for a Total Generator Output of 35,915 k.w.

Main generator rating 35,000 k.w.; auxiliary generator 1,200 k.w.; exciter 250 k.w. G.E. turbine with 13 stages; 390 lb. gauge and 700 deg. fahr. at throttle; 29-inch vacuum; 1,800 r.p.m.

continuously, should have one spare unit above the maximum load demand.

Steam turbines have been developed to a high degree of efficiency and reliability. Refinements in design permit some further gains, which, however, will come slowly. The largest turbines show only slight improvement in steam economy over the medium sized units. When steam expands in a condensing turbine, it becomes wet at a certain stage and the efficiency of the remainder of the turbine is decreased by the moisture in the steam. If the initial superheat can be materially increased, or if the steam can be re-superheated when it has expanded almost to the saturated condition, the deleterious effect of moisture in the turbine will be removed, the efficiency increased and the steam consumption lowered. To reheat between stages the steam must be carried back to a reheating superheater in the boiler. This additional complication, together with resultant boiler and turbine control problems, have made engineers reluctant to adopt reheating except where unusual base load conditions prevail and where high pressures are used.

As feed water is quite generally heated by steam bled from various stages of the turbine, less steam is delivered to the condenser. The limit of steam turbine output is the quantity of steam that can be passed through the longest permissible low pressure blades with a given leaving loss. Assuming this capacity is attained in a turbine with extraction bleeding, additional kilowatts can be secured from the steam bled off at earlier stages by proportioning all stages to the actual steam flow. This design may give 10 to 15 per cent increased output over non-bleeding performances with the same steam flow to the condenser, and is probably the cheapest way to secure additional turbo-generator capacity. Figure No. 8 shows the heat balance system for the new Gould Street station of the Consolidated Gas, Electric Light and Power Company, Baltimore, where the 35,000-k.w., turbine is designed in the manner just described. The condenser will contain only 30,000 square feet of cooling surface.

The nuisance of steam leakage at the turbine glands has been stopped by the use of water glands on both ends of the shaft. In some new designs of impulse turbines, the steam leakage at the high pressure gland is to be returned to one or more of the lower stages of the turbine. This will simplify both turbine and plant design, and will improve turbine performance slightly.

Closed air-cooled circuits are standard on turbo-generators with closed-type fin-tube coolers to remove the heat losses. This system lessens the danger of fire in turbo-generators, lessens the noise in turbine rooms and provides a neat compact design. These coolers along with the oil coolers may have condensate as the cooling medium with a slight gain in station economy, or may be cooled by raw circulating water if this is clean. Electrical engineers are now considering the use of hydrogen or other gases instead of air for cooling turbo-generators. Tests with hydrogen indicate that generators can be safely operated with practical elimination of the fire hazard. Windage and other losses are so decreased that the generator capacity may be increased about one-third with the same heat losses as with air. Increased generator capacity at low first cost may be obtained by the use of hydrogen provided no other difficulties develop.

The trend is still towards increased size in steam turbines, and single units of 100,000 k.w., may be expected within a reasonable time. Turbines are bled to heat feed water at two, three or four points, depending on the cost of coal and load factor. In some base load plants reheating is employed.

Condensers

Surface condensers are used where possible with large turbines as they produce a higher vacuum, require less auxiliary power than jet condensers, and also provide pure condensate for boiler feed. These may be single- or multi-pass, depending on whether there is an abundant or limited supply of cooling water. Developments are largely confined to improvements in tube spacing which will make all the cooling surface equally accessible to the exhaust steam and will cause this steam to sweep in straight lines towards the air cooler section. Improved performance, with reduced tube surface and hence lessened first cost, has been reported as a result of these changes. Formerly much trouble was experienced with split condenser tubes and with failure from other causes. These have not been entirely overcome but considerable improvement has been made in the art of manufacturing these tubes.

In some cases the character of the cooling water due to foulness, acidity or other causes, prohibits the use of surface condensers. Jet condensers must then be used and special provision must be made to treat all the raw feed water.

Some condensers act as de-aerators. The make-up water is warmed and sprayed into the steam space in the top of the condenser. This causes all gases to flash out and they are removed by the air pump. Where closed feed systems are used, a hot-well receiver of several thousand gallons capacity is added to the condenser to serve as a reservoir on the feed system.

Steam jet air pumps are favoured on many installations due to their cheapness, their simplicity, the high vacuum attainable and the small space requirements. The condensate passes through the inter- and after-condensers of these air pumps and recovers the heat in the steam used by the jets. Reciprocating dry vacuum pumps may in some cases make a lower steam demand on the boilers and may produce higher vacuum than with steam jets. These advantages are offset somewhat by high first cost, large space requirements, and generally higher maintenance.

Close study is now given to the probable source of the coldest available circulating water and intakes should be designed to utilize the bottom strata of water.* Such great quantities of water are handled in large central stations that careful study must be given to small details of design of intake and discharge tunnels, and suction and discharge piping, in order to keep the hydraulic losses at a minimum. Draft tube designs on the condenser discharge have been used to recover the leaving velocity head and thus lower the pumping head on the circulating pumps. These improvements reduce the power input to the circulating pumps. Care should also be taken to spread the cooling water in a thin surface layer at the outlet of the discharge tunnel so as not to cause any intermixing with the cold bottom strata of the water supply.

*"Lake Waters for Condensers", A. G. Christie, *Mechanical Engineering*, October, 1925.

Auxiliary Drives

The prime requisite of an auxiliary drive is reliability; high efficiency is a secondary consideration. Formerly steam driven auxiliaries were considered the most reliable but improvements in electrical machinery and in sources of electric auxiliary power have made the electric drive the favorite in many new stations.

Auxiliaries may be divided into two general classes. Those that are absolutely essential for the continuous operation of the station, such as boiler-feed pumps, powdered coal feeders or stoker drives, condenser auxiliaries, unit pulverizers when used, draft equipment, and exciters; and those that may be subject to interruption with no serious effect on operation such as coal handling and pulverizing equipment for storage systems, service pumps, air compressors, etc. The first class, if electrically driven, must secure power from a source not subject to line interruptions. House turbines of efficient design, often operating condensing, are used in some plants. In others, auxiliaries are supplied with power from the main unit through an auxiliary bus, with an automatic throw-over to a spinning house turbine in case of trouble. Another plan is to connect an auxiliary transformer to the main generator inside the switch gear and reactance coils, and to furnish auxiliaries with power from this transformer.

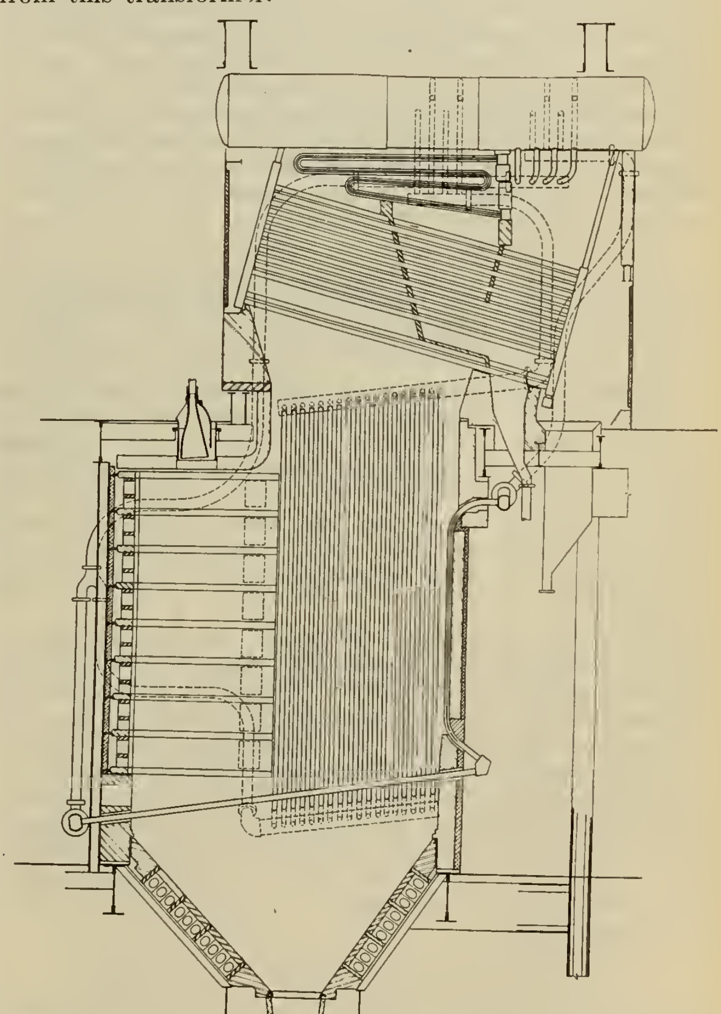

Figure No. 9.—Cross-section of Boiler and Powdered Coal Furnace for a Canadian Paper Company.

Heating surface in boiler 10,160 sq. ft.; in fin-tube water-screen 1,201 sq. ft.; furnace volume above water-screen 8,200 sq. ft.

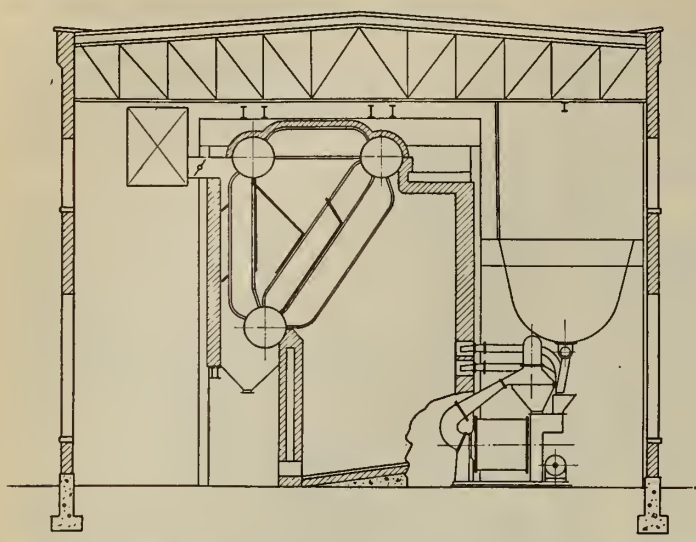

Figure No. 10.—Arrangement of Boiler, Furnace and Unit Pulverizer in the Boiler House of a Canadian Industrial Plant.

Heating surface in boiler 7,000 sq. ft.; furnace volume 4,450 cu. ft.

Still another plan is to provide an auxiliary generator driven by the main turbine and placed beyond the main generator. This provides cheap auxiliary power but is subject to shut down if the turbine should trip out from over-speed. A low cost stand-by non-condensing house turbine may be provided for starting up and emergency service. There is a wide difference in practice on this matter of auxiliary drive for normal and emergency operation.

Some designers prefer to install duplex sets with both turbine and motor drive for all essential auxiliaries. Improvements in the efficiency of small turbines tend to encourage such installations. All essential auxiliaries will be steam driven in one of the newest large stations.

The design of turbines of sizes used for house service is being further developed so that their efficiency will be only a little below that of the main units. This will lead to the use of more house turbines and since these operate at nearly constant load, it has been suggested that a portion or all of the feed water heating be done by steam bled from them rather than from the main units. This has some advantages with variable load conditions.

Methods of auxiliary drive, the use of full-voltage starting motors, means of providing variable speed to the various auxiliaries, and first cost and maintenance of auxiliary equipment, are all receiving much study and undergoing development. An arrangement which meets the requirements of one station may not be satisfactory in another plant. Hence the multiplicity of schemes. At present the electric drive with the auxiliary turbine is widely used. It is improbable that any one system will ever become predominant and that different plans will always be used to meet the conditions that exist in various plants.

Steam Stations for Industrial Plants

The preceding discussion refers specifically to large central stations. Many industrial plants require a steam station to furnish steam for heating or process work or for power. The use factor of such equipment may be quite high in which case refinements in design would be warranted that could not be justified with a low use factor.

While the same general tendencies prevail in industrial plant design as in central stations, the former lag behind partly due to the fact that the industrial steam plant is a secondary part of the whole works and partly because less efficient operating management and personnel are available in the small plant than in the large electric works. The management of large industries can often effect considerable savings by the reconstruction of their power plants and the employment of skilled operators.

Increasing boiler pressures, larger boilers of the water-tube type, pulverized coal or more modern stoker equipment, and large condensing or non-condensing steam turbines, now characterize the equipment of the larger industrial plants. There appears to be a tendency in European industrial plants where process steam is required, to use even higher steam pressures than in central station practice. Greater heat head is made available for power production by the use of these higher pressures before the steam is exhausted into the heating system. A careful analysis of this use of higher steam pressure has been presented in a recent paper.*

Small plants are usually built with little or no thought given to fuel economy. Owners would save money by engaging competent engineering advice before building such small plants.

Figure No. 9 shows a cross-section of a boiler and furnace for the new boiler plant of a Canadian paper company. The Lopulco pulverized coal firing system will be installed, with a central pulverizing plant using steam dryers and located near the wharf, some 1,200 feet away from the boilers. This plant is designed to burn any available coal, including Nova Scotia coals with low-fusing ash.

Figure No. 10 shows a cross-section of an addition to the boiler room of another Canadian industrial plant consisting of one 700-h.p., boiler to be initially operated at 130 pounds gage pressure, but built for 350 pounds gage. A superheater to provide 700° F. steam temperature will be added later. A Fuller-Bonnot unit pulverizer will furnish powdered coal to the solid wall combustion chamber. Secondary air will be admitted through a hollow bridge wall. No water screens will be used on this plant. The unit will operate at 250 per cent rating with peaks up to 300 per cent. An old economizer now in place will be used to heat the feed water.

Central pulverized coal systems may be justified in new industrial steam plants with many large boilers. New plants with a few boilers may employ unit systems for pulverized coal. Much must still be done to improve and further develop unit pulverizers to reduce outage, maintenance costs and depreciation, and to provide suitable mixing burners.

Steam Accumulators

The recent development of high pressure accumulators has directed the attention of engineers to the possibilities of this equipment. In large central stations, the principle of conservation of heat head together with the flat boiler efficiency curve over wide ranges of load, do not leave much opportunity for accumulators to effect savings. Another situation prevails in the process work of industrial plants particularly where widely fluctuating steam demands are common. Heat head is then of less importance than heat capacity. These accumulators seem to have possibilities in such plants, particularly when stokers with limited furnace volumes have been installed.

*"The Value of Higher Steam Pressures in the Industrial Plant", W. F. Ryan, presented at December 1925 Meeting of A.S.M.E.

Low Temperature Carbonization and Other Processes

Wide interest is apparent in low temperature carbonization processes as a means of furnishing a smokeless substitute for anthracite coal and of providing valuable by-products. These processes consist essentially of heating bituminous coal or lignite at temperatures not in excess of 1,200° F., and thereby driving off the rich gas and the light oils which, not being exposed to high temperatures, contain portions suitable for use in automotive engines. The coke residue contains sufficient volatile matter to kindle readily but burns without smoke. It can be used either for domestic purposes or for pulverized fuel The power plant engineer is interested in these processes as a means of furnishing him cheaper fuel through the sale of by-products.

Although many processes have been invented and several are in advanced stages of development, none are in full commercial operation. It is probable that a few of these will be worked out so that they may be incorporated in future plant design. The problem is quite fascinating and interest has been intensified by recent developments in closely related fields which will undoubtedly affect low temperature carbonization methods. Bergius has developed a process for the complete hydrogenation of coal into oils. Patart makes synthetic methanol out of water gas. Fischer hydrogenates the tar oils of the low temperature carbonization process into light motor fuels. He has also developed a synthetic process to convert the water gas made from the coke residue into a new motor fuel called "Synthol", which consists of a mixture of oils and alcohols. These foreign developments have started intensive research work at many places. One cannot predict what ultimate effect low temperature carbonization and these other processes will have on power plant design.

Electrical Equipment

This paper has been planned to discuss the steam power station up to the generator terminals only. Much could be written on the electrical side of the steam station design, particularly with reference to the type of switch gear to be used, the isolation of the phases, outdoor switching, protective devices and systems for maintaining auxiliary power supply. Types of motors for auxiliary drive and means of throwing these from one bus to another bus in case of a failure of power supply, could also be discussed at length. Such discussion would unduly lengthen this paper and since electrical equipment is so much dependent on distribution requirements, it will not be further considered.

Closure

The present trends of steam plant development are briefly presented in the preceding paragraphs. There may be differences of opinion among engineers in regard to the interpretation of these trends. Furthermore, the art of steam power plant design is still undergoing rapid change and the trend of development may be quickly modified by new thoughts on power production. This whole discussion indicates that one can look hopefully for better fuel economy and lower power costs from new steam power stations.

The author wishes to express his indebtedness to McClellan and Junkersfeld, Inc., New York, to the Consolidated Gas, Electric Light and Power Company of Baltimore, and to the engineers of these two companies for the use of their data and designs and for their assistance in the preparation of this paper.

Generation of Explosive Gases in Electric Water Heaters and Boilers

An Investigation of the Generation of Explosive Gases in Electric Water Heaters and Boilers Operating on Alternating Current with Submerged Electrodes.

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and
A. Blackie,
National Testing Laboratories, Winnipeg, Man.

Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

The complete demolition of an electric boiler together with the wrecking of the house in which it was installed drew attention to the possibility that the explosion causing this damage might have been due to an accumulation of hydrogen and oxygen within the system, the gases being generated by the electrolysis of water. An inspection of several similar installations discovered the fact that gases of an inflammable and explosive nature were being generated within the heating system.

Gases Generated from Service Heaters

Samples of gases were secured from two water heaters, the first a 550-volt, single-phase, 60-cycle installation. This heater was discharging gas continuously from the air relief valve at the rate of 10,000 cc. per day. The following analysis is typical of the gas collected from this heater:—

Carbon dioxide	10.4 per cent
Oxygen	1.4 "
Hydrogen	49.8 "
Nitrogen	38.4 "

This gas was found to be inflammable and when mixed with 70 per cent of air was explosive. Three months later this heater was found to be generating gas of a similar composition and at about the same rate.

The second heater was a 220-volt, single-phase, 60-cycle installation operating intermittently. Gas at the rate of 2,000 cc. per 24 hours of operation was being generated by this heater. The composition of the gas was as follows:—

Carbon dioxide	4.7 per cent
Carbon monoxide	0.6 "
Oxygen	1.0 "
Hydrogen	54.5 "
Nitrogen	39.2 "

This gas was inflammable and when mixed with air was explosive. Samples of gas collected during a period of three months had a similar composition and the rate of generation was approximately the same.

TABLE No. 1,—Electrolytic Gases Generated by a 60-Cycle Alternating Current

Electrodes	Iron	Iron	Carbon	Carbon	Copper	Copper	Lead	Zinc	Aluminum	Nickel	Platinum
Voltage	220	110	220	110	220	110	110	110	110		
Percentage composition of generated gases: Carbon dioxide	1.6	6.6	17.5	14.6	0.6	1.3	0.8	2.2	0.2	Explosive gases generated.	Hydrogen and oxygen generated in equivalent proportions.
Oxygen	18.4	21.1	3.2	5.0	1.2	3.2	1.3	5.4	7.6		
Hydrogen	35.2	39.2	66.2	61.7	97.2	83.6	85.9	71.4	89.5		
Nitrogen	44.8	21.8	0.4	12.7	1.0	11.9	12.0	21.0	2.7		
Carbon monoxide			6.5	6.0							
Hydrocarbon gases			6.2								
Explosion	vio	lent	ign	ites	ign	ites	ignites	ignites	violent		violent
Approximate electrode surface exposed sq. cm	180	180	105	105	75	75	180	180	180	180	8
Ccm. of gas collected in 24 hours	200	400	no record	no record	no record	no record	115	186	6000	no record	no record

Note:—It was impossible to determine the current density as the electrode chamber was in continued surge with respect to the immersion of the electrodes due to the automatic control of this type of heater.

Electrolysis by Alternating Current

Experiments on the generation of gases in this type of water heater were conducted in small model heaters designed to allow for the removal and exchange of the electrodes. Figure No. 1 indicates the apparatus used, and table No. 1 contains the observed results for various electrodes.

These experiments established without any doubt that single-phase, 60-cycle, alternating current of either 110 or 220 volts would generate gases in aqueous electrolytes and that these gases were generally of an explosive nature. The aqueous electrolyte used was water from the domestic supply of the city.

Gases Generated by Alternating Current

It is apparent from the composition of the gases generated that their nature depends upon the composition of the electrodes used in the experiments. The metals evolved very little, if any, hydrocarbon gases whilst the carbon electrodes gave a considerable percentage of these gases. During the process of electrolysis, the electrodes were all attacked with the exception of the platinum. The carbon electrodes were mechanically disintegrated and the copper almost completely dissolved. Metals capable of oxidation absorbed the oxygen generated by electrolysis forming oxides of the metal. This was particularly observed in the case of copper, lead and aluminum where an oxide or hydrated oxide appeared as a deposited sludge in the generator. This absorption of oxygen accounts for the low percentage of oxygen and the high percentage of hydrogen in the gases collected.

Oxygen also combines with the iron electrodes, but absorption is slower than in the case of the metals mentioned above. The automatic control of this type of heater permits the water to be evacuated into an expansion tank. Here atmospheric gases are redissolved, and on the electrode chamber of the heater cooling below the boiling point of water it is refilled with this aerated water which is degassed with rising temperature adding a fresh supply of oxygen, nitrogen, and carbon dioxide to the gases in the electrode chamber.

Effect of Lowering of the Electrical Resistance upon the Rate of Generation and Composition of Gases

It was deemed desirable to determine what the effect upon the generation of gases might be if the nature of the electrolyte was changed by the addition of certain salts. The following were the salts chosen for this experiment as they were those that if it were possible to inhibit the generation of gases might be expected to do so: magnesium sulphate; sodium dichromate; potassium permanganate; sodium nitrate; sodium bicarbonate; sodium phosphate; sodium cyanide.

The addition of these salts to the water in the electrode chamber in every instance increased the rate of generation of gases enormously. This rapid generation was largely due to the lowering of the resistance and the consequent increase of the flow of current through the electrolyte.

Relation of Grounding Shell to Generation of Gases

Since all service installations are surrounded by an electrically grounded metal shell in electrolytic contact with the electrodes through the electrolyte, (tap water), the experimental generators just described were provided with metal sleeves electrically grounded. In the case of the iron electrodes the generation of explosive gases was increased nine-fold by the introduction of the grounded shell rising from 25 cc. in 12 hours to over 200 cc. evolved in the same time.

To simulate more closely the type of heater employed in service a small cast iron model was prepared and operated on the 220-volt circuit with a watt meter in series. A typical analysis of the gas generated within this diminutive heater is as follows:—

Carbon dioxide	13.0 per cent
Oxygen	11.6 "
Hydrogen	30.0 "
Nitrogen	45.4 "

This gas exploded when an electric spark was passed through it.

It was found that the rate of evolution of gas depended upon the spacing of the electrodes, the relation of the electrodes to the shell, the current flowing, the temperature of the electrolyte and the depth of immersion of the electrodes. Moreover the composition of the gas was also a function of the manner of operation of the system that is the surge between the electrode chamber, the radiating system and the expansion tank. The majority of these variables are interdependent and consequently the evaluation of the rate of evolution becomes very complicated. The maximum evolution appears to take place just below the boiling point.

Water-cooled electrodes, (economically impracticable), prepared by using as electrodes iron pipes with water flowing through them, generated explosive gases both upon the electrodes and the metallic sheath. Electrodes of different types of iron such as cast iron, mild steel and high carbon steel affected the composition of the gases but little.

Large Experimental Heater

A service heater of the standard size used for domestic heating purposes was installed and operated for two months. The installation was provided with a thermometer inserted into the electrode chamber, a recording ammeter, a watt meter and a water gauge glass showing the fluctuations in water level within the heater. Gases were generated within the heater and the following is a typical analysis of the gas generated with a minimum surge throughout the system.

Carbon dioxide	3.3	per cent
Oxygen	3.7	"
Hydrogen	42.6	"
Nitrogen	50.4	"

On passing an electric spark through this gas a slight explosion occurred.

When the method of operating this heater was changed so as to produce a surging effect that is an evacuation of the water from the heater into the expansion tank and a refilling on condensation of the steam, a gas of the following composition was obtained:—

Carbon dioxide	12.8	per cent
Oxygen	2.6	"
Hydrogen	34.5	"
Nitrogen	50.1	"

This was non-explosive until the carbon dioxide was removed.

Generation of Gases outside the Electrode Chamber

The volume of gases generated in the electrode chamber of this system was not nearly so large as collected from service installations elsewhere. A chance remark from one of the operators that "air" was collecting in the cooling system led to the installation of a collection valve on the radiator and more gas was removed at this point than from the electrode chamber itself. Its composition was similar to that evolved from the electrode chamber.

The generation of gases by electrolysis at points relatively far removed from the electrodes will take place wherever the chemical decomposition potential of the electrolyte in contact with the metallic conductor is lower than that on the electrodes themselves. The generation of gases may be expected anywhere on the metallic installation system in contact with the electrolyte.

This discovery of the generation of gases outside the electrode chamber nullified the possibility of relating the evolution of gas to the recorded electrical measurements.

Explosiveness of Gases

The explosiveness of the gases collected from the experimental heaters and service installations varied in proportion to the inert gases present and with the oxygen content. The analyses of 22 gases are listed in table No. 2 arranged in order of increasing oxygen content. It will be noticed that in sample 7 the oxygen content is only 4.2 per cent and the hydrogen 5.2 per cent. This mixture gave but a slight explosion but all mixtures containing a higher percentage of oxygen and hydrogen exploded violently.

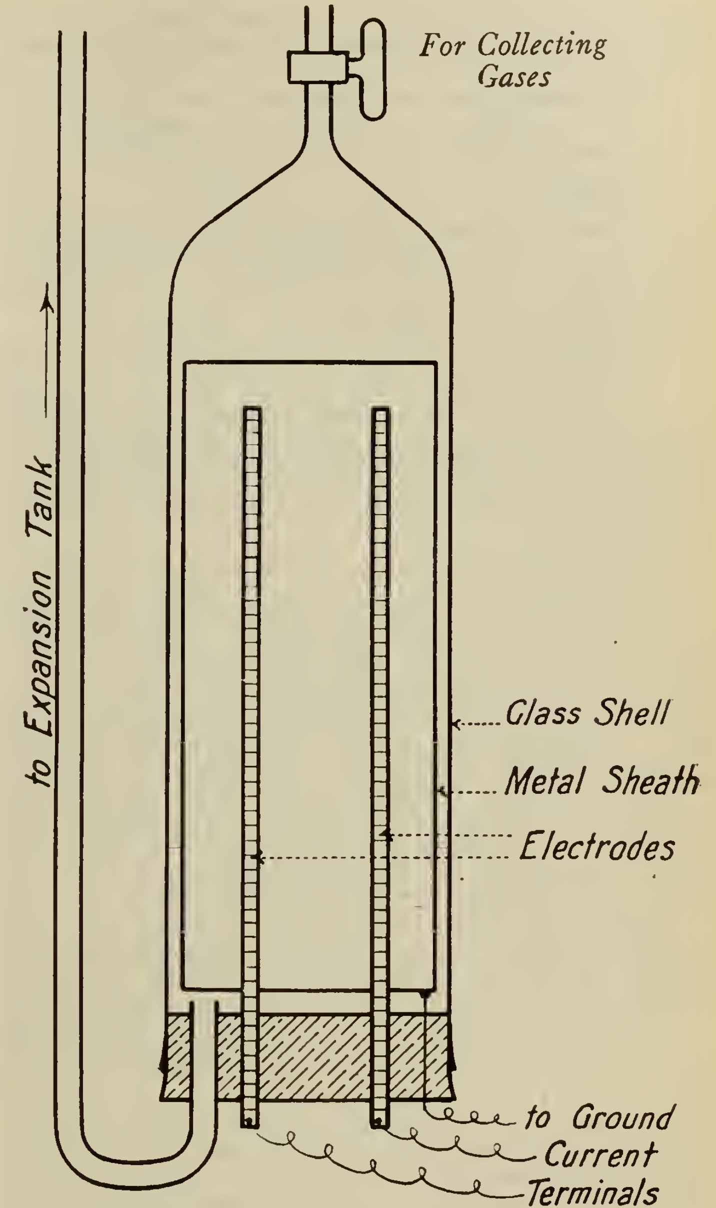

Figure No. 1.—Small Cast Iron Experimental Electric Water Heater.

Electric Steam Generators

While conducting this investigation gas was observed bubbling through water contained in the cup of an air valve attached to a steam radiator on the floor of the building in which the experimental water heater was installed. On applying a match to the bubbles a sharp detonation occurred as each bubble broke. The radiators

(Explosive = X, Non-explosive = —).

TABLE No. 2,—Explosiveness of Gases

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Carbon dioxide...	24.1	4.7	16.2	16.0	10.4	0.2	44.8	13.0	1.5	12.8	4.2	1.6	1.4	1.2	1.0	6.6	1.0	1.8	4.6	0.4	0.6	1.0
Oxygen.....	0.5	1.0	1.2	1.4	1.4	3.0	4.2	11.6	12.1	16.4	17.2	18.4	19.6	20.0	20.8	21.1	23.4	25.7	27.2	30.8	32.4	33.4
Hydrogen..	18.6	54.5	26.8	16.6	49.8	15.5	5.2	30.0	11.5	6.0	18.0	35.2	4.8	42.8	3.1	39.2	19.4	4.6	20.7	69.2	66.0	62.3
Nitrogen...	56.5	39.3	55.8	66.0	38.4	81.3	45.8	45.4	74.9	64.8	60.2	44.8	74.2	36.0	75.0	21.8	65.4	67.9	47.5	0.0	1.0	3.3
Explosiveness......	—	—	—	—	—	—	X	X	X	X	X	X	—	X	—	X	X	—	X	X	X	X

of this building are provided with steam from an electric steam generator in the basement operating on 2,200-volt, a.c., 60-cycle current.

Two litres of gas were collected from this radiator which on analysis gave the following composition:—

Carbon dioxide	0.6 per cent
Oxygen	32.4 "
Hydrogen	66.0 "

On being informed that several of the radiators on the top floor of the same building were "air locked" a sample of gas was removed from one of the cold radiators and analyzed. It contained the following:—

Carbon dioxide	0.4 per cent
Oxygen	30.8 "
Hydrogen	69.2 "

It will be observed that the proportions of hydrogen and oxygen in these two samples are approximately those obtained by the electrolysis of water and also they occur in proportions that would give an explosion of maximum violence.

Explosiveness of Gases in Relation to Steam

A sample of the explosive mixture taken from the radiator mentioned above was placed in a wide eudiometer tube over mercury with water in contact with the gas. The temperature was raised to 250° F. and the gas permitted to remain in contact with the water for one hour. The pressure on the mercury manometer registered a little over two atmospheres. On passing an electric spark through the mixture a violent explosion occurred completely wrecking the apparatus. This explosion was with 25 cc. of the gaseous mixture saturated with water vapor at a temperature corresponding to the boiling point of water under two atmospheres pressure.

The accumulation of gases in radiators or other cooling parts of a system provided with steam from an electric boiler must be considered extremely hazardous.

The explosiveness of such gaseous mixtures is determined by the proportions of hydrogen and oxygen present. The amount of water vapour present in the gases within the electrode chamber of a water heater depends upon two factors, the quantity of other gases present in the chamber when ebullition begins and the hydrostatic pressure under which the system operates. When only a small quantity of permanent gases are in the electrode chamber the depression of the water is secured by the generation of an almost equal volume of water vapour to the liquid displaced but as the chamber comes to contain more and more of the permanent gases a smaller volume of water vapour is required to depress the electrolyte. With several of the gaseous mixtures listed in table No. 2 even if the chamber were only partially filled with such a gas the amount of water vapour generated in depressing the water from off the electrodes would not sufficiently dilute it to prevent an explosion were an arc to form when the water receded from one or the other electrode.

Several determinations were made and the possibility demonstrated of exploding gaseous mixtures secured from the gases listed in table No. 2 and under the conditions of water vapour saturation and pressure described above.

Finally a small experimental heater with the electrodes inserted from the top and without any vent being provided for the generated gases was set up and permitted to operate under a small hydrostatic pressure and low electrolytic resistance. The surging effect was very pronounced until a considerable volume of gas collected in the electrode chamber. After about an hour's operation the generator blew up wrecking the whole apparatus. As the explosion was accompanied by a flash presumably it was caused by the formation of an arc when the electrolyte was depressed from off one electrode. The explosion took place while the heater was operating over water close to the boiling point.

Venting of Gases

The accumulation of gases in the electrode chamber of service heaters has been recognized by the installation of automatic valves. Such valves are frequently set to operate open up to approximately 214° F. when they close and remain closed at all temperatures above this. But the heaters actually operate under a head of pressure as high as an additional atmosphere at which pressure steam is generated and recondensed at 250° F. Consequently the temperature of the electrode chamber never drops to that at which the valve is supposed to open and the accumulated gases cannot be vented.

Such valves are also liable to become clogged by the accumulation of iron rust carried into them by the surging water of the electrode chamber. Such valves were frequently found to vent the accumulated gases only after vigourous tapping.

It is extremely hazardous to rely upon the automatic venting of the chamber gases and all installations of such water heaters should be provided with a water gauge glass whereby the accumulation of gases retained within the electrode chamber could easily be detected.

Explosion Hazards

Dantsizen and Horstkotte* carried out a series of determinations for the General Electric Company on the evolution of hydrogen by a 3-phase 60-cycle 6,600-volt electric boiler. They found 1.3 per cent hydrogen and 18.0 per cent oxygen in the permanent gas content when the boiler began generating steam and after several hours operating 4.4 per cent hydrogen and 20.5 per cent of oxygen were obtained. They determined the hydrogen content of the steam from a fuel fired boiler and found it to be 0.0003 cubic feet of hydrogen per each cubic foot of water evaporated while the generation of hydrogen by the electric boiler was 0.002 cubic feet per each cubic foot of water evaporated or seven times as much.

They conclude as follows: "The generation of hydrogen in an electric steam boiler will be approximately proportional to the amperes input, but whatever the current input the same volume of hydrogen might accumulate in a heating system if it were supplied with steam from a fuel fired boiler this being merely a question of time. However, since no destruction of heating systems has been attributed to hydrogen from fuel fired boilers it is reasonably safe to assume that the same performance might be expected with steam from an electric steam generator."

The generation of hydrogen is not the dangerous feature connected with electric steam generators but the generation of equivalent amounts of hydrogen and oxygen forming on the condensing of the steam an explosive mixture of the first magnitude. This in conjunction with the possibility of having such a mixture under certain conditions of boiler design adjacent to electrodes where an arc might form is the principal hazard so far as the boiler is concerned but another and greater hazard is the accumulation of these gases in radiators and other traps far removed from the generator.

The richness of the explosive mixture is much enhanced if the generator operates on condensate for this

Pulp and Paper Magazine of Canada, 22, 1251-2 (1924).

would contain but little dissolved gases from the air. Systems operating on raw water will dilute the explosive gases by the degassing of the water.

A cubic foot of raw feed water at atmospheric pressure and 68° F. contains about 183 cc. of dissolved oxygen and 340 cc. dissolved nitrogen. According to Dantsizen and Horstkotte a cubic foot of water on being generated into steam in an electric boiler produces 0.002 cubic feet of hydrogen or 57 cc. and 28 cc. of oxygen would also be generated from the same quantity of water. Consequently a cubic foot of raw water would produce 608 cc. of gas, (neglecting the CO_2), containing 57 cc. of hydrogen or over 9 per cent of the total volume. This quantity of hydrogen in air is above the border line of explosibility. Dr. Von Schwartz,* giving 7 per cent of hydrogen in air as the lower limit for explosibility when subjected to electrical ignition.

At a temperature of 180° F. which was the temperature of the feed water used by Dantsizen and Horstkotte the content of dissolved air at atmospheric pressure would be reduced from 523 cc. per cubic foot of water to one third this amount or 174 cc. and the proportion of hydrogen on generating steam would increase to 24 per cent in the residual gases from the condensate. It is evident from this calculation that these experimenters must have had dilution with atmospheric gases from another source than that dissolved in the feed water.

Granting an evolution of 0.002 cubic feet of hydrogen per cubic foot of water evaporated in an electric boiler of the exposed electrode type, the possibility for the accumulation of a dangerously explosive mixture is largely a function of the gaseous content of the feed water.

Summary

Electric Water Heater

(1) Gases of an explosive nature are generated in water heaters operating on bare submerged electrodes using 220- or 110-volt, 60-cycle, a.c. The nature of the gases depends upon the material of the electrodes. Carbon electrodes give hydrogen, oxygen, carbon monoxide, carbon dioxide and hydrocarbon gases. Aluminum electrodes as would be expected, generate hydrogen and oxygen most vigourously, the oxygen being largely fixed as hydrated oxide of aluminum. Iron electrodes produce hydrogen and oxygen with possibly a little carbon dioxide. The oxygen is largely fixed in the electrode chamber as hydrated oxide of iron.

(2) The gases accumulating in the system are due to three causes:

(a) Degassing of the water;

(b) The action of the water on iron producing hydrogen; and

(c) Gases generated by the electrolysis of the water by alternating current.

*"Fire and Explosion Risks," Von Schwartz, page 33.

Frequent surging of the water from the expansion tank into the electrode chamber brings in dissolved atmospheric gases. Nitrogen and carbon dioxide dilute the explosive gases but oxygen enhances the possibility of an explosion.

(3) The rate of generation with fixed electrodes is largely a function of the electric current flowing and the temperature. Apparently a larger volume of hydrogen is generated near the boiling point than the temperature co-efficient of the conductivity of the electrolyte will account for.

(4) Gases may be generated by the electric current in other parts of the system outside the electrode chamber. This is due to the intimate contact of the electrolyte with the whole metallic system and to the practice of electrically grounding the shell.

(5) Steam in so far as it dilutes the gases reduces the explosiveness. The range of explosibility of hydrogen and oxygen mixtures is too great however to permit of the presence of steam in the gases generated always preventing the possibility of an explosion. Gases generated by the 220-volt, 60-cycle current using iron electrodes in a water heater exploded in the presence of steam when fired by an electric spark.

(6) The gases generated may be ignited by an electric spark. The danger of ignition is greater with heaters provided with electrodes entering from the top. Whenever the electrolyte is depressed so that one of the electrodes is completely bared an arc will be produced. Other conditions may also arise within the electrode chamber causing the production of a spark.

(7) The explosive nature of the gases generated in this type of domestic heater makes reliance upon automatic venting extremely hazardous and since the generation of gases is a function of the alternating current electrolysis of water all types of heaters in which the passage of the electric current through the water within the heater is possible can only be operated in the expectancy of having explosive gases generated.

Electric Boilers

Electric boilers operating on a.c., with bare submerged electrodes, generate equivalent quantities of hydrogen and oxygen, and these are carried out of the electrode chamber with the steam, accumulating wherever the steam is condensed. If raw water is used in the boiler these explosive gases will be diluted with the gases of the atmosphere dissolved in the feed water, if condensate be used the accumulation will more nearly approximate a mixture of hydrogen and oxygen of the maximum explosibility.

Explosive mixtures of hydrogen and oxygen were found in "air locked" radiators and escaping from the air valve of radiators provided with steam generated by an electric boiler operating on 2,200-volt, a.c., 60-cycle current.

An explosion hazard exists at those parts of a system provided with steam from electric boilers wherever there is a possibility of gases accumulating from the condensate.

European Engineering Practice in Production, Transmission and Use of Electrical Energy

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Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

The Hydro-Electric Power Commission of Ontario arranged that a representative from the engineering staff attend the International High Tension Conference at Paris during June of 1925, with instructions to study such engineering and construction conditions in Europe as interested the Commission. This paper is a brief and cursory review of some of the more interesting features of this study.

Seeing is believing. It is very excellent practice on the part of administrations interested in the generation and distribution of electrical energy and in engineering matters generally to arrange that technical men shall have an opportunity from time to time to study developments and efforts of other engineers in the advancement of the art. Such an opportunity was afforded the writer during the year of 1925. Being identified largely with the transmission of electrical energy, such works naturally received the most attention. However, the feature which seemed to be most in evidence was the extent to which the efforts of the engineering profession are modifying the life of the human race generally. Reference was made recently in the press to an opinion that the primary element of disturbance and unbalance in British labour conditions is the reduction in the demand for coal. This may appear on the surface to be largely the result of economic conditions. However, an analysis will reveal in most cases that these conditions are the result of the efforts of engineers to minimize the amount of labour involved in the construction and operation of various works and processes. From the time of making an inspection of the oil fired boilers and enclosed steam turbines to the extent of 79,000 h.p., on the Mauritania, where some 150 stokers have been released, to that of observing on the return journey, the efforts, of calèche drivers of Quebec and of the horse-drawn cab owners of Montreal, to avoid being superseded by the 20 to 40 seat char-à-banc, there was one continued story of the relief of labour for other purposes on account of the efforts of engineers. The most remarkable examples are the electrification of state railways in those countries where coal is not generally available and the superseding of steam by internal combustion engines especially for marine work. These are referred to later in this paper.

First Impressions of Great Britain

On arriving in Great Britain, an opportunity was afforded to visit, among other engineering plants, the Perelli General Works at Southampton and to discover, as seemed to be the case throughout Europe, that most of the electrical engineering trades were quite busy. This company has samples of the joint used for the underground single-phase cable which is operating on the continent at 130 kv., and is, with the various laboratories and test rooms which are available, prepared to manufacture underground cables at voltages of 33 kv. and greater. This is common practice in England at the present time.

The small electric trams of this comparatively small city are typical. Two men are employed to operate the cars and at terminals automatic "Y" 's are installed in the overhead and track in such a way that it is not necessary for the crew to give any attention whatever to reversing and turning of the car. This is a considerable improvement so far as the comfort and convenience of the crew is concerned.

Transmission lines are not as much in evidence in England as they are on the continent of Europe and in America generally. In explanation of this, there are some calculations available by English engineers to indicate that coal can be transported from mine mouth to point of use cheaper than it can be transmitted as electricity after being developed at the mine.

Through Northern France

In the northern part of France considerable development is evident during the last seven years. Numerous concrete pole lines are operating at from 30 kv., to 60 kv., both single and double circuit, and there is a system of steel tower lines tying these lower voltage lines together in the Boulogne district. The concrete poles have a greater cross-section than is found in other countries. They are frequently of a sort of "A" frame construction with a cross-section at the ground line of approximately 9 by 20 inches. The total weight is reduced somewhat by placing circular or other holes through the pole so as to give the appearance of a ladder.

There are numerous cement mills served in this district as well as general manufacturing and public services in the various municipalities. The towns of the war zone are being restored very slowly indeed. A trip through such towns as Arras indicates that the electrical works, pole lines, railway depots, etc., have been restored, but many domestic buildings have neither been restored nor completely razed. Considerable more or less temporary electrical overhead work appears to exist still in some of these towns.

The International High Tension Conference

At the High Tension Conference, there was an opportunity to meet engineers from all parts of the world. The Japanese were very much in evidence and appeared very anxious to carry back to their own country all information and data they could possibly make use of.

There were some 27 countries represented by 226 foreign delegates. Twenty-three of these came from Russia and five from Australia. Some 304 members attended from France. Ninety-nine papers were presented. Of these 37 were printed in English and French, 36 in French only and 26 in English only. All of the discussions were carried on in either of these two languages.

With the preponderance of French delegates, the greater part of the discussions and papers was supplied by them. Speaking generally of the discussions, representatives from Sweden, from the Strassburg section of France and from Austria-Hungary appeared to take more than an ordinary part. These representatives spoke fluently in both French and English.

The development of the use of electrical energy in rural districts received considerable attention. In Sweden there is a tendency just now to curtail development of new districts and give attention to the addition of new customers to existing lines. About 70 per cent of the possible rural customers in Sweden have already been served with distribution lines; not all of these however

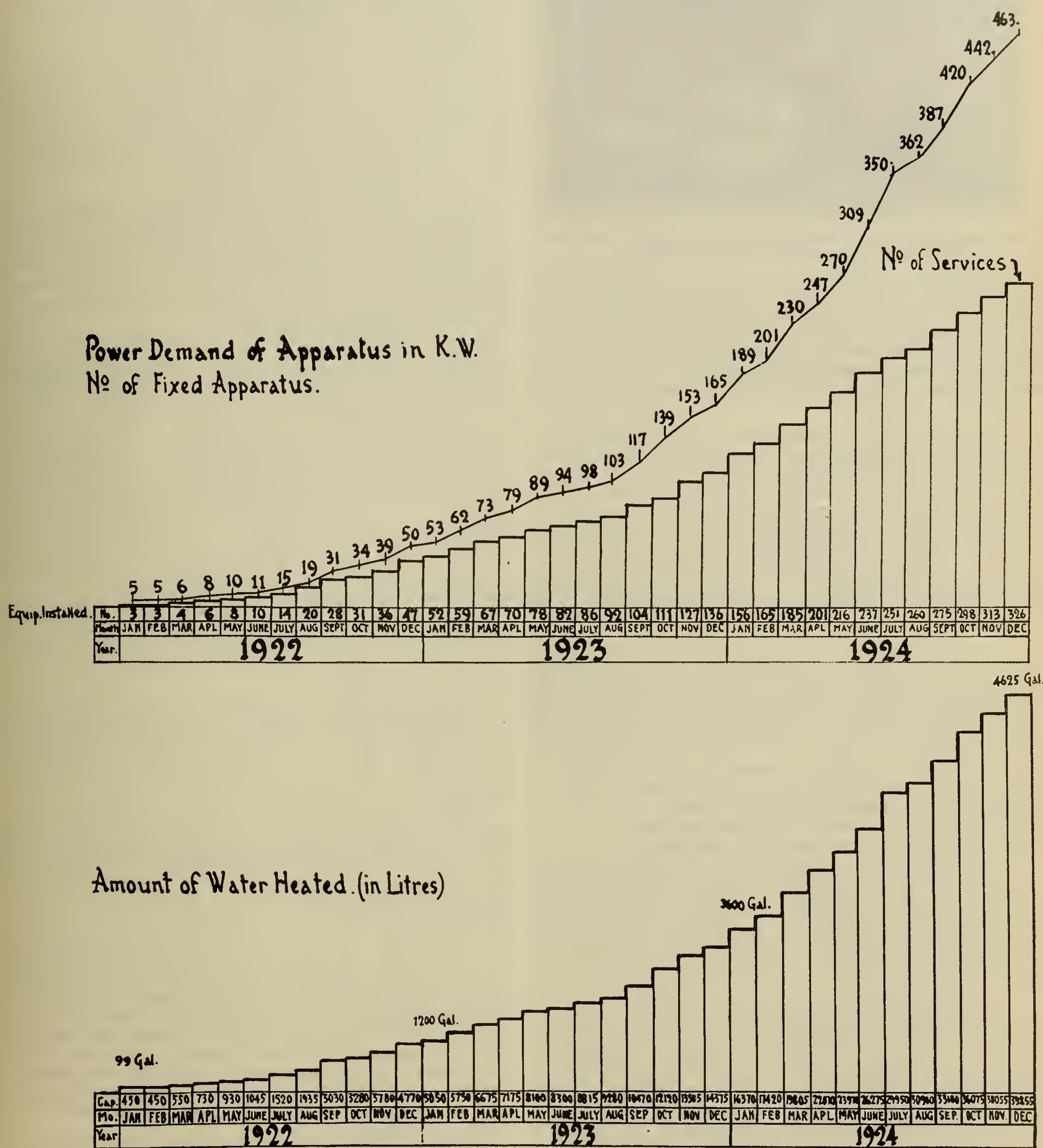

Figure No. 1.—Electricity in Strassburg—Utilization of Off-Peak Power in Hot Water Accumulators.

Figure No. 2.—General View of Plant of the Société Savoisienne de Construction Électrique Aix Les Bains.

are connected. The price is from 10 to 12 cents per unit. There is, of course, an agitation to have the rate for power in rural districts the same as it is in some of the cities. Matthews of England says consumption estimates should be based on the acreage of tillable land. He suggests 140 units per acre. He has found 200 different uses on the farm for electricity.

When combustion engineering was receiving attention, it was not difficult to get a considerable discussion regarding the merits of unit systems of steam generators as compared with the central systems. In the case of the unit system, it is necessary to grind coal at the time of peak load and this energy is often a considerable percent of the total revenue producing energy. Centralized systems for generation are therefore fundamental for low load power plants. Two papers were available on this subject and considerable attention is to be given the matter in subsequent conferences.

Tap switching of transformers under load was discussed by a number of the delegates. Some estimates and statements of costs were 7 per cent of the cost of the transformers, others were as high as 20 per cent. The Swedish engineers suggested four taps at 2½ per cent as being the most desirable. Mr. Semenza, representative from Italy, made a very fine suggestion in this connection. He recommends administrative control of load rather than the design of expensive, and otherwise superfluous, equipment to take care of voltage variations or other objectionable conditions due to low load factor.

Standardization of frequencies appears very desirable in Europe. It was mentioned that some fairly large electrical districts operate with three different frequencies with more or less overlapping, much as occurs within the municipality of London. Co-ordinations of this sort, would evidently improve conditions in all countries, and particularly in Europe.

The viewpoint of the continental engineers came out while discussing reactances, relays and other equipment which are frequently installed as safety and insurance features, and in order to have continuous service. Inferentially they admit comparatively numerous outages and frequent use of breakers. They asked the question—"Is all this extra equipment worth while?"—"Would it not be better to replace the contacts of the breakers a little more frequently and make more use of the breakers under load?"

There was plenty of evidence at the conference that insulating oils and gases for electrical equipment are still in the development stage. Catalysts were discussed extensively. A number of the manufacturers were anxious to standardize on at least two grades of oil as they felt that if this were not done some fairly large producers might be eliminated. The characteristics of the insulating oils produced in Russia were reflected in the remarks by representatives from that nation. They were anxious to establish one only high class specification and they did not agree with specifications regarding low temperature and freezing as found in many specifications. Representatives from America were asking for low viscosity especially for outdoor work. Some reference was made to the successful use of kerosene in this connection. The discussion was quite too varied to indicate that any decisions by agreement were possible.

An attempt was made by the Belgian representatives to introduce international rules for high tension overhead and underground. While there were national rules submitted which we understand in some cases have been made law, it was the consensus of opinion of a special committee that no attempt should be made just now to provide international standards.

Metal clad switch gear was brought before the meeting by Messrs. Gregory and Clothier. These papers brought out considerable discussion. Continental engineers evidently were not quite prepared to adopt such apparatus, although it was evidently quite popular in Great Britain.

The relative merits of enclosed and outdoor stations were reviewed by French representatives. The practice of using outdoor equipment in Alpine regions has not as yet passed the experimental stage. Twelve to eighteen feet of snow were considered as quite too strenuous weather conditions for outdoor electrical equipment.

From a description of the various high tension interconnected systems in France, it was evident that standard practice is to minimize the use of protective devices, and apparatus. The sky wire is generally carefully earthed. The neutral is frequently provided with a switch of about the same rating as the line switches. Scarcely any other protection is evident.

Tar and tar products appeared to predominate in the various recommendations and discussions regarding rust-proofing, although in practice galvanizing is used extensively. Some are using aluminum paint on galvanized material after they have been in contact with salt-laden atmospheres for five or six years.

There is no evidence at the present time of an agreement on suitable tests for dielectrics and especially for porcelain insulation as used on high tension lines. It is expected that there may be an agreement as regards national specifications in some of the European countries during the next year.

Similarly in the case of paper-insulated lead covered cables, there is evidence of a considerable search for a more satisfactory method of testing for the estimation of the life of the materials under load. Some of the manufacturers are submitting further evidence regarding the effect which the time element of tests has upon the value of tests for dielectrics. It would appear very advisable to test such apparatus and materials for a considerable length of time at the rated current in conductors involved, and at pressures which will be some multiple of the normal voltage

Glass insulators received some attention as they are being used extensively in France. Some think that glass will presently be generally competitive on account of comparatively low cost; however, some of the difficulties in annealing must be solved before the use becomes general.

The discussion of the effect of transients in the electrical circuits, led by Mr. Faccioli, was probably the most highly technical of the session. The effectiveness of equipment for the relief of surges and over-potentials, and analysis of the nature of these disturbances and their reproduction was reviewed. It followed rather closely the arguments which have been presented on various occasions in meetings of some of the American Institutions.

The economics of the distribution of electricity was the subject of a study and report by a representative from Holland who is using satisfactorily a rate making system which has given good service in England for some time. He finds that the rate zone for profits to companies is very limited,—that is, it is very easy to get the rates sufficiently high to reduce the consumption and thereby the profits. The Dutch Company charge rates of the order of 25 cents per unit for the first 130 hours and 5 cents thereafter. They figure their cost at the switchboard as 16 cents per unit whereas cost at the consumer's premises is 22 cents. One speaker stated that heat accumulators for domestic purposes were in use successfully and that the night rate for this class of consumption was 2 cents per kw. hour. This use of heat accumulators is probably the best example of a number of different efforts to improve very objectionable load factors in some of the electrical systems of Europe.

The Dutch representatives submitted some very interesting photographic records of electrical accidents and accident prevention methods. A set of these slides might be used very effectively in educating the staff of large electrical operating organizations.

At the final session of the conference, resolutions which had been discussed more or less tentatively up to that time, were submitted and passed as follows:—

(1) It was decided that national committees should be formed in all countries for co-operation in the development of the distribution of power at extra high tensions and allied undertakings much as has already been done in Great Britain with very satisfactory results.

(2) Instructions were issued for an enquiry and review of the production of power and the methods of utilization of various fuels throughout the world. This report was to be submitted to the Fourth Conference.

(3) It was decided that an international bureau of statistics should be organized by which it would be possible to establish in all countries uniform statistics of production, transmission and distribution of electric power in such a way as to make an analysis and comparison of the data from an economic standpoint.

(4) An effort will be made to co-operate with the International Electrotechnical Commission in establishing more satisfactory specifications and tests for insulating oils.

(5) It was decided that action upon the tests and specifications, including those for impact, on vitreous insulators should be deferred until the 1927 meetings. Similar action was decided upon in connection with specifications and proposed regulations for co-ordination of communication and power circuits when paralleling one another.

Electrical Industry in Europe

Throughout France and Italy the electrical industry appeared to be flourishing. Practically all of the plants which were manufacturing apparatus for electrical purposes were adding floor space. In many cases they were actually doubling manufacturing facilities. Electrical loads by districts were increasing at the rate of 15 per cent or more per annum. The development appears to be largely for the requirements of the French internal trade.

The factory of the Société Savoisienne de Constructions Electriques of Aix Les Bains under the management of Mr. Odier is an example of this development. This factory was opened January 1st, 1925, and is still being developed and extended. It is associated with the French electrical manufacturing group and produces transformers almost exclusively. Apparently this comparatively mountainous district was chosen for the plant in order to secure the best labor conditions possible in the republic.

The policy of taking over trunk lines and interconnected systems of railways by the state and of electrifying these, appears to be the outstanding economic development at the present time in Europe.

This policy is only getting established and confirmed in France, whereas in Italy, Switzerland and Sweden, very great expenditures are being made at the present time in electrifying railways systematically. In general a. c. motive power is being used. Mercury arc rectifiers are being installed on the Midi and some other privately owned railways in France. All of these countries excepting France have, of course, practically no coal and have considerable hydro-electric energy still available for transportation purposes.

Development of this sort has apparently been deferred in Germany on account of the war and latterly because the railways are evidently being used extensively to produce revenue for reparations purposes.

In Germany, they have under way extensive revisions of important pin type transmission lines, evidently operating at about 60 kv. This revision usually involves changing over the type of construction to suspension insulators so as to increase the operating voltage. In a number of cases new and larger conductors are being installed.

Concrete poles, as in France and Italy, are very much in evidence throughout Germany, and to some extent in Sweden where they have been used largely in the construction of a tie line designed to operate ultimately at 220 kv. This particular line is operating at 130 kv. at the present time.

The development of propeller type and Kaplan water wheels is receiving much attention in Czecho-Slovakia, Switzerland and especially in Sweden. This comparatively recent development will have avery considerable effect upon the efficiency and flexibility of low head plants. Some engineers venture the opinion that this type may be used in units as large as 30,000 horse power or more for heads up to 30 feet. The largest units projected at the present time are 10,000 horse power. An inspection was made of the progress of this work which will be put in operation in 1926, at the Lilla Edet plant of the Board of Water-Falls, Sweden.

A remarkable development in mechanical engineering which is affecting business conditions in Sweden, Great Britain and Italy, among other countries, is the Diesel engine. Some one million horse power for marine purposes is under contract at the present time with one company and its licensees. This type of primary producer is used somewhat in the electrical field and may at any time, as first cost is reduced, become an active competitor in the production of power for industrial purposes, as it has already in marine and land transportation.

The Fuel Problem in Canada

Lesslie R. Thomson, M.E.I.C.,
Consulting Engineer, Montreal.

Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 29th, 1926.

The Problem

The essence of the fuel problem in Canada can be stated in a few words and figures as follows:

	1922	1923	1924
Total consumption of coals in Canada in millions of tons........................	26	36	29.5
Total Canadian coal consumed in millions of tons..............................	12.5	15	12.5*
Differences supplied by importation from United States and Great Britain in millions of tons......................	13.5	21	17.0

The extraordinary fact in connection with these figures is that Canada, importing these tremendous quantities of coal, possesses the second largest coal reserves of any country in the world, as shown by the following table:

Coal reserves Reserves in millions of short tons (2,000 lbs.)				Special analysis of Canadian reserves			
Class	Canada	United States	Whole world		East	West	Total
Class "A" Anthracite or allied coals...	2,380	21,692	547,524	Actual		745	
				Probable		1,635	
				Total		2,380	2,380
Classes "B and C" Bituminous coals..........	312,593	2,154,984	4,201,044	Actual	2,411	29,723	
				Probable	8,466	271,993	
				Total	10,877	301,716	312,593
Class "D" Sub-bituminous coal and lignite.	1,043,192	2,053,524	3,303,535	Actual		422,234	
				Probable	28	620,930	-
				Total	28	1,043,164	1,043,192
Grand total..	1,358,165	4,230,200	8,052,103				1,358,165

United States possesses 52 per cent of world reserves
Canada " 16 per cent of world reserves
Of Canada's resources 77 per cent are in form of sub-bituminous and lignite coals Class "D"

NOTE:—These figures are taken from *Coal Reserves of World*, by McInnes, Dowling and Leach.

The amount of money involved when purchasing this coal may be taken roughly to be at least ninety millions of dollars annually. This money can be looked upon to some extent as being lost to Canadian industry.

While the problem can be stated thus very briefly, the solution is not by any means so easy to enunciate; and it is an open question whether any solution that is satisfactory to all parts of Canada can be reached immediately.

The Solution of the Problem

The solution of the fuel problem of Canada involves the consideration of a number of interdependent factors, and due weight must be given to each of these. The factors involved are geographical distribution of coal consuming communities and coal producing areas; transportation; basic relation of increased markets for Canadian coal on its selling price per ton; cost of production in various coal areas; proximity of United States coal areas; and other similar factors.

*Strikes occurred during this year.

There are two main questions that must be discussed before any permanent solution can be proposed:

1st. The actual situation in Canada in regard to location of coal, centre of gravity of consumption, size of markets in fixing selling price, magnitude of imports and consumption, and other similar factors.

2nd. Certain economic aspects of Canadian mining, in relation to mining elsewhere.

The writer proposes to discuss these two matters in sequence.

Actual Situation in Canada

The knowledge of the actual fuel situation in Canada need not be to-day in any state of ambiguity. The work of the Dominion Fuel Board since its inception has been of very great value in calling the attention of the Canadian public to the salient features of the Canadian fuel problem. Their reports are available to the public.

The subject has been further explored by a large Committee of *The Engineering Institute of Canada*, appointed in April, 1923, and presenting a final report in September, 1924. As the writer proposes to base the first portion of his paper upon the findings of that Committee, it seems desirable to record some facts concerning it. The membership was represented as follows:

From the Western region..	4
From the Central region (acute fuel area............................	18
From the Eastern region..	3
	25

All these were members of *The Engineering Institute of Canada*. All were more or less directly connected with the study, use, or application of fuel. None had any particular connection that would prejudice a consideration of the problem from the point of view of Canada as a whole. The result of their deliberations was in the main unanimous except on one or two slight points, and these were not serious enough to warrant a minority finding. Hence the considered opinion of such a Committee, reached without haste and without undue delay, would seem to warrant a further publication, at least as a basis for consideration and discussion of those new facts brought to light during the fifteen months that have elapsed since the report was prepared.

The reasonableness and accuracy of the findings and recommendations of that Committee are emphasized further by the fact that to the best of the writer's knowledge only one public exception was taken to the findings — that by the North Alberta branch of the C.I.M.M.

As a basis, then, for renewed discussion, the subject of fuel for Canada can be divided into the following heads:

I) Sources of fuel for Canada:
(a) Eastern Region (b) Western Region (c) Central Region.
II) Substitutes for American anthracite.
III) Possibility of utlization of Alberta coals in Ontario, and general Alberta situation.
IV) Miscellaneous matters.

These divisions will serve as guides for the orderly presentation of the whole discussion, and the writer next submits the digest of findings and recommendations of the Fuel Committee of the E.I.C. as presented in September, 1924.

Digest of Findings and Recommendations of the E. I. C. Fuel Committee

Sources of Fuel for Canada

(*a*) *Findings.*

1. That for the purpose of a discussion of fuel problems, Canada may be divided into three regions: the boundaries of which cannot be regarded as rigidly determined.
   - (i) Western: From British Columbia coast to Winnipeg.
   - (ii) Central: Ontario and approximately as far east as Montreal.
   - (iii) Eastern: Montreal to Atlantic coast.
2. That it is reasonable to expect that the Eastern and Western regions of Canada can be made generally self-supporting in the matter of coal for household and power purposes.
3. That the Central region must be dependent chiefly upon the importation of American coals, except insofar as Canadian coals can penetrate into competitive areas in the extreme east and west of the region.
4. That it is unreasonable and uneconomic to expect Alberta coals to compete in the Central region with American coals under present conditions.
5. That the apparent economic substitutes for American anthracite are: metallurgical coke, British anthracite and, to a lesser degree, briquettes.
6. That the work of the Dominion Fuel Board is of the very greatest benefit to Canada and that it should be encouraged in every way.

(*b*) *Recommendations.*

The committee recommended:

1. That the governments, federal or provincial, institute an inquiry into the real cost of moving coal.
2. That each province consider the advisability of establishing, with the authority of provincial legislation, standards of quality and regulations governing delivery of coal.
3. That a national fuel policy be only embarked upon after recommendations are received from the Dominion Fuel Board.
4. That Alberta operators concentrate their efforts on the production of high grade bituminous coals for power purposes in Western Canada and the United States rather than on any non-economic efforts to ship their low grade coals to Ontario.

Discussion of Findings

The writer proposes to discuss these recommendations and findings in sequence, with a view of pointing out what changes have occurred during the last 15 months.

In the opinion of many, the ideal solution of the fuel problem of Canada will be reached only when Canada is self-supporting from the point of view of supply of coal for household and power requirements. This solution is a counsel of perfection, as no country in the world has ever reached such a position, with the possible exception of the United States. In other words, except in time of war, that coal will reach the consumer which in the long run is most economic. The writer feels therefore that this ideal solution does not lie within the realm of the practicable.

The division of Canada into three fuel areas seems to be reasonable. It must be emphasized that the boundaries where these regions meet are not and cannot be sharply defined. They vary, too, from season to season.

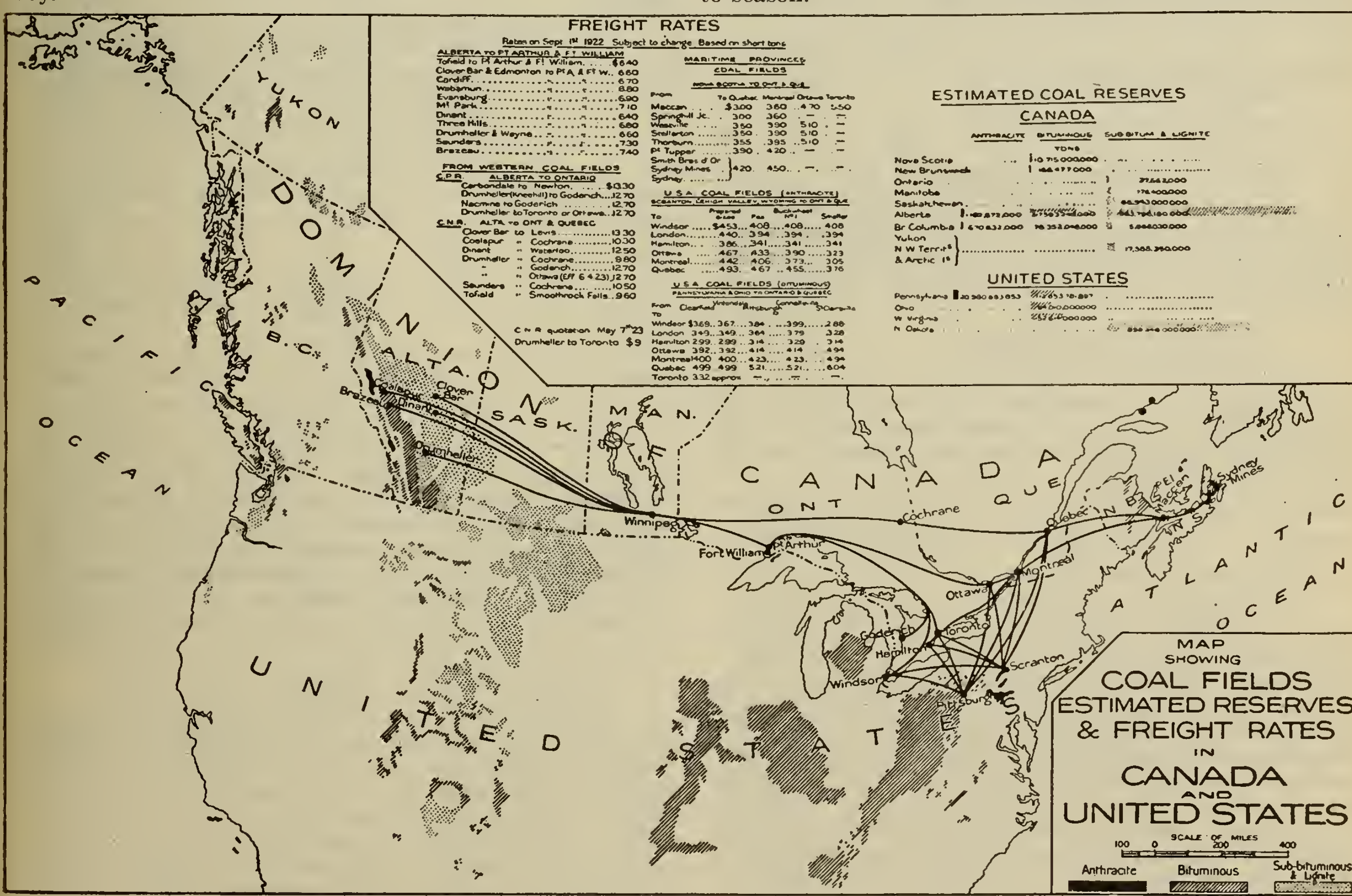

Figure No. 1.—Coal Fields, Estimated Reserves and Freight Rates in Canada and United States.

Coming next to a consideration of the sources of fuel for Canada, reference must be made to the fuel map appearing herewith. Figure 1.[⊕] A careful study of this map will give the reader a clear grasp of certain of the essential features of the Canadian fuel problem.

Eastern and Western Regions

All coal requirements of the Eastern region, both for domestic and power purposes, can be supplied on an economic basis from the Nova Scotia and New Brunswick fields. No foreign importations are essential for the complete and successful solution of the fuel problem of this region, even under present conditions.

Similarly coal for household purposes in the western region can be supplied economically from purely Canadian sources. The fields of Saskatchewan, Alberta and British Columbia can meet all foreign competition with untreated coal; and there is the further possibility of carbonized lignite briquettes supplying a portion of the demand. In a broad way it may be stated also that the power requirements of the Western region can be met from Canadian sources. This statement is subject to some correction in the case of Winnipeg, where American bituminous coals are being used to a certain extent. The threat of Alberta competition, however, has had the effect of keeping down the price in Winnipeg of American steam coals. These steam coals reach Winnipeg by a short rail haul from the head of the Lakes. In many cases the selling prices are so low that it is felt that this trade is purely a "dumping" one. In the meantime the Winnipeg consumer is getting the benefit. The magnitude of this trade can be gauged as follows:

	1922	1923	1924
Importation of Bituminous coal from U. S. into Manitoba in thousands of short tons	75	112	143
Total consumption of bituminous and lignite coals in Manitoba	760	890	878

Acute Fuel Area

The central region, or the "acute fuel area", is the crux of the real fuel problem. Here is the great coal consuming area, and here is the one large area of Canada where no coal is found. The problem falls into two divisions:

(a) household requirements;

(b) power requirements.

The magnitude of the difficulty can be judged by the following figures, giving the annual importation of coal into the acute fuel area of Canada, averaged over the 5-year period 1920-1924:

Anthracite...... 4,144,000 short tons—mainly for household purposes

Bituminous......14,030,000 short tons—mainly for power purposes

Total imported 18,174,000 short tons.

The household requirements of this area are not small. The great majority of the consumers are accustomed to and, in the main, still demand a luxury fuel — anthracite. As there is no anthracite available in Canada, the raw fuel to satisfy the demand must be imported either from the United States or Great Britain. *The Engineering Institute* Committee found that "acceptable untreated coal for household purposes in the acute fuel area cannot be supplied economically from Canadian sources under present conditions". In this opinion the writer still concurs. When considering power requirements the central region can hardly be considered as a single area, owing to the fact that its eastern portion (Montreal) has direct water access to the seaboard mines of Nova Scotia. Hence the Montreal district can be looked upon as being a fair market for Nova Scotia coals for power purposes, — largely due to the fact that under large contracts the Nova Scotia operators can lay down their coal f.o.b. dock Montreal at such small transportation charges. This has been due to thorough organization of shipping routes and first class unloading facilities in Montreal. When attention is turned, however, to the general manufacturing region of Ontario, it is practically impossible for the Canadian coal to compete, say, at Toronto with the American bituminous coals. The reasons for this will be touched upon in the second portion of this paper.

[⊕]Permission to use this map has been given courteously by the Dominion Fuel Board, Ottawa; 1925.

In 1924, the E.I.C. Committee found that "For power purposes in all but the Eastern section of the acute fuel area, it is quite hopeless to expect Canadian coals to compete with American coals." Since then the only marked change in the situation is the imposition of a Canadian duty of 50 cents a ton on bituminous slack, and the Canadian Government subvention on Nova Scotia coals of 1/8 cent per ton mile for points beyond Montreal. This duty makes the Canadian duty on all American bituminous coals uniform. The American coal roads are either meeting or will meet this duty by a shifting of freight rate on fine sizes.

The following table gives a quick grasp of the broad features of the situation. The figures are only general and are submitted more for comparison than any other purpose.

Approximate Cost of Coal in Toronto.

	Cost at pit head of R. of M. per net ton	Freight to Toronto per net ton	Duty net ton	Degradation and handling charges say	F.O.B. Toronto net ton
	$	$	$	$	$
American Bit.-Penn. or W.V.	2.25	3.50	.50	1.00	7.25
Nova Scotia	4.75	2.00 about (all water plus transfer Montreal)		1.00	7.75
Alberta	4.00	6.00 (experimental rate actually below cost)		1.00	11.00

A glance at the figures supplies the reason why Canadian coals can *not* compete at Toronto under present conditions. Quality for quality they cost more. If conditions, such as national sentiment, as reflected in tariffs or bonuses alter materially, a corresponding change may take place in marketing conditions. It is fair to point out also that in the foregoing table a very low freight rate has been assumed between Nova Scotia and Toronto.

Substitutes for American Anthracites

As above noted, Canada has been importing annually into the acute fuel area about 4¼ millions of tons of American anthracite. One of the major fuel problems before the country to-day is to discover if there are any feasible and economic substitutes. The necessity for such a search lies in the increasing cost of American anthracite, a lowering of its quality, the small quantity now left in the mines, and the not improbable imposition by the American Government of an embargo upon its exportation. The following are the possible alternatives:

(i) The development in the use for household purposes of metallurgical coke.
(ii) Importation of increasing quantities of Welsh and Scotch anthracites.
(iii) Possible development of briquetting industry using imported British or American anthracite fines as raw material.

The first two mentioned substitutes for American anthracite are extremely important while the latter is not quite so hopeful. But the increased use of any substitute, especially any increase in the use of coke and British anthracite, decreases our dependence on a single source of supply of a necessary commodity. In the past we have been almost at the mercy of the American anthracite operators. Be they as considerate as possible, this complete dependence is not wise.

The coke figures are interesting. In 1924 about 325,000 tons of coke were consumed for domestic purposes in the acute fuel area. For the first 9 months of 1925, over 300,000 tons have been sold for domestic use, and indications are not wanting that in the year 1925 about half a million tons of coke will be consumed. This indicates a healthy and, it is to be hoped, a permanent growth in the use of this substitute. As in other cases, the consumer must be educated in the methods of firing and burning coke, which are very different from corresponding methods for anthracite. The advantages of the coke over bituminous coal are obvious. It is a clean, smokeless fuel, provides a steady heat, and under proper draft control can be burned at higher efficiencies than coal. For domestic heating, metallurgical coke (by-product) is a better fuel than gas-house coke. This superiority is not so evident in the analyses as it is in the handling and burning qualities. The metallurgical coke is more solid, less brittle and less friable than gas-house coke, and is altogether a superior class of fuel. Plants are now in operation at Sydney and Hamilton.

Another important substitute is British anthracite. Welsh and Scotch anthracites have made impressive inroads on the former American monopoly. The figures are:

	1922	1923	1924	1925
Imports of British anthracites in short tons..	180,000	262,000	273,000	499,000 (11 months)

These British coals have penetrated into Nova Scotia, New Brunswick, Prince Edward Island, Quebec and Ontario, though about 75 per cent of the amount imported is consumed in the district of Montreal. It is quite probable that the captured part of this market has been lost to the American anthracite operators, though even this part of an attractive market will not be relinquished without a hard struggle. Price adjustments and grading qualifications will be made undoubtedly by the American operators to meet the British competition. But the low ash content and fine burning qualities of the British fuel are gaining and retaining many former markets.

Possibility of Alberta Shipments to Ontario

The effort to ship Alberta coals to Ontario under present conditions seems to be more of a political rallying cry than a serious economic proposal. The figures published by the E.I.C. fuel committee showed that such shipments were not feasible on purely business grounds, and the writer has not observed any serious criticism of the accuracy of the figures submitted. A brief digest of the fundamental economic difficulties will not be out of place: Alberta mining costs are high, due to the lack of co-operation among Alberta operators, the very short mining season in certain of the mines, high wages of the operatives, the mining difficulties encountered and the general over-development of the mining industry. The result of these conditions is obvious when coal costs at pitmouth in Alberta from $4.00 upwards, while coal at least as good in the American bituminous area costs from $1.90 upwards. Of course it can be pointed out with justice that the American prices are low at the present time due to a variety of causes which will be touched upon later.

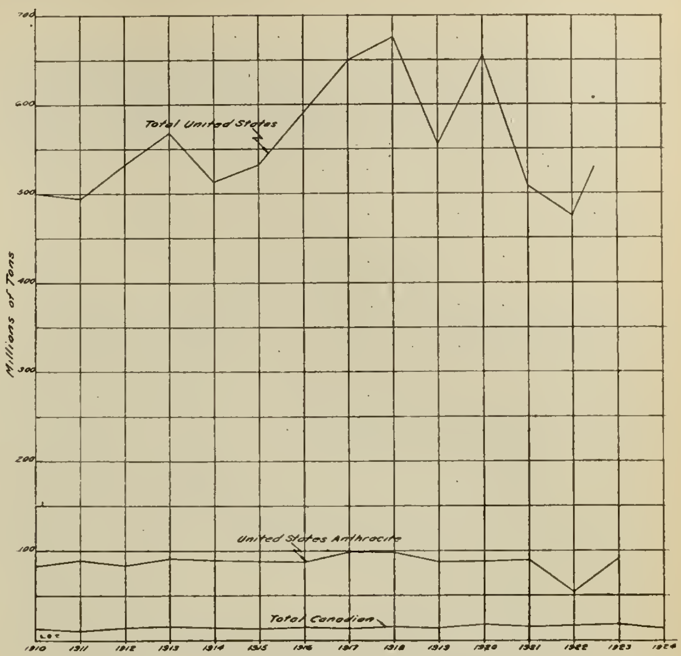

Figure No. 2.—Coal Production — North America.

Transportation is another stumbling block to this traffic. The basic fact is that first quality American coals can be put into Toronto with a haulage of only a few hundred miles as against eighteen hundred miles from A berta. Here geography is fighting against Alberta sales in Ontario. Even if the freight rate were produced to $6.00 — admittedly below cost — the coals can not compete on an economic basis as the following table will show:

	Cost at mine per net ton	Freight	Duty	Degredation and handling	Total per ton Toronto
	$	$	$	$	$
American low volatile bituminous coals. $2.25 to $4. take higher figure	4.00	4.00 (purposely high)	.50	1.00	9.50
Alberta coals $3.75 to $5.75: take low value.	3.75	6.00 (experimental rate —) below cost		1.00	10.75

In the foregoing table every possible advantage has been given to Alberta coals, yet they cannot compete in Toronto with American coals that, even at the worst, are quite as good as Alberta coals. The writer has often seen figures comparing the selling price in Ontario of Alberta and American anthracite coal — to the advantage of the former. But it is *not* with American anthracite that Alberta coals would have to compete ultimately. It is with the low volatile American bituminous coals. Nothing is gained in the long run by not

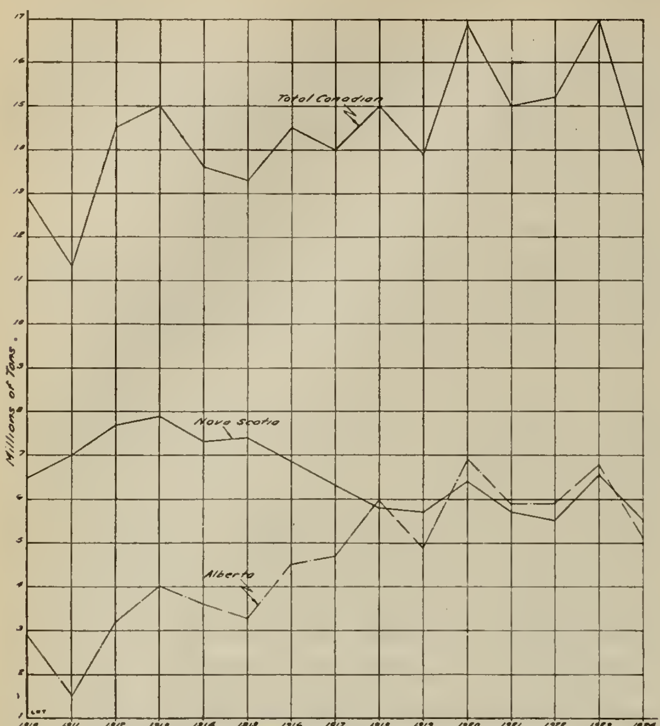

Figure No. 3.—Canadian Coal Production.

facing these facts fairly. If for national reasons the Dominion decides to become self-supporting so far as coal is concerned, then such a position can only be reached by tariff or bonuses in favour of the Canadian operators (Alberta and/or Nova Scotia), with, however, the necessary corollary that manufacturing costs in Canada would be increased.

Miscellaneous Matters

A solution of the fuel problem in the acute fuel area will be advanced by a co-ordinated policy of water power and fuel power development. As the use of water power increases coal will be released for heating purposes. In the congested centres also, central heating and steam plants will be conducive to more efficient utilization of coal both for power and heat.

For off-season heating, peat offers a desirable substitute for imported coal, and the writer wishes to record a word of appreciation of the work accomplished at Alfred by the Peat Committee financed by the Federal and Ontario governments. This is now being put upon a commercial footing, through the efforts of E. V. Moore.

As the use of oil for fuel in the industrial plants is very small relatively, the writer does not include oil in this discussion. There are certain cases, however, where special load factors or other local conditions justify the use of oil. One difficulty is that no firm price can be obtained for future deliveries of oil in quantity.

The use of oil as a household fuel is often very advantageous, especially when the owner is willing to pay a little more in operating costs and fixed charges for the cleanliness and convenience of oil firing.

Another subsidiary factor in the domestic field is the development of special grates with or without small blowers to enable the householder to burn small sizes of anthracite. The growth of these installations will result in an improvement in general fuel economy.

The foregoing constitutes a brief resumé of the fuel problem as it exists in Canada to-day. A successful solution from Canada's point of view is somewhat obscure. A few general observations must be considered however:

Is it reasonable to expect a Canadian consumer to pay more for a Canadian coal than he would for an American coal of equal quality, or to pay an equal amount per ton for a lower grade of Canadian coal? The result of such action is to increase immediately manufacturing costs, and ultimately selling price. The writer has never observed any tendency among the Canadian manufacturers to accept any such limitation, and believes that it is not wise to confuse patriotism with bad economics. Therefore, the general doctrine may be laid down that the coal that should be consumed in any given area is the coal that under normal operation of economic forces will reach there at lowest cost per ton grade for grade. This may be laid down as an economic axiom.

There has been some talk also of forcing the railways to move coal for less than cost on the grounds of an "all-Canadian policy". This paper is not the proper forum at which to discuss such a view, but the writer believes that it is unsound and pernicious from the points of view both of patriotism and economics.

What, then, can be done to solve this problem? Coal at the ends of our country — coal needed in the middle, while vast quantities of American coal are in close proximity to our centre of gravity of consumption.

Immediate Steps

The writer ventures to suggest that the following steps be taken:

That the federal government set on foot an enquiry into the actual cost of moving coal in train load lots and in steamer lots in order to place this matter beyond the realm of half-informed controversy. This duty might be discharged with propriety by the Railway Commission of Canada, but that its findings be not made public without including in the final figure proper allowance for overhead, depreciation and profit. Any other course of action might seriously prejudice the whole question of a long haulage movement of coal.

For example, the real cost of moving coal by water from Montreal to Toronto should be examined. In many cases the 14-foot draught vessels coming down to Montreal with grain return absolutely empty to Lake Ontario. A ballast cargo of coal to Toronto might be shipped very economically. The purpose of this suggestion is to get at the facts of the case in order that the

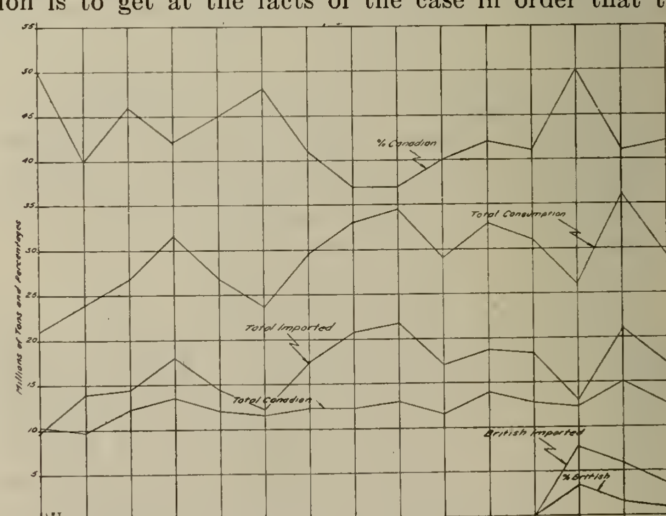

Figure No. 4.—Annual Consumption of Coal in Canada.

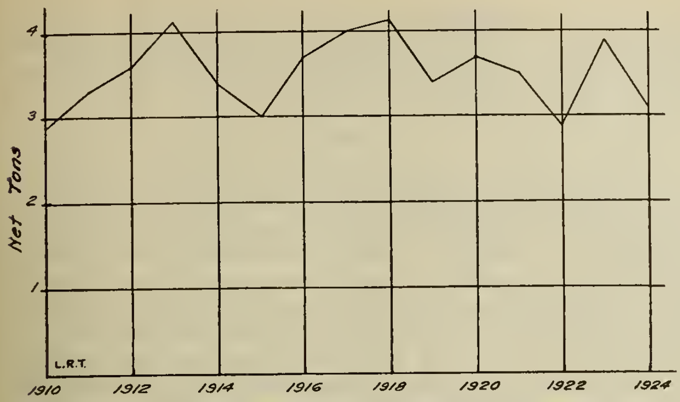

Figure No. 5.—Canadian Consumption per Capita per Year.

government may be able to assess accurately the amount of assistance required to place Alberta and Nova Scotia coals into Ontario on a competitive basis.

The writer now submits verbatim certain of the remaining detailed recommendations of the E.I.C. Committee. In these recommendations he concurs:

"Your committee recommends to Council that the federal government be urged to take appropriate action in order that each of the provinces concerned should adopt after discussion standards of quality and regulations governing delivery of coals. Until this is done, the public in their purchasing of coal will not be protected in any way.

"Your committee recommends that the Council place on record with the federal government its appreciation of the valuable work at present being undertaken by the Dominion Fuel Board, that the government be urged to prosecute this work vigourously and, further, that any so-called national fuel policy should only be adopted after receiving recommendations and reports by the Dominion Fuel Board.

"Your committee recommends that Council go on record as opposing any tendency to force the railways to haul commodities at less than cost except in times of national peril; and further recommends that, if for national reasons it be desirable to have Ontario become a market for Alberta coals, the Council urge upon the federal government the wisdom of bringing about such a result by subsidies or tariffs, rather than by imposing non-economic operation on the transportation systems.

"Your committee recommends that the Alberta operators be urged to concentrate their efforts on the production of the high grade coals for supply to the Western region rather than on the shipment of their low grade coals to Ontario."

Summary

The problems of the Eastern and Western regions are in a fair way to be solved successfully. The central region fuel problem is being attacked. One can see now the extension of the use of coke and British anthracites. This relieves a portion of our market from absolute dependence on one single source of supply. If the steps be taken as recommended, then will the information and facts be available on which a same and economic solution of the problem can be based. What is wanted are facts — not boosting speeches about "our glorious and illimitable coal deposits". Then and then only will a truly national fuel policy be possible.

Certain Economic Aspects of Canadian Mining

The mere possession of large coal mines and mining areas, even if of first quality, does not imply necessarily that it is economic to mine them. The questions of mining economics and mining costs are intimately bound up with the questions of geographical location, shipping costs, marketing costs, and foreign competition. Any attempt to solve the mining or fuel problem without giving due weight to these features is certain to prove abortive. Therefore time spent in studying the Canadian mining problem from a detached point of view will prove not unprofitable.

The writer proposes to divide this elementary introduction to the subject into the following heads:—

I Scale of coal industry in North America — See figures Nos. 2 and 3.

II Canadian consumption — See figures Nos. 4 and 5.

III Costs of a comparative character — See figure No. 6.

IV Comparative efficiency — See figures Nos. 7, 8 and 9.

V Transportation problem.

VI Summary.

Scale of Industry

Figure No. 2 shows graphically the magnitude of the coal industry of the North American continent. It will be noted that the scale of the United States production of coal is five hundred to six hundred millions of tons. The Canadian production is of the scale of fifteen millions, while Nova Scotia and Alberta are each producing in the neighbourhood of five millions of tons. It is interesting to note also the convergence of the lines of the Nova Scotia and Alberta productions. (See figure No. 3). From this it can be seen that, as an economic factor on this continent, Canada produces but 3 per cent of the total coal used, and Nova Scotia and Alberta each less than 1 per cent. At this point it should be noted that Nova Scotia is capable of producing another two million tons per annum without any further capital expenditure of magnitude. Alberta is also able to produce much greater tonnage if markets could be secured.

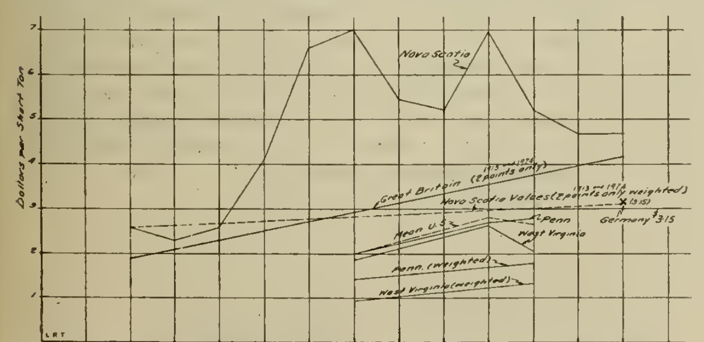

Figure No. 6.—Selling Price of Coal per Net Ton for Run of Mine of Pithead.

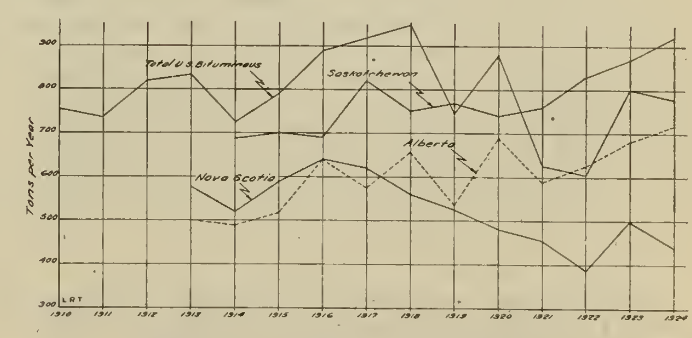

Figure No. 7.—Output per Man per Year.

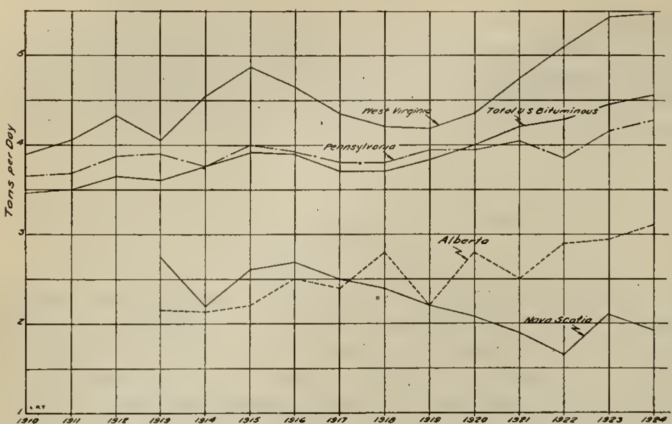

Figure No. 8.—Output per Man per Day.

It can be stated that in a broad way, values of coal quality for quality in North America are established by the United States conditions and not by the Canadian mines. It is impossible for the tail to wag the dog. Therefore one should accept with considerable caution the oft repeated statement that the threat of the penetration into Ontario of Nova Scotia coals has the effect of reducing the selling price in Ontario of American coal. While it is possible that the American operators would regard Ontario shipments* as dumping shipments, and thus reduce their Ontario selling cost to capture some or all of the market, it does not seem probable that, in the absence of competition, the price in Ontario of American coals could ever be artificially boosted, in view of the large number of independent and competing American operators. The difference between this situation and the presence of American coals in Winnipeg is very interesting. In Winnipeg the total of American shipments is small enough to be controlled and "dumped" whenever desired. Also it is only 10 per cent to 15 per cent of the Canadian coal supplied. Of course, it may be emphasized again that within political boundaries the price of coal or any other commodity can always be determined artificially by tariffs.

Consumption

The total annual consumption of coal in Canada is running pretty steadily since 1913 in the neighbourhood of thirty millions. (See figure No. 4.) The per capita consumption may be taken to be 3½ tons, which figure has also been maintained very steadily. (See figure No. 5.) Reverting now to the total consumption, it can be noted that the curve (see figure No. 4) of imports is *always* above the curve of Canadian coal consumed, showing that since 1910 Canada has always imported more coal for consumption than she has produced from her own mines. This idea is expressed in percentages at the top of the chart. To state it in another way, Canadian production has never exceeded 50 per cent of Canadian requirements. Practically all the imported coal is from the United States — the only other source of import being Great Britain. The curve of Britain coal imports from 1921 is shown and the percentage of this British coal to total consumption is also shown. The figure in 1922 was 3 per cent, while in 1924 only about one per cent of our consumption was supplied by Great Britain. This figure of one per cent will be slightly larger in 1925, due to the increased use of British anthracite. If the consumption of British anthracite in Canada be expressed relative to our anthracite requirements, the figure will run a little over 10 per cent this year.

Costs

The writer is well aware that cost figures may be very misleading, and the cost curves shown in this paper are not submitted with any feeling of absolute accuracy or finality. They are taken from official sources and compiled as nearly as may be to illustrate relative conditions. The writer emphasizes therefore that it is the inclination of the various lines to the horizontal that is of interest. The vertical position of the lines is of less importance than their relative positions and respective tangents. The costs per ton are in each case the selling price of run-of-mine coal f.o.b. pit head per short ton, unless noted otherwise. The general inclination of the average United States line is upwards between 1918 and 1921, but from then to 1923 it is downwards or horizontal. Especially interesting is the remarkable drop in the West Virginia field, which is one of the principal bituminous fields which compete with Canadian coals in the acute fuel area. Coming now to Nova Scotia coals, the curve of prices (see figure No. 6) is one made by the Montreal selling prices run-of-mine adjusted for freight, Nova Scotia fields to Montreal by water. Whereas in 1913 the cost was $2.60, the cost in 1924 was $4.70. It is a very interesting fact to notice that the average curve of British prices f.o.b. mines Great Britain (2 points only spotted)* has practically the same tangent as the line joining the 1913-1924 Nova Scotia prices. It will be observed that the average tendency then of British mines and Nova Scotia mines is steadily upwards in scale of dollars. Both Nova Scotian operators⊕ and British operators feel that this condition is a temporary one only, and that with better labour conditions, extended markets, and other special difficulties removed prices will again turn downwards. Against this opinion Great Britain and Nova Scotia each have nearly all their coal in deep mines, and often thin seams. The logical result is more expensive mining as time goes on. A reasoned opinion on this point is very difficult to submit owing to the difficulty of obtaining the confidential information necessary to form a judgment. If one were to assume that the wholesale commodity index of the United States Bureau of Labour is a fair guide on coal values, it is possible to form an estimate of the intrinsic value of these various prices already quoted, namely: $2.60 for 1913 and $4.70 for 1924. The curve of these corrected values is plotted on figure No. 6, and it will be seen that coal in 1925 is valued a little higher than it was in 1913. The United States selling prices per ton decreased in dollars but in terms of commodity value they have risen somewhat. These value curves are all marked "weighted". As another indication of the world marketing price, the German figure for corresponding grades of bituminous coal at pit head is equal to $3.15 per short ton. This is based on the gold mark. The order of selling prices to-day is: — United States, Germany, Great Britain, Nova Scotia.

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*Ontario shipments from United States are about 3 per cent of the total United States production — and about 6 per cent of the production of the Pennsylvania, Virginia and Ohio fields.

*Average costs Great Britain — 1913 — 8/10
1924 — 19/1½

⊕It is only fair to note that the Nova Scotia price has receded since 1922.

Comparative Efficiency

The efficiencies of mining and of management are reflected to some extent in the costs already touched upon. The writer also desires to examine the apparent efficiency from the points of view of output per man per year, and output per man per day. The presence of too many men in the mines, too few working days in the year, ca'canny, or other disadvantageous principles, soon makes its appearance in statistics of this character.

The examination of the output per man per year of Great Britain and the United States show that in 1886 the two countries were not far apart. (See figure No. 9.) By 1910 the output per man per year in the United States fields was about 600 long tons, while the corresponding figure in Great Britain had fallen to 270 long tons. This remarkable increase in United States figures was due to the introduction of mining machinery, good thick seams, easy and workable mines, and other favourable factors. The British have deep mines, often bad seams, increasing number of men necessary for ventilating and handling, and other difficulties. Coming now to the years 1910 to 1924 there has been a drop in the United States bituminous output per man per year, but it is still very far above the British and Canadian figures. (See figure No. 7.) This drop has been due to changing labour conditions, shorter hours, etc. It is to be noted also that the Saskatchewan and Alberta figures were on a slight upgrade until 1921, when, due to rapid extension of Western Canadian markets, the output per man per year moved up comparatively quickly. During these years the condition of the Nova Scotia industry is of interest. From 1916 to 1922 there was a steady decline in Nova Scotia of output per man per year and the mean of the whole curve shows a falling tangent.

An even more illuminating condition is supplied by the figures for output per man per day. Figure No. 8 shows the coal produced per man per day. Here again there is a steady increase in West Virginia, Pennsylvania, and the total United States bituminous fields. Each of these tangents is positive. There is a steady increase also in Saskatchewan and Alberta. But the ominous fact appears that there is a steady fall in the output per man per day of the Nova Scotian fields. It is only fair to point out, however, that in 1924 Nova Scotia showed a big increase over 1923, and that the Nova Scotia operators have had difficult problems to face in connection with disorganized conditions, labour troubles, etc. As already observed it is not just to single out any one year, but the general tendencies of these lines are of real importance, and illustrate fundamental economic trends in the industry. It will be noted that the Nova Scotia and Alberta figures on output per man per day are much lower than any of the American fields — and this difference is not sporadic but is consistent. It is open to doubt if they are as far apart in fact as they appear. Some difference in assumption of the divisor may account for this. But in any event, the writer emphasizes the inclination of the lines — not their vertical position.

Transportation

The cost of transportation of coal to Ontario from Alberta or Nova Scotia is one of the real fundamentals of the Canadian problem. It is obvious that with reduced costs of haulage Alberta coals can move farther to the east and Nova Scotia coals can penetrate further westwards into Ontario. An analysis of transportation costs is obviously outside the scope of this paper, but certain points may be raised.

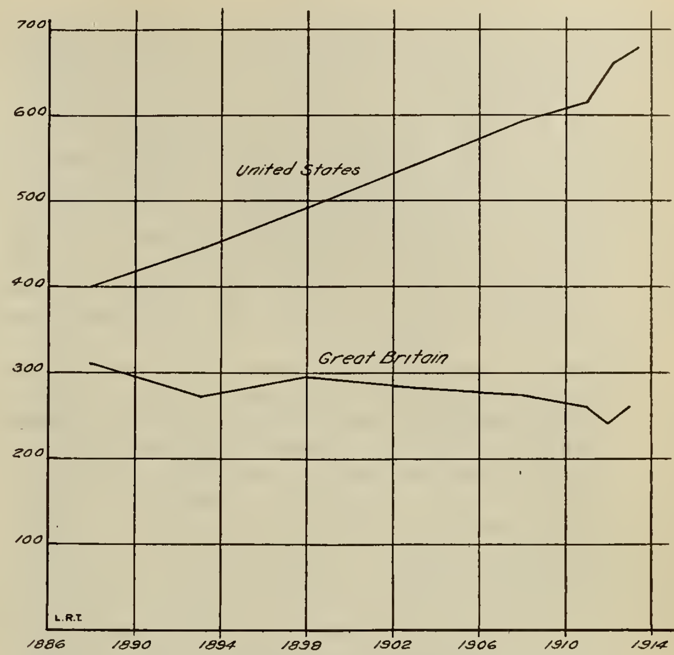

Figure No. 9.—Output per Year per Man in Long Tons.

The Canadian freight rate structure is at once delicate and intricate. In the main the freight rates are purely empirical, and no pleasing generalities, such as comparative rates per mile on various commodities, are able to solve the problem. On the other hand, the Railway Commission has in hand at the present time a complete investigation and revision of Canadian freight rates. Representations to them of glaring abuses or of commercial discrimination will be received most carefully, and will have great weight in clarifying the whole matter. A single example of one of the minor difficulties that Nova Scotia coal meets in order to penetrate into the eastern portion of the acute fuel area is the fact (touched on before) that the 14-foot grain carriers moving westbound Montreal to Port Colborne (passing Toronto) are practically always empty of heavy freight. The coal rate westbound quoted under the present lake freight structure makes it impossible for the Nova Scotia operators to compete in Toronto with American coals. If, however, a special rate were conceded with the object of getting some freight rather than none, it is possible that under certain circumstances Nova Scotia coals could make an impression in Toronto. The difficulty appears to be that this special westbound lake coal rate cannot be granted without prejudicing the whole question of the grain rates on the Great Lakes. It is obvious that we have here a very delicate point, and the writer quotes this example merely as one instance of how intricate the question of coal transportation is when looked at from a detached but responsible point of view.

In closing this section the writer would call attention to the fact that never before has the Canadian public been so well aware of the fact that in their ultimate analysis coal and transportation are national problems, and that the present is an opportune time to discuss the question of coal transportation in a non-partisan spirit.

Summary

To present briefly any condensed summary of the economic factors of the Canadian fuel problem is very difficult. Canada, roughly speaking, is a strip of country three thousand miles long and perhaps fifty to one hundred miles wide. At the two extremities there is abundance of good coal. At the centre there is none whatever thought it is just at this point that the centre of gravity of coal consumption lies. In close proximity are the finest bituminous mines in the world. As already pointed out these American mines during a period of years, have had a steady increase in the output per man per day. The Alberta fields cannot possibly compete, and the Nova Scotia fields have a decreasing output per man per day. The American fields have decreasing costs per ton pit head — the Nova Scotia fields have a far higher cost and possibly increasing prices. This is the very essence of the problem.

The writer believes, for reasons already outlined, that a complete Canadian supply for Canadian needs is from a purely economic point of view almost hopeless. On the other hand, if the people of Canada desire to reach an independent fuel position irrespective of economic law, it can be done by means of tariffs and bonuses. Before taking such an important step, however, it is essential that the facts of the situation be collected, collated carefully, and their real import understood. In this connection the real cost of moving coal should be known. It should also be understood *why* Nova Scotia prices are moving *upwards* — i.e. as a general tendency over a period of years — and outputs per man per day downwards when during the same space of time the American bituminous fields of similar types of mines are going through diffeient cycles. The public anxiety towards the Nova Scotian situation is reflected by a corresponding disquietude in England over a similar state of conditions obtaining in the British mines.

If part of the low prices and increasing outputs of the American mines are due to a cycle of disorganization, unfair competition and overdevelopment in these fields, then some estimate should be made of the amount of price adjustment to be expected, and the time when it will take place, in order to assess the amount of assistance to be granted to the Canadian areas. To the best of the writer's knowledge there has never been a time in Canada when so much interest is being shown in the question of fuel and a national fuel policy. The public, the miners, and the operators are all agreed that the matter is one of national importance and not merely a dispute as to wages and living conditions. The origin and the outcome of strikes, the protracted negotiations, etc., are no longer the sole concern of the disputing parties, but are of infinite importance to the future of this Dominion, for fuel is undoubtedly one of the basic facts of our civilization. The spirit of a sincere desire to solve this formidable problem has been born in a new atmosphere of national feeling, and in this atmosphere alone will a satisfactory solution be found. The order of the solution is beyond question:—

1st, What are the facts?

2nd, What is the real import and explanation of the facts when gathered?

3rd, The initiation of a national policy based on the facts.

To this work Canada should devote her finest and best ability. Nothing less will meet successfully so grave a situation.

In closing this paper, the writer wishes to acknowledge gratefully the assistance given him in the preparation of certain material by A. J. P. Walter, B.Sc., Dawson Research Fellow in Mining, McGill University, Montreal.

Fuel Preparation and Treatment

A Statement of the Present Situation Regarding Fuel Carbonization

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Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 29th, 1926.

We are generally familiar with the various methods of preparing fuel and its utilization, and the remarkable strides made in recent years in their technical and commercial development. Washing and de-ashing, de-volatilizing, mixing, blending, etc., are of interest in certain fields, but are unlikely to become commercially important so long as we have available, at reasonable prices, large quantities of good coal.

During the past few years, a considerable amount of interest has been shown, both from technical and commercial standpoints, in the low and high temperature carbonization of coal.

Interest in low temperature carbonization is mainly due to the fact that a very high yield of tar and tar oils is obtained by this method of distillation, varying from 15 to 30 gallons per ton of coal as compared with 8 to 12 by high temperature carbonization.

Low temperature tar is a thin fluid or oil containing large proportions of paraffin bodies from which gasoline, fuel, and lubricating oils may be obtained. So far motor fuel has not been successfully produced, but if inferior bituminous coals and lignites can be made to yield these products, they will become of increasing economic importance. It is reported that the brown coals of Germany are giving satisfactory results, but this fact is of little interest in this country, because the commercial success of any system capable of general application is rendered more complex by the wide differences that exist between different coals. Low temperature carbonization is intimately bound up with the constitution of the coal to be treated. For example, coal contains resinous and cellulosic substances derived from resins and gums or from cellulosie of the original vegetation. Resinous substances have low melting points, yield large quantities of liquids on distillation, which consist chiefly of paraffins, napthenes, olefines, leaving a pitch which acts as a binding material for the char. The cellulosic or humic compounds are infusible and yield small quantities of liquids, which are generally phenolic in character. Sulphur, nitrogen, etc., are also present, making coal a very complex material.

Low temperature carbonization, (450 to 550 degrees C.), reduces the rate of transmission of heat through the charge. For this reason about four or five inches is the maximum depth of material that can be treated in stationary charges within economical limits of time. If the material is agitated during carbonization, poor char results. Hence, capital outlay is increased owing to increase in units, space required, maintenance and labor costs. Any free space left at the top of the coal increases the amount of air left in contact with coal. Those systems carbonizing at low temperatures with excessive air space above the coal usually produce a friable powdering mass of char. Brown coals or lignites in Germany have been submitted to a form of complete gasification in producers of modified Mond type, giving a tar resembling low temperature tar, but as the temperature of the exit gases evolved is high, the tars resemble more nearly high temperature tar. Products of distillation in this case are kept separate from those of combustion, and hence the temperature of the distillation products does not rise above the decomposition point. High yields of tar oils are obtained, which yield upon rectification motor fuel, fuel oils, lubricating oils, solid paraffin wax, ammonia, benzine, etc., yet it is the cost of such products, which is of vital interest. Cheap labour and other costs may offset any possible advantage we might have on this continent, especially when we are required to compete with high grade quantity produced products.

The distillation of coal at low temperature has created considerable public interest, but it is unfortunate that such publicity has been taken advantage of by some promoters, because there has been no developments along low temperature lines on this continent, or possibly in Europe, which would justify the statement that any of the various processes have passed from experimental stages, to commercial success.

It is believed today by many that the yields of by-products from low temperature processes are so much more valuable than those derived from high temperature processes, that the returns would immediately put low temperature carbonization processes ahead of all others. The low temperature processes have had considerable difficulty in finding markets for their products, for the reason that practically no markets existed for certain of the oils, and when an attempt was made to put them on the market in quantity, they were found to fetch about the same price per gallon as the tar made in the modern by-product coke oven. The quantity of tars derived from low temperature carbonization is in excess of those from the coke oven, and hence a greater return is shown on the balance sheet. This one item, however, may be offset by other considerations, such as the much larger quantity of saleable gas produced by the coke oven, the higher ammonia yields, etc. If the same economical rules which govern modern by-product coke companies, also apply to low temperature processes, the establishment of the latter as a commercial success may prove somewhat difficult. In general, coke must be sold at a considerably higher price than that of the raw coal from which it is made, and unless the yields of by-products in the low temperature carbonization processes very greatly exceed those of the coke oven, any scheme which has as its object the treatment of coal for the removal of by-products and the use of the coke or semi-coke as boiler fuel, may labour under severe difficulties.

With the exception of coke breeze, which is a so-called waste product from the high temperature processes, coke is unable to compete with bituminous coal as a fuel for power plants.

Furthermore, there is a great deal of discussion regarding the value of coke produced by the high temperature processes versus that produced by the low temperature process. In general, however, with proper equipment, we do not believe that low temperature coke is inherently superior to by-product coke even for domestic purposes.

We now arrive at the crux of the situation with regard to low temperature carbonization coke as a possible domestic fuel for Canada. If we must treat or briquette the product before it is suitable for the market, we have added to the cost of the product. Careful study has shown that there are few, if any, satisfactory briquetting processes in existence. Hence, where we have to double process a fuel to render it suitable for the market, we have made the cost excessive. At this point it would be, perhaps, well to point out also that the high temperature carbonization process leaves much to be desired, especially in the preparation of fuel for domestic purposes. In the past, it has been the custom to market coke rejected from the metallurgical screens and by sizing, place it on the market as domestic fuel, without regard to its physical characteristics. There are only very few modern by-product coking plants on this continent which start out with the primary idea of making domestic fuel, and studying the structure of the coke produced, from this standpoint. This idea, however, is very rapidly becoming recognized, and attempts to make domestic coke hard and dense have met with more or less success. There is still room for much improvement.

The advocates of one form or another of fuel carbonization, express commercial rather than scientific differences of opinion; hence the question of relative efficiencies of various processes is not of primary importance. There have been many reasons put forward for the use of low temperature carbonization, and of all of these, the most important is the commercial value of the products after processing. These products must also show a reasonable margin of profit after meeting cost of production, overhead expenses, etc.

From the standpoint of conservation, when it is well known that the world's supply of known fuels is rapidly diminishing, it is necessary to find new means for utilizing them more efficiently, and hence economically. This is the attractive feature of low temperature carbonization, and it is not our purpose to discourage additional and original research along these and other lines by those who have the capital and inclination to promote the general welfare. It is only because of the fact that the high temperature carbonization process has been established so successfully over a period of years, that the word of warning is sounded, when one is considering investment of money in new projects.

Considerable interest has been created in the scientific world by the production of "methanol" and "synthol", which may be described respectively as synthetic methyl alcohol and a mixture of liquid hydro-carbons. There are several ways of extracting, or obtaining oils from coal, as follows:

Extraction of solvents (1/2 of 1 per cent) non-commercial.

Low temperature distillation (4-10 per cent).

Hydrogenation of coal (10 to 45 per cent).

Combination of gases produced from coal with coal.

Hydro-carbons from carbides.

Fischer estimates that one ton of coke should produce in the neighborhood of 350 gallons of methyl alcohol. This figure, of course, has never been reached to date, and is entirely a theoretical one.

By subjecting coal held in oil to certain high temperatures and pressures in an atmosphere of hydrogen a mixture of liquid fuel results. One-third water gas and other fuels such as the higher alcohols and ketones are combined by using gas and steam catalytically, and the resulting product is known as "synthol". However, these fuels, methanol and synthol, have a lower calorific value than benzol, but may become increasingly important. The results have apparently been so promising with the meagre information at hand, that it would appear that the trend of scientific investigation will turn from the field of low temperature distillation to the new fields of synthesis of gases.

Carbonization of coal aims to raise to a higher point the value of the products and the availability of the heat units. However, the case of so-called "low grade fuels", such as shale or peat, leads to the belief that it is, at present, commercially unsound to attempt to increase their value by carbonization. Only as the higher grades of fuel increase in price, will the inferior fuels become of commercial importance.

It is not the purpose of this paper to discuss in detail, the various ways and means of carrying out low or high temperature carbonization. In the case of the latter, these methods are fairly well known, but in the case of the former, there are some technical problems which are of scientific and commercial interest. Where coal is exposed in thin layers, having been crushed, to the action of heat, a char is produced, which requires, or may not require, further treatment. Other processes are those in which the coal is stirred, which tends to break up the lumps of coke when formed and produces a friable coke, which must be processed before using for domestic fuels. The use of coking, or non-coking coals influences and makes the design of the retort difficult. The question of internal and external heating of the coal is also of prime importance.

We now arrive at the point where we can perhaps point out a commercially successful means of utilizing the low temperature process, and that is, in connection with the generation of power. Neither the by-product coke oven, nor the gas retort, offer many indications of success in the carbonization of non-coking coals. Here low temperature carbonization may prove of value in that the recovery of the valuable by-products will be accomplished, and at the same time, produce a fuel which is suitable for power generation, in a form which will not require further processing. Certain experiments have achieved results which indicate that non-fusible coals will coke much faster than fusible coals, as it is possible to drive the gases and oil vapours from the coal at a much faster rate.

It may eventually prove that this increase in capacity will offset other charges, and we will have gained in more efficient utilization of the material at hand. The foregoing is, of course, based on the assumption that the char will be used in pulverized fuel systems, where the power plant consumes enough fuel per day to warrant a large installation of the low temperature carbonizing process. Thus from the two angles which have been discussed in this paper, it would appear that there is room for both the high and low temperature process in Canada,—the former for the production of suitable domestic fuel at lowest possible cost, and the latter for the production of power under the same relative conditions, and yet attaining that which has never been accomplished,—the saving of valuable ingredients which have heretofore gone to waste up the stacks of many power plants.

For the purpose of comparing the two systems, the yields of the by-product coke oven and of low temperature carbonization are given. The yields are those per ton of coal carbonized, and those for the coke oven are actual results, while those for the low temperature carbonization process are the summary of the claims of various advocates of low temperature.

By-Product Coke Oven		Low Temperature Process
26-30 lbs	ammonia as sulphate	13-15 lbs.
8-12 gals	tar	20-30 gals.
3-3.5 gals	benzol or motor spirit	3- 4 gals.
10,000-12,000 cu. ft. 500-600 B.t.u's	total gas	6,000-7,000 cu. ft. 600-650 B.t.u's.
6,000,000	B.t.u's total in gas	4,000,000

It will be noted that advocates of low temperature carbonization recognize that the ammonia yield is such that at present prices, and cost of installation, its recovery is hardly worth while. Recent figures available indicate that for equal capacities the cost of a low temperature carbonization plant would be slightly less than that needed for high temperature carbonization. However, when reprocessing is necessary, or the by-products are to be made suitable for the market, the capital cost becomes greater for plants of equal capacity.

As before noted, the tar yield in the low temperature process is about three times that of the high temperature process, and the yields of motor spirit as such, are about equal. Great claims are made by advocates of the low temperature process of the value of the high B.t.u., gas produced. The fact is, however, that this question is entirely open to discussion, as the absolute quantities available for sale are not definitely known in the case of low temperature carbonization. Gas men for years have been fighting for reductions in the B.t.u. standard, and they could only secure this concession when it was proved that within limits, the lower B.t.u., gas could be utilized just as efficiently as high B.t.u. gas.

Granting that the cost of carbonizing one ton of coal by either the high or low temperature process is about the same, and assigning known values to the by-product, we still find that the balance is in favour of the coke oven at present. This is borne out by the experience of those who attempted to establish low carbonization on a commercial basis. This situation may change when the market is developed, and the value of low temperature by-products proven and recognized.

The Principles of Combustion and Heat Transfer as Applied to Steam Generation

John Blizard,
Research Engineer, Power Specialty Company, New York.

Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 29th, 1926.

While the exact laws governing the combustion of fuel, and the transference of heat to the water in a boiler from the gases and fuel bed are unknown, sufficient is known to enable engineers to design boiler plants to give overall thermal efficiencies as high as 90 per cent. To obtain efficiencies as high as this the fuel must be almost completely burnt and the gases cooled to a temperature well below that of the steam in the boiler of an ordinary power plant or factory.

It is proposed here to review first some of the factors involved in burning coal, then to consider methods of cooling the gaseous products of combustion.

Combustion of the Coal

The methods of burning coal may be subdivided into two parts:—

1. That of burning it in suspension in air.
2. That of burning it on a grate.

Powdered Coal

When the coal burns in suspension as in a powdered coal furnace its upward velocity is less than that of the air and it is this motion largely which enables it to burn with the desired rapidity. Its rate of descent through still air depends on its density, shape and size. If the particles are similar in shape and extremely small the terminal velocity will be proportional to the square of their linear dimensions, and when very large to the square root of their linear dimensions. With ordinary powdered coal, as used commercially, crushed so that the bulk of it passes through a 100-mesh screen the terminal velocity is proportional approximately to the linear size of the particle, and a particle with a mean diameter of one-hundredth of an inch falls with a velocity of about 1.4 feet per second.

The powdered coal is admitted to a furnace in either a horizontal direction or vertically downwards and usually it is mixed with about one-third to one-fifth of the air required to burn it, since this mixture ignites and burns more readily than one comprising all the air required for combustion. The remaining air is admitted later in such a way as to impart as much turbulence as possible to the particles of coal.

On entering the furnace the coal should be exposed to radiation from the flame itself to enable it to ignite readily. Once ignited it will burn completely if it is sufficiently finely ground, and enough air and combustion space are provided. The actual space required varies to some extent with the size of the largest particles of coal. The larger the particles of coal the greater their downward velocity relative to the stream of gases passing up the furnace and consequently the longer they will remain in the furnace. The rate at which the particles burn probably is proportional approximately to their velocity relative to the gases and to their surface, and is thus roughly proportional to their mass. But obviously the greater rate of combustion and slower speed of the particles through the furnace cannot enable them to burn to completion as rapidly as smaller particles. In ordinary boiler plants coal is ground so that about 90 per cent of it passes through a screen of 100 meshes to the inch, and about 1½ pounds of coal are burned per hour in one cubic foot of combustion space.

If the combustion space is too small, particles of coal are carried through the furnace and up the stack, and little or no carbon monoxide is produced. In attempting to burn powdered coal in the furnace of a Scotch marine boiler over 20 per cent of the fuel was carried through the boiler and lost, while on only one of five tests did the carbon monoxide exceed 0.2 per cent.

The great advantages of burning powdered coal lie in the ease with which the flow of air and fuel can be adjusted to the load, and the completion of combustion of the coal without an excessive ratio of air to coal.

Burning Coal on Grates

When coal burns on a grate the process of regulating its combustion is much more complicated than with powdered coal. Not only is the fuel bed far less homogeneous and more massive than a flame of powdered coal, but any troubles with clinker affect at once the flow of air and consequently the efficiency. The process of combustion in a fuel bed has been studied by Kreisinger who showed that the fuel bed acts principally as a gas producer and a gas retort. Only about one-half the chemical energy of the coal is liberated by combustion in the fuel bed, the remainder remaining latent as carbon monoxide, and hydrocarbons. Thus the gases leaving the surface of a fuel bed a few inches thick may contain as much as 30 per cent combustible matter and have no free oxygen present to burn it. This means that of the air necessary for complete combustion only one-half can be supplied through the grate, and therefore the other half must be supplied above the fuel bed. Thus the rate of supply of air beneath a fuel bed governs merely the rate of gasification of the coal, and the combustion can be completed only in the combustion space above the bed of fuel.

In the light of the above experiments, one may inquire why the loss caused by combustible gases in a boiler plant is not greater than it is, and various experiments have been carried to find out whence comes the air to burn these gases.

Tests on a Domestic Boiler

A series of tests carried out at the Bureau of Mines on the fire-pot only of a small domestic boiler, with no supply of air above the bed of fuel, showed that when burning anthracite and coke the heat lost by not burning carbon monoxide was never over 5 per cent of the calorific value of the fuel. But when burning a high volatile coal the loss caused by combustible gases leaving the fuel bed varied from 2 per cent just before the time for re-charging the fire-pot with coal to as high as 50 per cent after charging the fire-pot. This high loss could not be ascribed

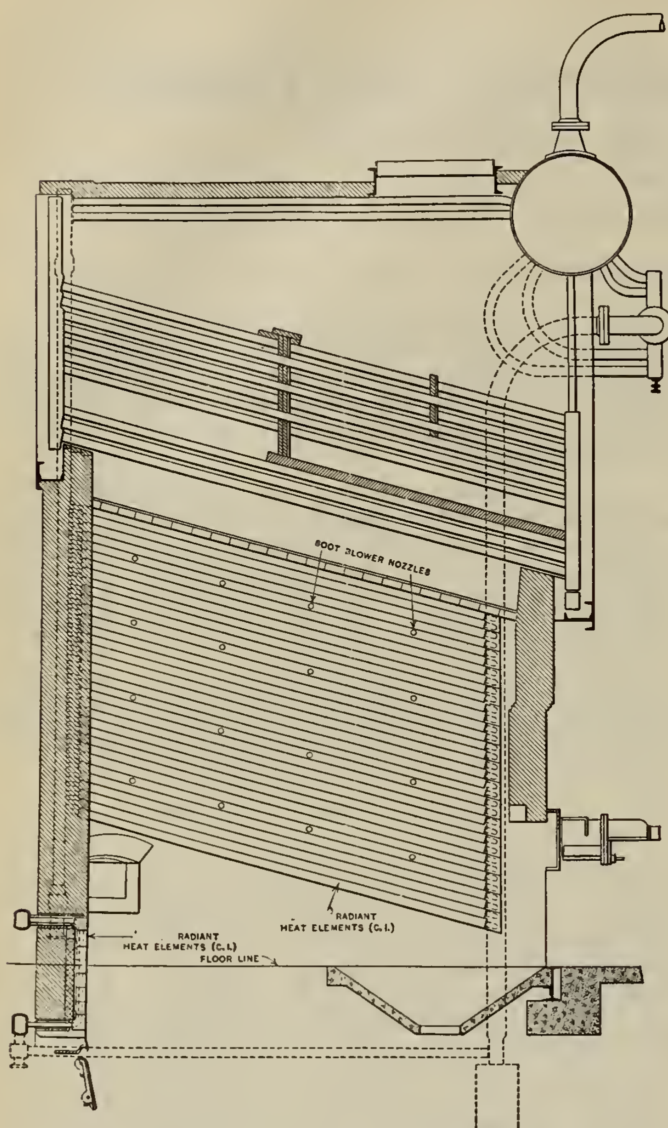

Figure No. 1—Boiler in the Power Plant at Zilwaukee, Mich., of the Consumers Power Company—Stoker Firing.

entirely to a deficiency of free oxygen above the fuel bed since at practically all times sufficient free oxygen was present to consume the combustible gases. Actually then, in a small domestic furnace sufficient oxygen finds its way around the edges of the fuel bed to complete the combustion of the combustible gases when burning anthracite and coke and for the most part in sufficient quantities to burn the gases rising from a fuel bed of bituminous coal. The thermal efficiency of the fire-pot alone of a domestic furnace was found to be 51 to 59 per cent when burning anthracite or coke, and about 33 to 40 per cent when burning bituminous coal. It was shown also that in any ordinary domestic boiler, admitting air continuously through slots in the fire door, reduced the efficiency with anthracite and coke, and on the average had little effect on the efficiency with bituminous coal. The temperature of the products of combustion leaving the fire-pot of the furnace of a domestic boiler are so low, at all ordinary rates of combustion, that the combustible gases do not ignite once they have left the incandescent fuel bed. The overall efficiency of a domestic furnace with anthracite or coke ranges from about 60 to 70 per cent, and the loss by combustible gas does not usually exceed 3 per cent, so that there is not as great a field for improvement by redesigning the boiler to enable the combustible gas to be burnt as there is when burning bituminous coal, when the efficiency may be as low as 50 per cent. If a domestic boiler is to be designed to burn bituminous coal with a better efficiency some arrangement will have to be made to mix supplementary air with the combustible gases before they have left the top of the fuel bed. Certainly there is ample scope for materially improving upon the efficiency of the ordinary domestic furnace when burning bituminous coal.

Tests on a Hand-Fired Grate

The difficulty of burning the gases rising from the fuel bed of a commercial steam boiler, with its higher rate of combustion, is less than with a domestic boiler because the temperature at which the gases leave the fuel bed of the commercial boiler are considerably higher. But the area of the grate is now larger in proportion to its periphery, so that any air admitted above the fuel bed has to travel a greater distance to burn the combustible gases rising near the centre of the grate.

Some interesting tests to determine the composition of the products of combustion were carried out by the Bureau of Mines on a marine water-tube boiler, and the first two or three tests showed considerable combustible gases at the base of the stack, while flames were observed frequently in the up-take. This condition was ameliorated by admitting suitable quantities of air over the fuel bed at the front and back of the grate.

When air is admitted over the grate to burn the gases rising from the grate it is desirable to mix the air with the gases as rapidly and as near to the fuel bed as possible. It happens frequently that the loss from combustible in the gases leaving a boiler is not very great, but that the secondary air mixes so slowly with the combustible gases that the gases continue to burn in their passage through the boiler. This means that much heat is generated by combustion too late to enable it to be cooled by the heating surface near the furnace and accordingly, the temperature of the flue gas is very high. For example, in a series of tests to determine the relative values of coke anthracite and bituminous coal, for generating steam in a low pressure cast iron boiler of 815 square feet of heating surface, the bituminous coal gave a thermal efficiency of only 67 per cent, while coke and anthracite gave efficiencies of about 78 per cent. The lower efficiency with bituminous coal was caused by the much higher temperature of the flue gases, which in turn was shown to be caused by prolonged combustion.

A striking example of the presence of combustible in the gases leaving a fuel bed was shown by the composition of samples of gas taken from the furnace and combustion chamber of a Scotch marine boiler. Here it was found that the contents of combustible gases leaving the fuel bed was as high as 14 or 15 per cent of the total volume of gases, but that in passing over the bridge wall at a high velocity these gases mix so rapidly with the air from the front of the grate, that the combustible is rapidly burned. This illustrates also the desirability of causing the gases and air to pass over a bridge wall or some constricted area to enable the free oxygen to mix rapidly with the combustible gases. One may notice also that although the furnace and combustion chamber of a Scotch boiler are bounded entirely with water-cooled surface, this did not prevent rapid and complete combustion of the combustible gases; and this shows that it is not essential for high efficiency to have a furnace lined with refractory material. This is borne out by the high efficiency of the Scotch marine boiler which was about 76 per cent when fired by hand with coal, and over 80 per cent when fired by oil.

Combustible Gases with Stoker Firing

When firing coal with a stoker, the fire is carried gradually across the furnace so that the fuel bed contains less and less combustible matter as it approaches the dump plate or other receptacle for the ash. In the main portion of the fuel bed, combustible gases are given off from the fuel bed and where the fuel bed becomes thin, free oxygen finds its way through the fuel bed. The furnace must be large enough and so constructed that the free oxygen passing through the thinner portions of the fuel bed may mix with the combustible gases before they have travelled far. The two principal stokers used in modern power plants are underfeed and chain-grate stokers. The underfeed stoker differs from the chain-grate in that on the under-feed stoker the coal is continuously agitated so that fissures occur in the fuel bed through which free oxygen may pass. With the chain-grate stoker little or no free oxygen finds its way through the main body of the fuel bed. The composition of the gases leaving a forced draft chain-grate stoker burning small anthracite has been determined by Mumford and he showed that above the rear end of the grate where the fire is thin the gas consists mostly of air, while towards the front of the grate a large proportion of carbon monoxide is present. Thus with a chain-grate some means must be provided to permit the free oxygen leaving the rear part of the stoker, to be employed usefully in burning the carbon monoxide rising from the front part of the stoker. This mixture of the oxygen and gases may be effected by a rear arch which causes the free oxygen to be brought forward and mixed with the combustible gases.

When burning a free burning bituminous coal on a chain-grate stoker the combustible gases have been burned by air injected through the front arch and the passage of free oxygen through the rear of the stoker has been reduced by installing a rear water box, whereby a thicker bed of fuel is maintained at the back of the grate.

With the modern multiple retort underfeed stoker, no arches are installed, though with these stokers, it is not unusual at high ratings to find gases burning above the tubes of the boiler in the first pass. Were it practical to construct and maintain arches over an underfeed stoker the gases could be burned probably at all times within the furnace; but were this done the radiation from the fuel bed to the tubes of the boiler would be reduced and probably at ordinary ratings the efficiency would not be improved by an arch.

If some form of constriction through which these gases pass from these stokers is to be used, the constriction and furnace should be composed entirely of water-cooled surface which absorbs radiation. On passing through this constriction the combustible gases and air would be mixed well and burn rapidly after passing through the constriction. This constriction would give also tolerable assurance that any free air admitted over the fuel bed would be used and undoubtedly enable operators to regulate better the composition of the gases. It would also reduce somewhat the temperature of the flue gas. But these heroic measures would not be justified when operating boilers at ordinary ratings, and would be justified only at high ratings if it then eliminated the delayed combustion of the gases. Thus in modern furnaces delayed combustion is tolerated though it is one of the factors reducing the rating at which a boiler may be operated with fair efficiency; and since delayed combustion reduces efficiency mainly by increasing the temperature of the flue gas, this tendency may be offset by installing more heating surface in the boiler proper, or in an economizer or air heater.

The foregoing shows that one of the principal obstacles to be overcome before a high efficiency is maintained in a stoker or hand fired boiler, is that involved in supplying the combustible gases rising from a fuel bed, with the least amount of air to burn them, and while this is done with stokers so that very high efficiencies are attained, the composition of the gases varies with the clinker formation, thickness of fuel bed and other factors somewhat difficult and laborious to control.

These difficulties have been instrumental in increasing the use of powdered fuel for firing boilers which may be fired with the requisite air by automatic control. It is true that stokers too, may be put under automatic control, but not to the same extent that powdered coal may be.

Efficiencies have been obtained with stokers which are as high as those obtained with powdered coal but in general the loss of combustible with stokers is greater and the flue gas loss is greater.

It is not intended here, to discuss at length the relative merits of powdered coal and stokers, since anyone contemplating installing a boiler plant must consider both in reference to his particular plant. The prospective purchaser must decide whether the additional cost of

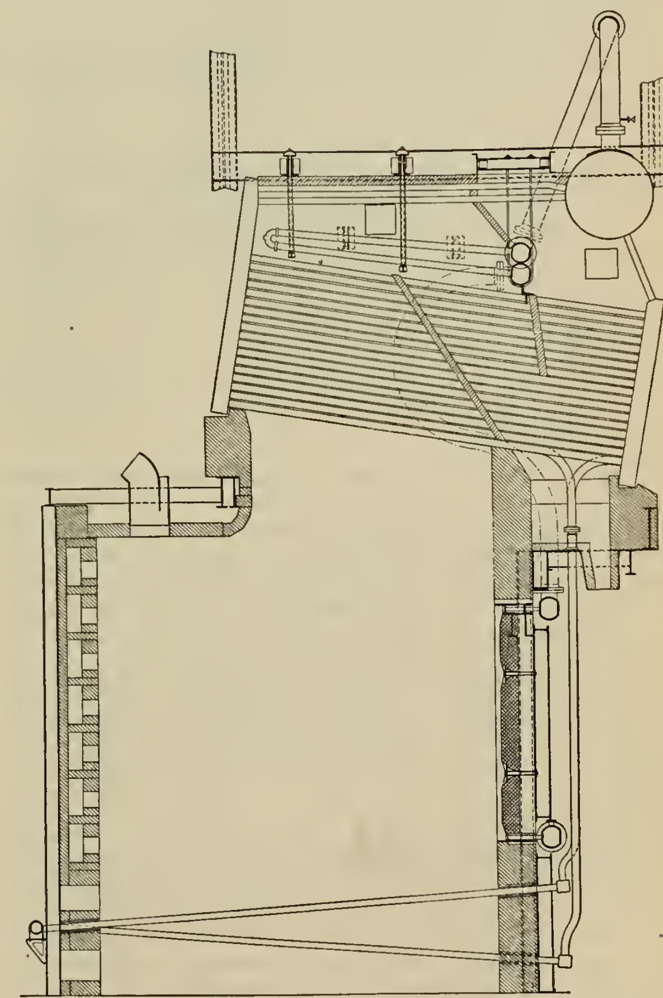

Figure No. 2.—Boiler in the Power Plant of the St. Paul Gas Light Company Limited, St. Paul,—Powdered Coal Firing.

installing and operating the equipment for burning powdered coal will be offset by the higher efficiency and convenience when using powdered coal.

In modern power plants in which a coking coal is burnt, the stoker generally used is a long underfeed stoker with clinker grinder, and the full length of the boiler tubes are exposed to the furnace. When the coal is free burning a forced draft chain-grate stoker is commonly used. This stoker has a set of separate air compartments across the stoker to control the relative rates of combustion of the fuel as it passes through the furnace. It is used also for the small sizes of anthracite. All ordinary commercial coal can be used in powdered form.

Transfer of Heat

The heat generated by combustion is transferred to the water and steam by radiation, convection and conduction. In the furnace the principal method of transfer is by radiation, and the rate of transfer may be as high as 70,000 B.t.u. per square foot of heating surface per hour or over two boiler horsepower. The magnitude of this may be appreciated better when it is realized that when a boiler operates at 200 per cent. of its rated capacity the mean rate of transfer amounts only to about 7,000 B.t.u. per square foot per hour or about one-tenth of the rate by radiation in the furnace. The radiation comes from the fuel bed and from the flame. It increases with the rate of combustion of the fuel and decreases when the ratio of air supplied to combustible burned increases.

There is no evidence to show that the walls of furnaces should not be composed of heating surface and thus increase the absorption of heat by radiation. The tests on the internally fired Scotch boiler referred to earlier give no evidence that the cool walls impede combustion and it is not uncommon today, to find furnaces, the walls of which are composed mostly of heating surface. Figure No. 1, shows such a furnace, the walls at the side are composed of tubes on to which cast-iron blocks are shrunk, and through the tubes water circulates, in fact the tubes form a part of the boiler. On the rear wall is a superheater, which is not shown in figure No. 1, but a similar superheater is shown in figure No. 2. It consists of a series of vertical wrought steel elements of rectangular section, which are connected by nipples to the inlet and outlet steam headers.

The advantages of installing heating surface instead of brickwork in the furnace of a boiler are many. The upkeep of the brickwork which the wall replaces, is eliminated, the upkeep of what brickwork remains is reduced since the temperature of the furnace is reduced, and heat transferred by radiation involves no loss of momentum to the gases, and consequently no equivalent loss of draft.

The radiation from the flame and fuel bed is absorbed by the heating surface on which it impinges; it is then transferred through the metallic walls of the boiler tubes, superheater or water walls by conduction and finally it is transferred to the water or steam by conduction and convection.

Since the conductivity of iron or steel is of the order of 300 B.t.u., inches, per square foot, hour, degree Fahr. the drop in temperature across a slab of steel one inch in thickness will be 200°F when transmitting 60,000 B.t.u., per square foot per hour. Even this temperature head of 200° can have little effect on the transfer, and this may be seen by the following simple computation. Let us suppose that if there were no drop in temperature through a heat absorbing wall, the wall would be at a temperature of 600°F. and that actually the wall is so thick that the outer temperature is 800°F. Then if we suppose that the outer wall radiates as a black body, the radiation per square foot per hour from the wall at 600° will be 2,150 B.t.u. and from the wall at 800°, it will be just twice as much, that is 4,300 B.t.u. Thus a difference of 200° in the temperature of the wall reduces the net heat absorbed by 2,150 B.t.u. per hour or by less than 4 per cent. of the total absorption. The temperature head required to transfer the heat from the inner wall to the water in the boiler tubes or water walls is very small, and this head can be kept low in a superheater by maintaining a high rate of flow of steam.

After the gases have left the furnace they are cooled to some extent by radiation to the boiler heating surface, but in the main, they are cooled by transferring heat from the hot gases by convection and conduction to the walls of the tubes of the boiler.

Both latter modes of transfer are caused by a movement of the gas itself in a direction normal to the heating surface and thus normal to the general path of the gases. When the transfer is by convection, small masses of gas in the form of eddies move to and fro across the main stream and when the transfer is by conduction the transfer takes place by the individual motion of the molecules themselves. At the walls of the heating surface the gas is stationary; and near the wall, the rate of flow is lower than in the main stream and is laminar. Near the wall where the flow is laminar, the heat is transferred across the layer in laminar flow solely by conduction and the rate of flow depends upon the thickness of the layer, the difference in temperature at the boundaries of the layer and on the conductivity of the gas. In the main stream where the velocity is higher and the flow turbulent the heat is transferred to the stream in laminar flow by convection. Thus the transfer of heat from a stream of gas to the metallic boundary separating the gas from the water in a boiler, depends upon many factors. They are, the temperature, size, shape and roughness of the channel in which the gas flows and the viscosity, conductivity, temperature, density, and velocity of the gas. Usually it is found sufficiently accurate to assume that the rate of transfer of heat is directly proportional to the difference between the mean temperature of the gas and of the mean temperature of the wall and of the channel; and to assume that the rate of transfer of heat per unit area of the wall is a function only of the mass flow of the gas.

The usual form of equation used is:—$R = a + bF$ where R is the B.t.u. transferred from the gas per square foot of area of the boundary, per hour, per degree difference in temperature between the gas and boundary; F is the mass flow in 1,000 pounds per square foot of free area per hour and a and b are constants. The value of a is about 2 and b varies from 0.75, which may be used for fluids flowing through a tube, to 1.4 for fluids flowing at right angles to tubes as in a boiler.

An example of an equation which takes account of more variables, is that of Weber which is for gases flowing through a pipe of diameter d inches: $R = 0.68\ (F^{.8})\ (T^{.5})\ (c)\ (M^{-.3})\ (d^{-.2})$. Where T is the mean absolute temperature of the gas in degrees Fahr., c its specific heat and M its molecular weight. This becomes for $T = 460 + 500$; $c = .24$; $M = 29$; and $d = 3$, $R = 1.8F$.

All experiments on the transfer of heat show that the rate of transfer per unit area increases as the rate of flow of the gas increases and that other conditions being the same, a small tube, whether the gas flows inside or outside, absorbs more heat per unit area than a large tube though this effect becomes less marked as the product of the mass flow and diameter of the cylinder increase. Thus by increasing the rate of flow we may use less surface to obtain the same efficiency as with a larger surface and lower rate of flow. In a boiler this may be done by increasing the number of baffles. But the resistance to flow increases approximately as the square of the rate of flow, so that we have to decide whether it is more economical to install a large amount of heating surface or to expend more energy on moving the gases at a higher velocity across the smaller surface.

Economizers and Air Heaters

It is obviously impossible to reduce the temperature of the gases passing through a boiler below that of the temperature of the water in the boiler, which in modern power plants is not less than 400° F. But if the boiler is to be operated at a high efficiency the gases should be reduced to temperatures below 400°F and in many plants the gases are discharged to the stack at temperatures below 300°, so that the sensible heat lost by the flue gas does not exceed 5 or 6 per cent. These low temperatures can be attained by letting the gases preheat either the air for combustion or the feed water. Usually these heaters are designed so that the gas and air, or gas and water flow in opposite directions. This principle enables economizers to heat the feed water to a temperature higher than that at which the gases leave the economizer.

In deciding upon the extent to which economizer or air heater surface should be installed, one should carefully consider a boiler, economizer and air heater as a unit for cooling the gases. Obviously the air heater or economizer has the advantage of the greater temperature head between the flue gas and fluid to be heated, which means that if the same rate of heat transfer per unit area of heating surface per degree temperature difference between the flue gas and fluid to be heated can be maintained in the boiler, economizer and air heater, then one square foot of heating surface in an air heater for heating the air to a moderate degree will cool the gases more than one square foot in an economizer. In the same way one square foot of economizer heating surface is of more value than that of a boiler. But while rates of heat transfer per degree temperature difference in an economizer, may, by suitable design, be made greater than that in a boiler; the rate of transfer in an air heater is usually low.

This relatively low rate of transfer in an air heater is caused by the resistance to the transfer of heat from the wall of tube or plate to the air, being much greater than that to the water in a boiler or economizer where the resistance to flow of heat from the wall to the water is negligible.

Further, while the temperature head at the cool end of a counter flow air heater may be two or three times that at the cool end of an economizer, yet air is heated through many more degrees of temperature than water so that at the hot end the difference between the temperature of the gas and water in the economizer may be twice that of the gas and air in an air heater.

When an economizer can be installed it is preferable to an air heater, but the tendency to go in for heating feed water to a high temperature, by bleeding steam from several stages of the turbines, makes the adoption of air heaters in these plants as auxiliaries to economizers, essential if high efficiency is to be maintained.

Differentiation of the Action of Acids, Alkali Waters and Frost on Normal Portland Cement Concrete

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For the past three years an intensive research into the effect of alkali ground waters on concrete has been carried on under the auspices of a Committee of *The Engineering Institute of Canada* with the financial support of the National Research Council, The Canada Cement Company, The Canadian Pacific Railway, and the three Prairie Provinces.

As has been stated many times, this Committee decided to undertake a research of a fundamental nature and not one guided by empirical methods. Up to the present time a great deal of work of value has been done and a brief review of the first published paper will be found in the November, 1925, issue of *The Engineering Journal* of Canada. From this review it is hoped engineers may obtain a general idea of how the work is being conducted and how it is progressing, and that they will again note how research of a fundamental nature not only throws light on the problem of immediate concern but always explains and illuminates problems that were not even thought of when the work was started. It will be seen that the above mentioned research, which was started primarily to examine the action of alkali ground waters on Portland cements, has already led to conclusions about the setting of cements, the effect of leaching waters, the effect of different kinds of alkali solutions, and it is hoped that by the methods developed in connection with this research and the data obtained, it will be possible in the near future to explain many matters in connection with the character of Portland, high alumina and other cements that will have far reaching scientific and practical effects. Such experiences indicate the wisdom of attacking in a scientific manner even problems that are essentially practical in nature. Fundamental scientific research provides the capital for applied science and if we merely live on the interest and do not add capital, we as a country cannot progress.

As a review of the purely scientific aspects of the research has appeared recently in *The Journal* of *The Institute*, it is proposed to submit to this meeting a brief account of some practical applications, and show how findings, made incidentally in connection with the research on alkali disintegration, have not only allowed us to make valuable field diagnoses, but have thrown considerable light on the action of acid solutions on cement.

It is common knowledge that concrete is attacked both by sulphate, (alkali), waters and acid waters; it is also known that poorly made and porous concretes may be disintegrated by the mechanical forces of expansion due to alternate freezing and thawing. In some cases of disintegration the cause can be well established by an inspection of the local conditions, but in others it remains a matter of conjecture whether the destruction has been due to acid action, alkali action, frost action or a combination of these.

This article has for its purpose: — (1) The presentation of a chemical procedure evolved by one of the authors for determining from a chemical analysis of disintegrated concrete whether the cause has been acid action, alkali action or frost action; (2) the description of an interesting case in a western city upon which one of the authors was asked to report, where cases of acid action, alkali action and frost action were all found in one sewerage system and of how the procedure mentioned above was applied and of how some chemical studies threw light on various phases of acid disintegration.

Chemical Procedure for Determining the Cause of Disintegration

The procedure for differentiating between alkali (sulphate) acid and frost disintegration of concrete by chemical analysis described below was evolved from, and has been used for some time in connection with, a larger research, and as much confusion has existed in the past due to the fact that in many cases of disintegration there has been serious disagreement as to the cause, a description of the chemical studies made in evolving the chemical procedure referred to above will be given, in order that those interested may realize the reliability of the method.

Chemical analyses were made of various samples of concrete which had been disintegrated by known agencies and a few typical examples are given below.

Samples

A. *Sulphate Action.*
- No. 1. Softened concrete removed from the outside of an aqueduct in contact with sulphate water, below level of frost action.
- No. 2. Softened concrete removed from blocks in contact with soil which contained a soil solution very high in sulphates; no evidence of frost action.

B. *Frost Action.*
- No. 3. Disintegrated concrete from a parapet of a bridge in Saskatoon, Sask., exposed only to weather action.
- No. 4. Disintegrated concrete from large concrete pipe in Saskatoon, Sask., exposed only to weather action.

C. *Acid Action.*
- No. 5. Portland cement mortar disintegrated by a very dilute solution of hydrochloric acid.
- No. 6. Neat Portland cement disintegrated by a dilute solution of sulphuric acid (¼ per cent).

Treatment of Samples

The cement material was loosened as far as possible from the aggregate, the former was pulverized, leaving any grains of sand intact, and the portion which passed a 40-mesh sieve used for analysis. This sample was ground fine, dried at 360° C. and determinations were made on the dried sample for loss on ignition, silica, iron oxide, alumina, lime and sulphate.

It is evident from table No. 1 that chemical analysis distinguishes clearly between concretes disintegrated in the three ways. Thus the sulphate (SO_3) content distinguishes clearly between sulphate action and frost

TABLE No. 1,—Results of Analysis
(Expressed in per cent of sample dried at 360° C.)

Group No.	Loss on ignition	Silica SiO_2	Iron oxide and alumina (Fe_2O_3 and Al_2O_3)	Lime CaO	Sulphate SO_3	Chloride Cl
A–1	11.25	29.25	11.15	25.10	9.65	
A–2	13.50			31.80	11.90	
B–3	9.90			27.05	0.59	
B–4	12.15	40.10	12.45	22.40	0.86	
C–5	2.55	81.25	9.90	2.35	——	4.28
C–6	0.84	22.25	10.55	28.35	39.40	——

action. A number of analyses of weathered concrete all gave a SO_3 content below 0.86 per cent while as a rule the value was much lower. Three samples of concrete from aqueducts carrying fresh water gave values between 0.2 and 0.4 per cent. In any case it is safe to say that the SO_3 content would never rise above that of the original cement unless it is subject to sulphate action.

The residue from cement disintegrated by acids evidently varies with the acid used, and thus the interpretation of the analytical results is not such a simple matter. The evidence however enables one to come to definite conclusions as follows:

(a) Loss on ignition after drying at 360° C. is very small. The reason is that the acids attack first the hydrated and carbonated materials of the cement, so that very little firmly held water or carbon dioxide remains.

(b) Presence of the acid radicle in the disintegrated cement indicates the specific acid causing the disintegration. This is the case even when the calcium salt of the acid is soluble as in No. C–5 above.

(c) When the calcium salt of the acid is soluble the lime is removed almost completely, while the residue is largely silica.

It may appear that there is a difficulty in distinguishing between sulphate action, ("alkali" water) and action of sulphuric acid, on account of the large amount of SO_3 present in both instances. Such is not the case. In the residue from disintegration with sulphuric acid the ratio of lime to SO_3 is but slightly greater than that for calcium sulphate, namely, 7 of lime to 10 of SO_3, while in cement residues from neutral sulphate action the proportion of lime is much higher. When the residue from H_2SO_4 disintegration is leached with water, lime and SO_3 are removed in chemically equivalent proportions and a residue low in calcium and high in silica is obtained similar to No. C–5. Thus, ultimately, if the acid is very dilute and the disintegrated cement is thoroughly washed by a stream of water the product has a low loss on ignition, is high in silica and low in lime.

Acid disintegration is a purely surface phenomenon, the material beneath being perfectly sound; it thus presents a characteristic physical appearance and can usually be identified, but it should be remembered that in the case of disintegration of a very rich and dense concrete by alkaline sulphate water the action also proceeds superficially and may thus resemble in physical appearance typical acid disintegration.

It is rare in practice to find combined acid and frost disintegration or any uncertainty as to which of these factors has been the cause of failure of concrete, but it is very common in the western plains to meet cases of combined sulphate and frost action, and many cases have occurred where the evidences of frost action have led authorities in the past to doubt the existence of alkali action, and even to make the absurd claim that all so-called alkali disintegration of concrete was really the result of weather action on inferior concrete.

Most concrete failures near the surface of the ground, have the appearance of frost action. This is due to the fact that the final disruption of the concrete usually is due to frost, while the real cause may be the weakening due to sulphate action, in the absence of which frost would have been permanently withstood. In such cases the information given by chemical analysis of the disintegrated concrete is most valuable and may be considered conclusive. Two cases will be cited as typical of what has been found many times.

SAMPLE D–1: *Disintegrated concrete from experimental blocks in surface soil.* The ground water contained about one per cent of sulphate calculated as SO_3. Disintegration was evidently due to sulphate action but there was also evidence of breaking down by frost.

SAMPLE D–2: *Disintegrated concrete from a partially disintegrated irrigation structure.* The soil in contact was heavily charged with sulphates, but the appearance of the structure suggested frost action.

Analyses showed that the calcium content was normal in each case, but the SO_3 content was 5.3 per cent in D–1 and 3.2 per cent in D–2. It will be noticed that while the concretes D–1 and D–2 represented failures as advanced as concretes A–1 and A–2, the SO_3 content of the former, while well over the normal, was well under the latter. The concrete of D–2 was made under careful supervision according to specifications and was of excellent quality as shown by other unaffected portions of the structure not exposed to sulphate water but exposed to extreme wind and weather conditions. It seems safe to conclude then that the real reason for disintegration was weakening due to the action of sulphates, with a secondary acceleration of failure due to frost.

One may also further conclude that whenever the sulphate content of concrete rises materially above the quantity which can be accounted for by the original sulphate content of the cement there is evidence of harmful sulphate action and disintegration is likely to be accelerated through frost action: a critical value for SO_3 content of one per cent is suggested tentatively, as in a large number of analyses of normal concretes according to the above procedure no SO_3 content over 0.86 per cent has yet been found.

INVESTIGATION OF A PARTICULAR CASE IN SASKATCHEWAN

The practical problem which suggested this article, and to which the results of the above study were applied, was an investigation of certain cases of concrete disintegration that had occurred in a city in Saskatchewan. The most serious case was the erosion in a large reinforced concrete storm sewer which received the effluent from an industrial plant and also for a few weeks per year a limited amount of storm water. The normal flow in this sewer was a relatively small quantity and averaged 6 inches to 12 inches in the bottom of a 6-foot sewer; the disintegration occurred only over the surface wetted by the normal flow. It was known that the effluent from the industrial plant was acid at times, but in view of the fact that concrete disintegration had also occurred at several places in the sewage disposal plant, which did not receive the effluent from the storm sewer, it was felt that a thorough

Figure No. 1.—Storm Sewer Invert Showing Reinforcing Rods Bared by Concrete Disintegration and Erosion.

study should be made to prove the cause of decay, especially as the financial responsibility for repairs rested with the company if necessitated by the effluent from its plant.

TABLE No. 2,—ANALYSES OF CITY WATER SUPPLY

	Parts per million			
	Analysis of Mixed Supply		Supply from Pump Well	
	I	II	III	IV
Date of analysis	21–9–20	28–10–24	21–9–20	28–10–24
Alkalinity ($CaCO_3$)	404.3	391.8	478.2	464.9
Calcium (CaO)	233.1	201.2	263.2	237.9
Magnesium (MgO)	112.1	38.6	130.6	52.7
Sulphates (SO_3)	239.0	257.6	394.1	302.4
Chlorides (Cl)	16.0	6.0	16.0	8.0
Total solids by evaporation	1049.	900.	1185.	1065.

NOTE:—The water supply is a mixture of well and spring water. The relative proportions vary somewhat throughout the year. The analysis of the supply from the pump well gives the upper limit of concentration.

The raw water supply from the city contains a high percentage of sulphate as shown by table No. 2, and as the water from the industrial plant was of a similar quality it was suggested that possibly this was a factor, but a careful examination of the concrete sanitary sewers in the city showed that no action whatever had occurred in them and as no other liquid in appreciable quantities was discharged into the storm sewer it appeared that any action taking place in the storm sewer was caused by the effluent from the industrial plant referred to It was learned that from 1916, when the sewer was first put into use, until 1923 a very considerable amount of damage was done, the concrete having been eroded quite generally along the area of flow to a depth as great as 2 inches, baring the reinforcement at places, as shown in figure No. 1. The action was typical of acid action, i.e.

TABLE No. 3,—Acidity, (in p.p.m.—H_2SO_4), of Sewage in Storm Sewer at Various Periods

Sample No.	Date	Sample taken		Acidity Brom-Thymol Blue
		at	time	
1-(A)	Sept. 6	A	11.00 a.m.	326
1-(B)	Sept. 6	B	2.00 p.m.	80
2-(A)	Sept. 18	A	4.00 p.m.	123
2-(B)	Sept. 18	B	7.00 p.m.	6
3-(A)	Sept. 18	A	3.00 p.m.	98
3-(B)	Sept. 18	B	6.00 p.m.	nil
4-(A)	Sept. 18	A	2.00 p.m.	55
4-(B)	Sept. 18	B	5.00 p.m.	nil

the gradual dissolving away of the cementing material with exposure of sand and gravel particles, but with no softening of the remaining concrete. In 1923, before the report referred to above was made, extensive repairs had been made and figure No. 2 shows how these were distributed. It will be noted that over fifty per cent of the repairs were made in the first third of the length and that the third nearest the outlet contained only about eight per cent of the repairs. The general distribution of these repairs was taken as an indication of the rate of disintegration along the pipe from outlet to inlet. After the time of flow in the sewer from inlet to outlet had been calculated and checked by floats, a series of tests were made of the acidity of the liquid as it passed "A", (inlet), and of the same liquid as it passed "B", (outlet), three hours later.

Table No. 3 shows four sets of analyses which are typical of many made, and on figure No. 2 these results are plotted and the points joined by dotted lines to indicate how the acidity of the sewage decreases from inlet to outlet. Whether this decrease follows a straight line or curve is not material to our conclusions. The point it is desired to make is that dotted lines (1) (2) (3) (4), of figure No. 2 which indicate in a general manner the acid conditions existing along the sewer line for variations in the concentration of the influent, explain why decay is more rapid at the inlet end than at the outlet, i.e. the acid is used up in combining with the cement and in some cases until it is all neutralized. It cannot be determined how uniform decay would have been throughout the length of the pipe had the incoming sewage at all times been of a sufficient acid concentration to prevent neutralization before it reached the outlet. It can be deduced, however, that in cases such as the one under review, where an industrial plant is discharging an effluent that varies from a neutral to a highly acid solution, any attempt to prevent trouble by reducing slightly the concentration of the acid content will likely have little effect on the portion of the sewer near the inlet, although action near the outlet may be materially retarded. Another interesting point to note is that permanent repairs by tile liners laid over the first portion only, where disintegration is most marked, would merely shift the area of intense action towards the outlet end of the line.

When a concrete surface is exposed to an acid solution the layer of acid in immediate contact with the concrete reacts with the calcium aluminates and calcium silicates forming the calcium and aluminum salts of the acid; this action is very rapid and for the layer in immediate contact may be considered instantaneous. Thus a neutral layer composed of a dilute solution of the calcium salt of the acid is formed at the boundary between the solution and the concrete and for further action to take place the acid molecules must normally diffuse through this layer. This protective layer is further increased by the inert material of the concrete remaining after solution of the cement particles. If the liquid is moving rapidly over the surface of the concrete, this adhesive layer will be torn away and fresh acid will be brought continually in contact with fresh concrete and the erosion will be greatly speeded up. It will readily be seen then that acid disintegration is a function of both the strength of the acid solution and the eroding effect of the moving liquid on the surface of the concrete. It was found that, in the sewer mentioned above, erosion was most marked where the velocity of the liquid was greatest, and that the underlying concrete was hard and sound. The secondary effect of erosion by rapidly flowing water was strikingly illustrated at several points where a small trickle of water entered the large sewer; these small streams entered the large pipe about half way up and dropped rapidly to the normal flow line below, it was noticed that above the flow line there was no action but that a furrow deeper than the surrounding erosion was caused where this falling water passed over the surface acted upon by the acid of the sewage.

At several points along the sewer depressions had occurred in the pipe line with the result that pools of slow-moving liquid of varying depth were formed; it was found that at these places no apparent action had occurred over the bottom of the pipe, but a slight action was noted over a small area at the water line. There were deposits in the bottom of the pipe at these depressions, which subsequent chemical analysis proved to be the products of acid-disintegrated concrete. It was at first suggested that the absence of any signs of action on the bottom of the pipe could be accounted for by the absence of the eroding effect of flowing water. It was felt, however, that on this assumption a slight softening or action would have been noticed. A chemical study was made in the laboratory, the results of which explain conclusively the phenomenal action of dilute acid solutions in such comparatively quiet pools. A few typical results of this study are presented below.

Two hemispherical earthenware jars, each 15 inches in diameter and 4½ inches in depth, were filled with a

TABLE No. 4,—Results of Chemical Study of Solution of Sulphuric Acid in which Cement Briquettes were Immersed

Jar	Time from Immersion of the Briquettes	Acid concentration in per cent of original strength	
		Top of liquid pt. (a)	Bottom of liquid pt. (b)
		per cent	per cent
3-A	0	100	100
	1 hour	97	63
	3 hours	91	53
	6 hours	80	44
	9 hours	71	33
	12 hours	66	28
	24 hours	34	12
3-B	0	100	100
	1 hour	97	91
	3 hours	96	70
	6 hours	94	58
	9 hours	91	49
	24 hours	87	28
	2 days	78	24
	3 days	73	22
	4 days	66	20
	6 days	53	15
	7 days	49	14
	10 days	34	11

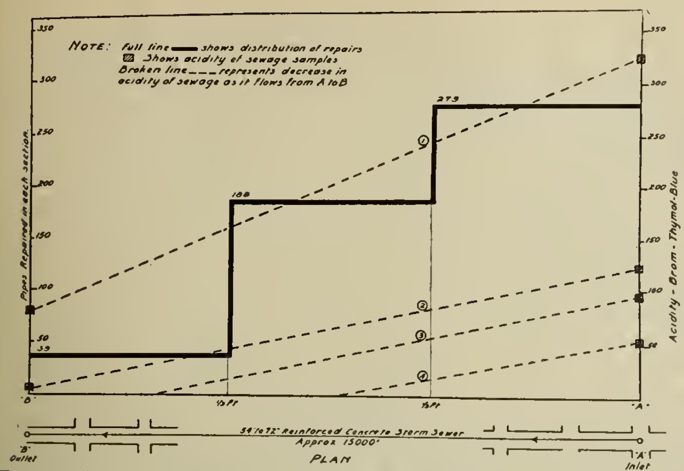
Figure No. 2.—Distribution of 1923 Repairs Between "A" & "B" and Change in Acidity of Sewage as it Flows from A to B.

solution of sulphuric acid of about 500 p.p.m. Eight cement briquettes were arranged along the sides of the jar as shown in figure No. 3. In 3–A the briquettes were placed at the top of the jar near the surface, while in 3–B they were placed at the bottom of the jar. Samples of the liquid were removed at intervals from points (a) at the top and (b) at the bottom of the jars and the concentration of the acid determined. Table No. 4 gives the results.

The above results are very interesting, and it will be noted that when the briquettes were at the top, the concentration at the bottom decreased much more rapidly than at the top, although by the laws of diffusion the reverse should be the case. It will also be noted that when the briquettes were at the bottom the concentration also decreases much more rapidly at the bottom than at the top, but that it took 10 days to arrive at the same condition in the vessel as was arrived at in one day when the briquettes are at the top. It will be seen then that if the entire vessel were lined with cement, approximating the condition of a depression in a sewer pipe, and if the dilute acid solution were moving slowly, the concentration at the top would be many times that at the bottom and consequently practically all the acid action would occur along a narrow line at the surface of the liquid. This is what was found in the actual case above mentioned.

The theoretical explanation of this phenomenon is as follows: When dilute acid solutions act on the concrete at the sides of a sewer a solution of the calcium salt is formed, which is heavier than the original acid solution; this neutral solution therefore tends to sink along the walls to the bottom and fresh acid solution takes its place in contact with the concrete at the water line, while the neutral solution protects the lower portion of the sewer against action of the acid. In addition the inert solid products of the decomposition at the water line tend to sink and cover the floor of the pipe with a thick sluggish layer of protective neutral liquid.

While in the above case of the large storm sewer a physical examination alone provided conclusive evidence that the deterioration was caused by acid action, the fact that a chemical analysis of the products of disintegration, which settled out in the depressions, proved beyond doubt that such was the case, would be very valuable evidence in case of a dispute.

Three other cases of concrete disintegration, however, were found in the sewage disposal plant of the same city, where it was impossible to state definitely from a physical inspection alone, what caused the decay. In these cases an application of the principles outlined in part one of this article allowed definite conclusions to be drawn, and further, led to some interesting conclusions as to the lower limit of sulphate concentration in an effluent or water which may cause sulphate disintegration of good quality concrete under certain conditions.

The sewage disposal plant consists of preliminary sedimentation tanks, percolating filters and final settling basin; the plant treats the domestic sewage only; the effluent from the storm sewer, that was affected, does not pass through the disposal plant.

The filters are of the circular type. Open underdrains radiate from the centre and discharge into a gutter which encircles the filter; the drains are made of the same grade of concrete as the floor on which they rest. The underdrains were badly disintegrated at the outer end where they emerged from the filter bed, the concrete was soft and badly crumbled, and the exact cause could not be determined from an inspection alone. Experiences elsewhere suggested that the disintegration might be acid action due to the formation of H_2S from sewage of high sulphate content, with the subsequent formation of sulphurous or sulphuric acid; the disintegration also resembled alkali action. The curb on the outside of the gutter surrounding the filter was also badly shattered, and the appearance suggested frost action.

Samples of the disintegrated concrete from the drains (E1) and the curb (E2) were analyzed and by applying the principles set forth in the first part of this article, to the analytical results as shown in table No. 5 definite and reliable conclusions were drawn.

TABLE No. 5,—Analysis of Samples E1 and E2

Sample	Loss on Ignition	Lime (CaO)	Sulphate (SO_3)
E1	18.10	26.0	5.9
E2	14.45	25.0	1.9

In both samples E1 and E2 the high SO_3 content indicates sulphate action. The content in E1 is probably high enough to account for complete disintegration under conditions where a part of the calcium sulphate formed is removed by the water. Sulphate action was probably contributory to the failure of E2, the final cause being frost action.

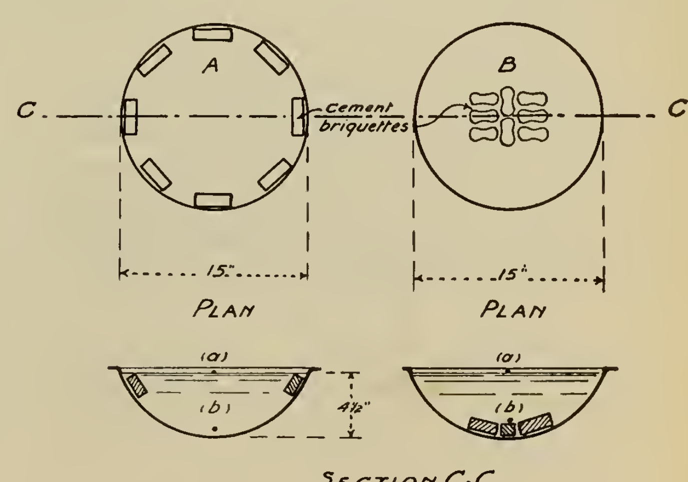

Figure No. 3.—Plan and Section of Jars A-B.

But the sulphate content of the city water as shown in table No. 2, while considerable, does not reach the limit usually considered dangerous to concrete structures. Several analyses of this water gave total dissolved solids of about one-tenth of one per cent, and sulphate content expressed as parts per million SO_3 as varying between 300 and 400 parts per million. Expressed as sodium sulphate the maximum is about 700 parts per million or well below a concentration of one-tenth of one per cent. Analysis of the sewage effluent after passing through the filter under consideration gave total solids of a little over 1000 parts per million and a sulphate content of about 300 parts (SO_3) per million. Thus while it may be mentioned that sample E2 was in contact with the soil and might have gained sulphate from the soil solution, the only source from which sample E1 could obtain sulphates was the effluent with its total sulphate content, calculated as sodium sulphate, of from 500 to 700 parts per million.

As mentioned before these drains, (E1), rested on a concrete base made of the same material, which showed no evidence of disintegration. The effluent flows through the openings in the drain so that the liquid covers the base completely but wets only the lowest fraction of an inch of the drain. The greater portion of the drain is thus exposed directly to the atmosphere while the base is continually wetted by the flowing liquid. It is evident that capillary forces cause a layer of the effluent to cover the exposed surface of the drain and that evaporation will take place from the whole surface of the drain not covered by the flowing liquid. The liquid film covering the exposed portion of the drain or permeating the same thus increases its concentration and may finally become a highly concentrated solution of sodium sulphate while the liquid in contact with the base of the drain and in contact with the concrete base on which the drain rests can never reach a concentration higher than that of the effluent. It would follow from such an explanation of the failure observed in the filter beds referred to above that only the tile at the outer surface of the bed, i.e. those which are in contact with freely circulating air, and therefore air which is not usually saturated with water vapor, should show signs of disintegration and the tile underneath the bed where the air is constantly saturated and no evaporation takes place should be intact.

Since writing the above and in accordance with our request the city engineer has had an examination of the tile made and reports: "We found that the interior blocks appear quite sound and in many cases the second block from the outside was found quite firm although the outside block adjoining it was in a crumbled condition." This is an interesting practical confirmation of the view outlined above. Thus it is evident that while a solution containing 500 parts of sodium sulphate per million, (a concentration commonly found in drinking waters in the West), may be harmless to good concrete immersed in it, (such as the concrete base in this case), the same concrete partly immersed, (here the drain), may disintegrate just above the water line, and that the lower limit of sulphate concentration which may thus cause disintegration depends on how favorable the conditions are for evaporation from the concrete just above the water level.

It may be mentioned that concrete foundations in sulphate soils usually show the greatest disintegration just around the upper limit of soil moisture, i.e. at the point where the soil moisture continually evaporates. Also that concrete walls and floors of basements which are in contact with sulphate ground water on the outside, sometimes show sulphate disintegration on the inside of the basement walls, while action is not so evident on the outside. Here the walls and floor are permeable to the dilute sulphate solution, and, while the original concentration of sulphate is not great enough to cause serious harm evaporation takes place on the inside of the walls, and the sulphate accumulates until the concentration is high enough to cause disintegration. In such a case the action can be stopped by painting the floor and walls inside with some material impermeable to water vapor so as to stop evaporation.

The third case of disintegration at the disposal plant was noted in the concrete columns which supported the roof over the sedimentation tanks. These columns rested on the side and partition walls of the tanks and their bases were within a foot or so of the water level in the tank. Several of these columns were badly eroded near the base to a depth of several inches. In appearance the damaged columns looked very much like those found disintegrated by alkali ground water in many buildings in the West, but a chemical analysis showed that the disintegrated cement was of the constitution of normal cement, which indicated that there had been no alkali or acid action to any extent. On inspection it was noticed that all of the columns eroded were situated either in front of doors or around the outside walls which were not sealed against the wind. It will be seen that this case was one of extreme frost action. Under normal winter conditions the atmosphere immediately above the tanks is moist and comparatively warm, the base of the columns becomes saturated and then, when there occurs a wind with a temperature anywhere down to 40° below zero, it is easy to see what happens to the nearest column when a door is opened, and to the columns on the windward wall through which air will filter freely.

To summarize: There has been presented in the above paper a description of an actual case where concrete disintegration caused by the three different agencies of alkali water, acid water and frost occurred in one sewerage system, in which conditions were such that failure could have been attributed to any two of three causes. There has been presented the chemical methods developed and adopted to determine definitely the cause of disintegration in each case, and this method of differentiating, by chemical analysis of disintegrated concrete, between alkali action, acid action and mechanical decomposition as found in frost action, will be appreciated as an important and practical contribution by those who have been confronted with the difficult problem of placing the responsibility for failure of normal concrete under conditions of uncertain exposure.

Design of East York Sewers and their Construction by Contract and Day Labour

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Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

The Township of East York is one of several municipalities which are situated on the borders of the City of Toronto. It occupies a length of about four miles along the north-east boundary of that city. The natural slope of an area of about 1,000 acres in the centre and the west end of the township is south-westwards towards the city, and about 500 acres in the east slope in the opposite direction. For many years efforts were made to obtain outlet facilities into the city sewers, but in 1923 the city authorities definitely decided this was impracticable. The township council thereupon submitted the matter to the ratepayers, who by a large majority declared in favour of proceeding with an independent scheme of combined sewers.

The portion of the township which was urgently in need of sewers lay south of the Don river and this was divided into three sewer areas, known as Todmorden, Greenwood and Danforth Park, each area approximately 500 acres in extent.

The most pressing need was in Todmorden where the houses were subject to flooding by surface water in the spring, and the subsoil in places was wet and treacherous, and the engineers' first efforts were bent to design a scheme for this sewer area and Greenwood.

At first it was thought desirable to find an outlet for Todmorden and Greenwood on the west side, but sufficient land for a disposal site was not available, nor was the estimated cost of the same attractive. In the meantime the trustees of the Davies Estate offered the township a parcel of land on the Don river, 24 acres in extent, on the north side of Todmorden and Greenwood areas, which gift was accepted by the township council. Consequently the final sewer scheme for these areas was designed with an outlet on the north, whereas the slope of the district was southwest. This necessitated designing and constructing about 2½ miles of the trunk sewers in tunnel, ranging from 15 feet to 72 feet in depth from the ground surface to the invert of the sewer.

The Danforth Park sewer area has a superficial slope towards the north, and the first scheme considered for this district was that of concentrating the outfall works on the above mentioned 24 acres of land. It was found more advantageous, however, to locate the Danforth Park works in close proximity to the area, thus obviating the construction of an expensive trunk sewer which would be required to connect the area to the Don River works. Moreover, it will be necessary in the future to provide sewers and plant for additional subdivisions of about 1,000 acres, and these will then discharge at the Danforth Park works, for which about 16.9 acres of land have been acquired, but only a portion of which can be made available, owing to the uneven nature of the land.

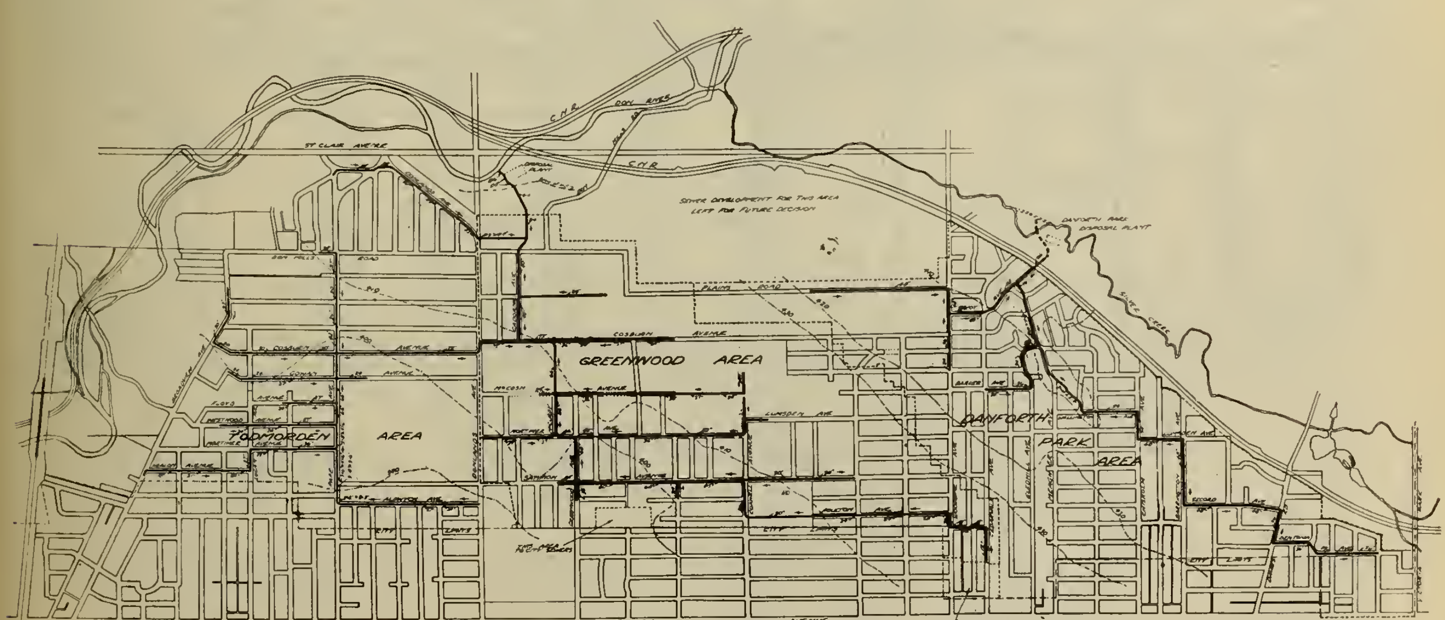

Figure No. 1.—Township of East York—Trunk Sewers, Twenty-seven Inches in Diameter and over, in Todmorden, Greenwood and Danforth Park Areas.

Sewer Design

Having decided on the general policy, it was necessary to formulate a basis of design of sewers. What is known as the "rational method" has been adopted by many authorities, but care has to be taken in its application, otherwise excessive capacities will be provided. Incidentally, it may be argued that the term "rational" is a misnomer. The many modifications suggested by different engineers indicate that it is not truly rational, that is, it is not always reasonable unless great care is taken in the selection of the factors. The term synthetical would be much more appropriate as this method of designing sewers consists in building up the system by making a whole out of parts. It is desirable that engineering terms should be precise and suggestive.

Before describing the synthetic method which was utilized in the design of East York sewers, it is advisable to deal with the matter of run-off. After much study and enquiry, a curve representing the rainfall intensity was adopted, which curve conforms to the equation

$$I = \frac{15.2}{t^{0.586}}$$

where, — "I" is intensity in inches per hour, which also practically equals cubic feet per second per acre, and "t" is the duration of a storm expressed in minutes.

It will take too much time in this instance to discuss the subject of rainfall intensity in Ontario, Quebec and certain eastern states of America. Suffice it to state that whilst there are some considerable differences in various cities, the intensity curve adopted for East York was from 3 to 15 per cent lower than the average for twenty-four cities.

It is evident to all engineers that only a portion of a rainfall reaches the sewers and this proportion depends upon several factors, such as the proportion of impermeable

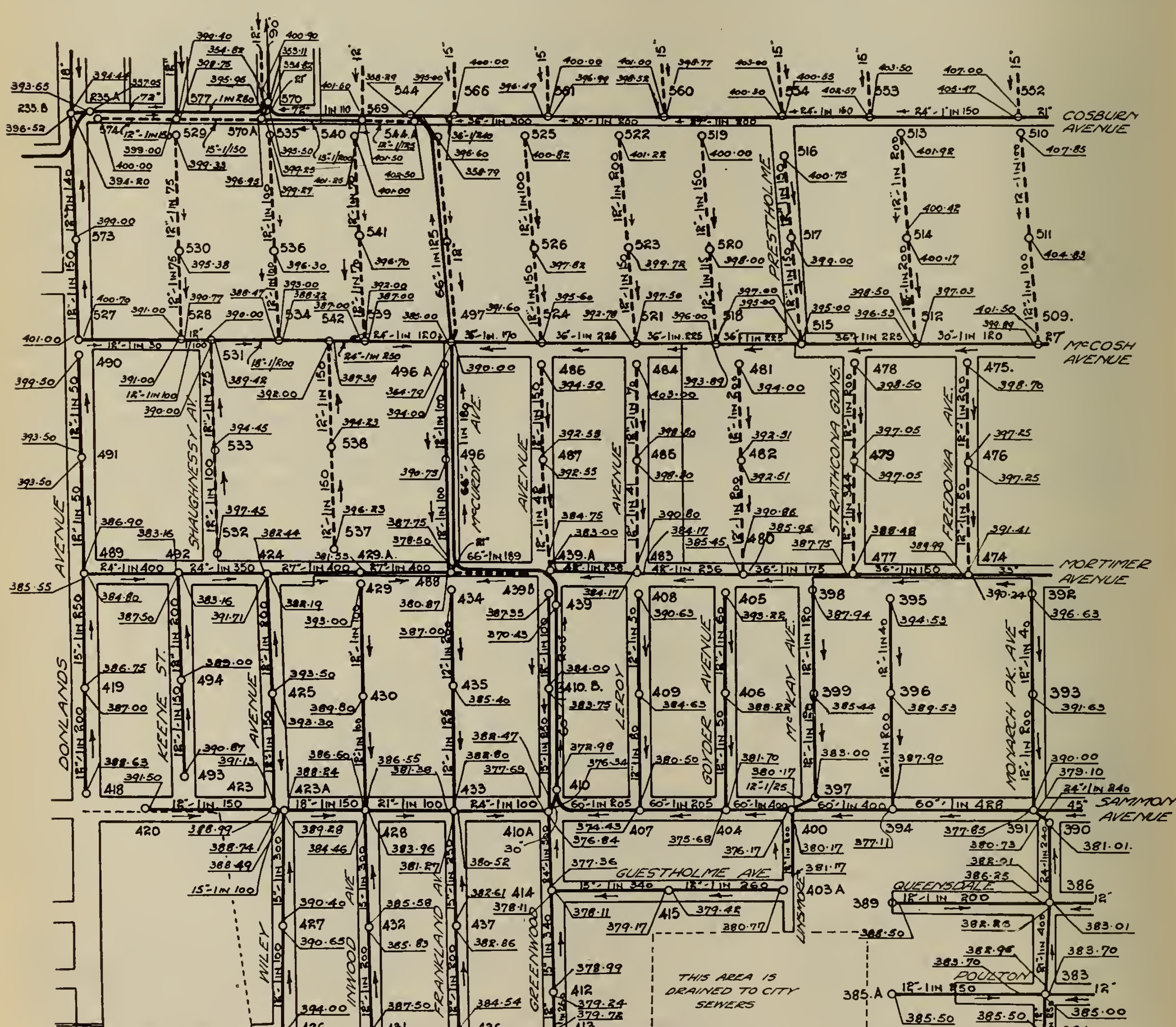

Figure No. 2.—Portion of Key Plan of Greenwood Area.

Figure No. 3.—36-inch Brick Sewer in Open Cut.

area to that permeable, the shape and slope of an area, the time to be allowed for the storm water to enter the sewers, and other details.

Although the average rainfall intensity differed but slightly, the factors used in the above mentioned cities to calculate the run-off were much more varied, and before adopting any proportion for run-off in East York, numerous computations were made and graphs were plotted. Raymond's zone principle, as described in his paper, Fruhling's graphical method, Coleman's summation curves as described in his book on "Hydraulics Applied to Sewer Design", and other methods were applied to ascertain by each method what would be considered as the maximum run-off. In the final analysis, the results obtained from the various methods were comparable, and as Raymond's zone principle was less laborious to calculate than the others, it was adopted.

The following summary indicates the run-off in cubic feet per second-acre. The average run-off given below is the average of the calculations as made in about twenty cities, and the East York run-off is that obtained by the zone principle.

Time in minutes	10	20	30	40	50	60	70
Average run-off c.f.s. per acre	1.15	0.98	0.82	0.72	0.62	0.56	0.50
East York	0.93	0.78	0.68	0.60	0.54	0.49	0.47

Montreal and Rochester, N.Y., engineers are designing sewers on a basis of a lower run-off than that mentioned for East York.

The time assumed in East York for the entry of storm water into the sewer in the Todmorden and Greenwood areas was eight minutes. In the Danforth Park area, where a sandy and gravelly soil obtains, sixteen minutes were allowed. The time allowed in other towns and cities varies from 3 to 20 minutes.

If it is feasible to have overflow outlets into recipient waters of sufficient capacity to be capable of oxidizing putrescible matters, the size of sewers can be modified and regard should be paid to any such conditions when comparisons are made.

Attention is here drawn to a very interesting paper by Mr. J. G. Caron, A.M.E.I.C., on a "Consideration of Rainfall and Run-off in connection with Sewer Design in the Montreal District", which appeared in June, 1925, issue of *The Engineering Journal* and which deals with some of the points discussed herein.

Having decided upon the run-off, the next business was to apply the same, and the synthetic method was used. The length of every sewer between street intersections, the area draining to the same, and other particulars were ascertained and entered on a sheet, of which the following is a copy containing a specimen of the calculations. (see table A).

TABLE A—TOWNSHIP OF EAST YORK COMPREHENSIVE SEWERAGE SCHEME.
CALCULATION SHEET.

Street	From M.H. No.	To M.H No.	Dist.	Length	Width	Acres	Acc. acres	Coeff C.I.	Q in C.F.S.	Fall in feet	Grade 1 in.	Grade %	Diam. in inches	Vel. in F.P.S.	Time of concentration at start	Time of concentration in sect.	Time of concentration accum.	Invert levels in	Invert levels out	Levels at surface in	Levels at surface out
Sammon..........	420	423	377	377	300	2.6		.96	2.5	2.51	150		12	3.8	480	109	589	391.50	388.99	400.5	398.8
Wiley N..........	425	423	325	200	300	1.4		.96	1.4	2.17	150		12	3.8	480	80	560	393.30	391.13	402.3	398.5
Sammon..........	423	423a	24.7				4.0	.94	3.8	.25	100		15	5.7	560	4	564	388.74	388.49	398.8	398.5
Wiley S...........	426	427	335	335	300	2.3		.96	2.2	3.35	100		12	5.0	480	67	547	394.00	390.65	403.9	398.5
Wiley S...........	427	423a	335	200	300	1.4	3.7	.94	3.5	1.12	300		15	3.3	547	102	649	390.40	389.28	398.5	398.5
Sammon..........	423a	428	247	272	300	1.9	9.6	.93	8.9	1.64	150		18	5.2	649	48	697	388.24	386.60	398.5	396.7
Inwood N.........	429	430	320	320	300	2.2		.96	2.1	3.20	100		12	5.0	480	64	544	393.00	389.80	405.0	—
Inwood N.........	430	428	325	200	300	1.4	3.6	.94	3.4	3.25	100		12	5.0	544	65	609	389.80	386.55	—	396.7
Inwood S..........	431	432	335	335	300	2.3		.96	2.2	1.67	200		12	3.6	480	93	573	387.50	385.83	395.5	395.7
Inwood S..........	432	428	335	200	300	1.4	3.7	.94	3.5	1.12	300		15	3.3	573	102	675	385.58	384.46	395.7	396.7
Sammon..........	428	433	257.8	260	300	1.8	18.7	.90	16.9	2.58	100		21	6.8	697	38	735	383.96	381.38	396.7	394.1
Frankland N......	434	435	320	320	300	2.2		.96	2.1	1.60	200		12	3.6	480	91	571	387.00	385.40	397.0	395.5
Frankland N......	435	433	325	200	300	1.4	3.6	.94	3.4	2.60	125		12	4.5	571	72	643	385.40	382.80	395.5	394.1
Frankland S.......	436	437	335	335	300	2.3		.96	2.2	1.68	200		12	3.5	480	96	576	384.54	382.86	392.3	393.2
Frankland S.......	437	433	335	200	300	1.4	3.7	.94	3.5	1.34	250		15	3.7	576	91	667	382.61	381.27	393.2	394.1
Sammon..........	433	410A	383.4	285	300	1.9	27.9	.89	24.9	2.83	100		24	7.7	735	37	772	380.52	377.69	394.1	393.3
Greenwood N.....	439b	410b	335	335	300	2.2		.96	2.2	3.35	100		12	5.0	480	67	557	387.35	384.00	397.0	394.0
	410b	410A	320	200	300	1.4	3.6	.94	3.4	1.28	250		15	3.7	557	90	667	383.75	382.47	394.0	393.3
at M.H. 410A.....	410A	eye trunk											30					376.34	eye		
Greenwood Trunk.	410	439	524				210.3	.68	133.0	2.55	205		60	10.	1778	52	1830	372.98	370.43	393.2	397.1

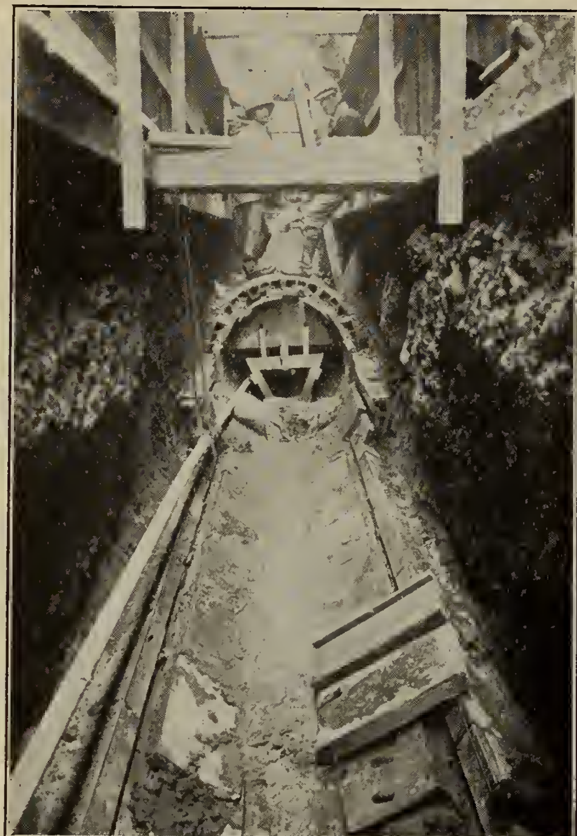

Figure No. 4.—36-inch Segmental Block Sewer in Open Cut.

These sheets were filed in sequence in book form and a key plan of the area drawn. From these sheets plans and profiles of any sewers can be prepared in any order, with an assurance that the ultimate scheme will be co-ordinated, comprehensive and complete.

It will be noted that by the synthetic method, the whole system of sewers is designed in small sections commencing at the point most remote, and following downstream to the outfall. In this manner every street is provided with a sewer sufficient for its need, and every trunk sewer is ample to convey the maximum flow due to a storm of a duration equal to the time it takes for the sewage to reach any specific point.

The following is a copy of a small portion of the general sewer maps. It will be observed that each sewer has information as to invert elevations, diameter, grade, number of manholes, etc.

Sewer Construction

As has already been indicated, the construction of the main trunks was largely in tunnel. The majority of the trunk sewers built in open cut served also as "service" sewers, that is, provision was made for the house connections. At intervals of 25 feet, stub house connections were made to the trunk sewer and, encased in 6 inches of concrete, were carried up to within 12 feet of the ground surface. From this point, as required, the township works department lay the private drain to the house.

In the construction of the sewers, the township council at the outset decided that local labour and materials should be used. The percentage of local labour has risen steadily from 25 per cent in the first tunnel contract to 95 per cent in the case of contractors, but has always been 100 per cent in contracts awarded to the township works department. Minimum wages, both for labour and teams, were set by the council. Local bricks are used in the construction of sewers, except in the case of the lower half of the inner linings where approved shale bricks are employed.

With regard to excavation, it has been necessary to close sheet and brace every trench in open cut work. The majority of contractors used compressed air picks and shovels, loading the material into buckets which were hoisted from the trench and removed by a carrier on rails to another point on the work, where the excavated materials was used as a backfill. In the case of tunnels very considerable difference in strata was encountered. On a large proportion of the work compressed air, with gauge pressures from 6 to 23 pounds, had to be used on account of the wet material in the crown. On the Pape Avenue sewer, the contractor used 15 pounds of air to hold the crown of the sewer, but at the same time, was forced to employ large charges of dynamite to remove the material in the invert. Considerable difficulty, owing to the character of the soil, was experienced in retaining the compressed air, with the result that the air often escaped some distance away from the jobs. In another instance where the job was carried out under compressed air, whilst the crown was maintained reasonably dry, the bottom was too wet to permit the construction of the brickwork. The contractor, with the consent of the engineers, adopted the flying arch method, that is, building the crown and haunches supported by longitudinal timber, and on completion of a length of this work then the invert was inserted.

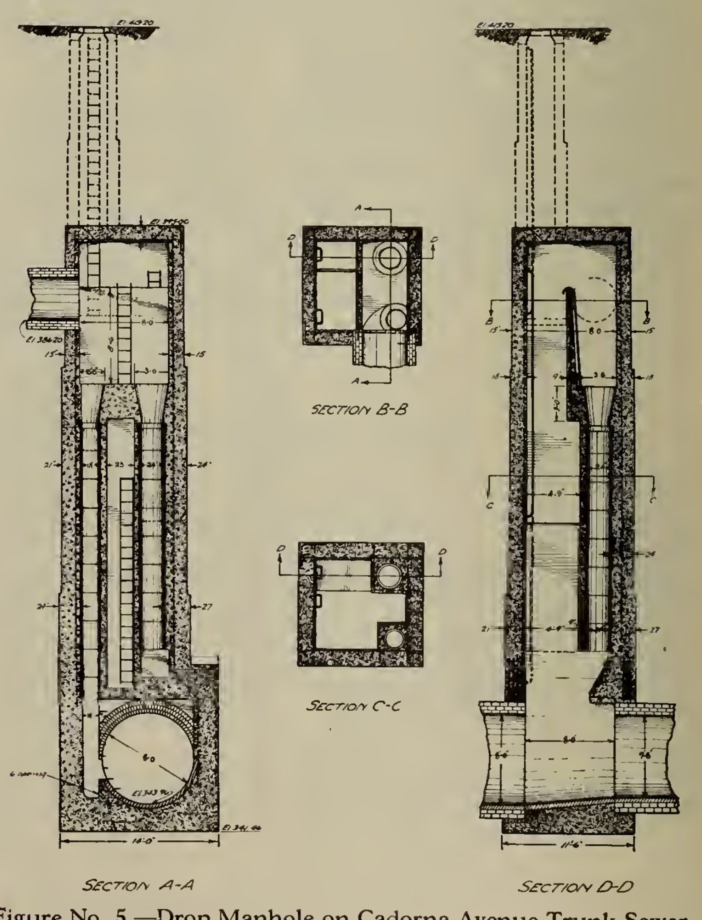

Figure No. 5.—Drop Manhole on Cadorna Avenue Trunk Sewer.

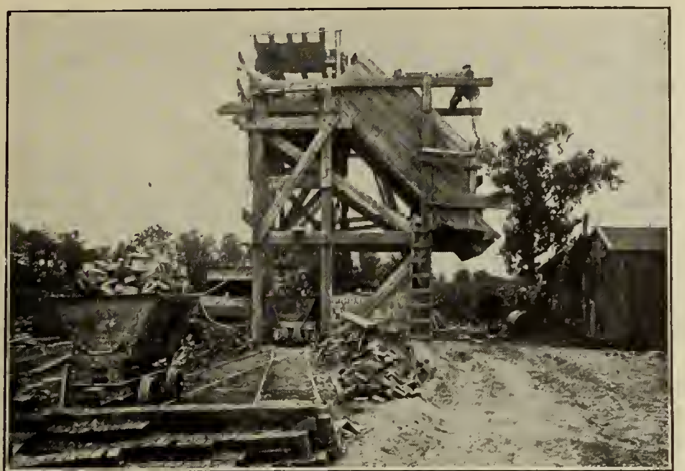

Figure No. 6.—Head Works at Drop Manhole Seventy-two Feet to Invert, Cadorna Avenue Tunnel Sewer.

The Meagher Avenue trunk sewer, which is now in course of construction near the proposed Danforth Park outfall works, is being built in a valley containing wet soft material. This has necessitated piling for about 1,500 feet in length of the sewer. The piles, three to a bent, are about 3 feet apart, and in some places are driven to 38 feet below the surface. In better ground they are only 20 feet deep. The piles are capped by

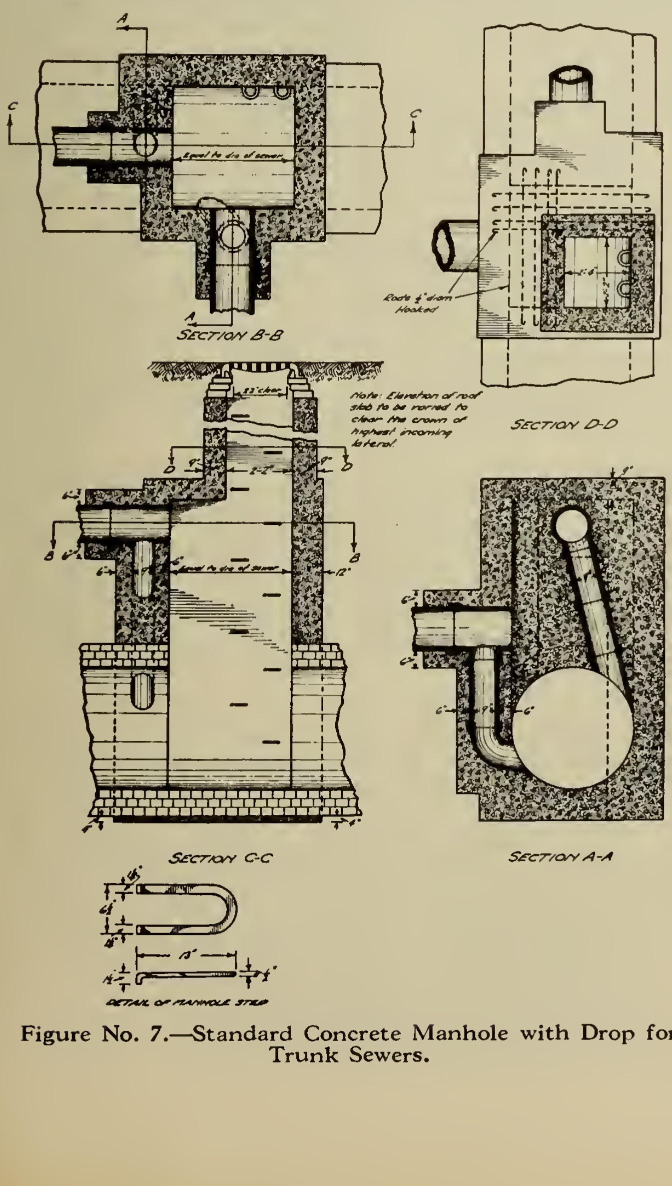

Figure No. 7.—Standard Concrete Manhole with Drop for Trunk Sewers.

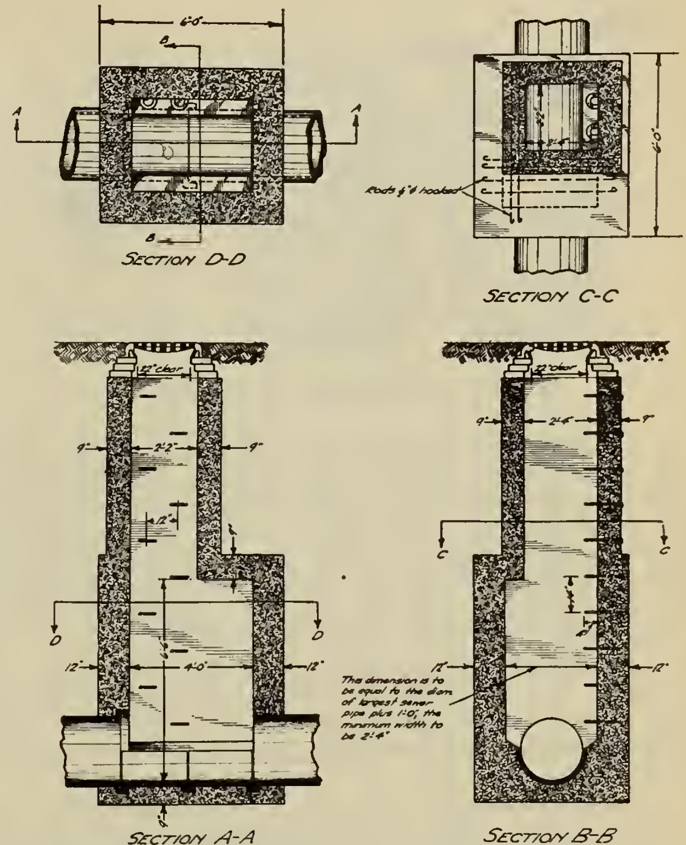

Figure No. 8.—Standard Concrete Manhole without Drop for Lateral Sewers.

8- by 8-inch timber on which is laid a 3-inch decking, and on this will be constructed an egg shaped concrete sewer 3 feet 10 inches by 5 feet 9 inches. There will be a fill in this valley of about 13 feet above the sewer, and consequently every care has to be taken to ensure satisfactory foundation and no settlement.

It is interesting to note that when tenders were called for the first, (Cadorna Avenue) trunk sewer, 90 inches and 96 inches in diameter, contractors were given alternatives of tendering on a 3-ring brick sewer, segmental block sewer, monolithic concrete with paving brick lining to the invert, and semi-elliptical reinforced concrete sections. This sewer was in tunnel at depths varying from 65 to 72 feet below the ground, and the lowest tenders from various firms on the concrete, brick, and segmental block were remarkably close to one another. As before-mentioned, the council wished to employ local materials, and inasmuch as there are several brick companies operating in the Township, the contract was awarded as a brick sewer. In this particular contract, the engineers sought tenders on a unit cost basis, but as the local contractors disliked this system, having been accustomed to bidding on a lump sum basis, and the township council were desirous of knowing the total expenditure to which they were committed when opening the tender and when awarding a contract, all further tenders were received as a lump sum for the construction of a definite specified piece of work. On a number of the other trunk sewers, contractors were permitted to bid on alternative sections, and in one or two instances, were given the choice of tendering on the work as an open cut or tunnel job. In the latter cases, the depth to invert, kind of ground, season of the year, and local conditions all had a bearing.

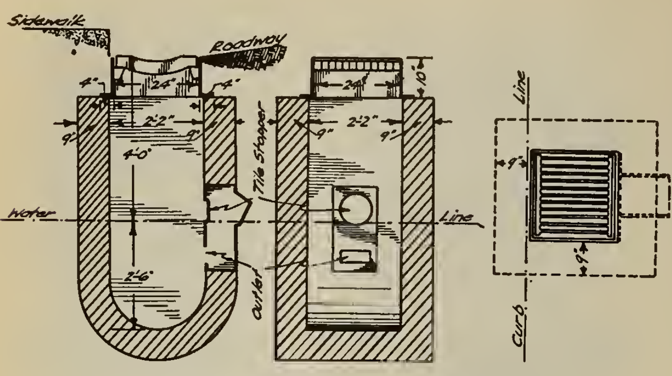

Figure No. 9.—Standard Catchbasin.

A schedule of prices to be paid for extras and additional work accompanied all specifications for sewer construction, but somewhat of an innovation was made in this respect, that the township, not the contractor, specified the rates and prices. These prices were most carefully considered for each contract and were accepted by all contractors without question. Deductions were based upon these prices less fifteen per cent.

Small sewers from 12 inches to about 27 inches in diameter have been built of vitrified clay pipe. Where such pipe is laid at depth greater than 12 to 14 feet, concrete cradles have been employed in order to ensure good bearing.

Sewers in tunnel, without exception, are built of brick and other sewers of large diameter have been built of brick, segmental blocks and monolithic concrete. The brick and segmental block sewers have been rendered with a one-half inch coat of cement mortar. The space between the sewer and the sides of the trench has been filled with concrete up to a height equal to two-thirds of the outside diameter of the sewer. Where necessary on account of unsatisfactory foundation, the bases of the sewers have been squared by means of a concrete filling. The monolithic concrete sewers have been constructed by the township works department and by the use of sheet metal forms, very satisfactory and smooth stream lines and crown have been obtained.

Brick sewers have been usually built 2 rings up to 48 inches in diameter, and 3 rings from 54 inches to 96 inches in diameter. The smallest diameter sewer that any contractor has elected to construct as a tunnel is 45 inches. In both the 45 inches and 48 inches diameter tunnels, the contractors made good progress, averaging 14 to 16 feet in each heading per 24 hours.

Figure No. 10.—Meeting of Two Headings on 6-foot Sewer in Greenwood Avenue Tunnel.

In the design of manholes interesting conditions had to be met. For instance, the invert of the Donlands Avenue sewer, which is an egg-shaped sewer 3 feet 2 inches by 4 feet 9 inches, is about 43 feet above the invert of the 8 feet diameter Cadorna Avenue trunk sewer in tunnel. This created a big drop which is taken care of by two vertical vitrified clay pipes encased in concrete. Figure No. 5 illustrates how this manhole was designed.

At another point in the Cadorna Avenue trunk sewer, two sewers, each 72 inches in diameter, converged into the main trunk. Both sewers were in tunnel, and built of brick. The contractor built the bell mouth 60 odd feet below ground, under an air pressure of about 20 pounds, and constructed the shaft of this manhole from the sewer upwards to about 20 feet from the ground surface, and simultaneously worked downwards from the ground to meet this shaft.

On the main trunk in Danforth Park area the manholes do not have such great drops and there has been incorporated in the design a chamber into which the water falls forming a water cushion and breaking the impact.

To facilitate construction, standard types of manholes, manhole covers, and catch basins were adopted. The catch basins were constructed of concrete, and the manholes of concrete or brick, as decided for the particular contract. Brick manholes were rendered on the outside. (See figures Nos. 7, 8 and 9).

All records of progress of construction are regularly reported by resident engineers and inspectors to the township office and there posted into various books. The inspector on each contract sends in a daily report of progress made, materials and labour employed, etc.

When contracts for the two largest trunk sewers were let to the contractors it was stipulated in the specifications that they should employ at least twenty-five per cent of township residents. This was done in order to try and relieve the unemployment situation in the township. but it soon developed that it did not in any way cope with the situation. It was therefore decided to create a works department which would be under the control of the engineering department. This department has grown, and to-day there are six gangs constructing sewers, and one constructing sidewalks, employing in the neighbourhood of two hundred men. As is usually the custom, these gangs are controlled by a foreman who is directly responsible to the township engineer, who has charge of all the work carried on by this department.

The foreman has control of his own organization and is required to make a daily report on a sheet provided him stating the number of feet of work completed, material received and any additional information which will be of use in connection with compiling the cost of construction. He is also required to make a daily time report to the township office stating the number of hours worked by each man in his organization and placing the different letters of the alphabet after each man's name according to the schedule given hereafter, so that the cost clerk in compiling his unit cost records of each job can arrive at the actual cost of each portion of this work. The schedule showing the division of labour and how they must be reported is as follows:—

TABLE B—DISTRIBUTION SHEET — Sewer on: WOODVILLE AVE.
Week ending Feby. 18th

	Distribution	Monday 16 No. men	Monday 16 Hrs.	Monday 16 Rate	Monday 16 Cost	Tuesday 17 No. men	Tuesday 17 Hrs.	Tuesday 17 Rate	Tuesday 17 Cost	Wednesday 18 No. men	Wednesday 18 Hrs.	Wednesday 18 Rate	Wednesday 18 Cost	Thursday 12 No. men	Thursday 12 Hrs.	Thursday 12 Rate	Thursday 12 Cost	Friday 13 No. men	Friday 13 Hrs.	Friday 13 Rate	Friday 13 Cost	Saturday 14 No. men	Saturday 14 Hrs.	Saturday 14 Rate	Saturday 14 Cost
A	Foreman	1			6.67	1			6.66	1			6.66	1			6.67	1			6.67	1			6.67
B	Pick and shovel, top	8	64	55	35.20	7	56	55	30.80	6	48	55	26.40	9	72½	55	39.88	9	72½	55	39.88	7	49	55	26.95
C	Pick and shovel, bottom	8	67	58	38.86	8	64	58	37.12	9	71½	58	41.47	6	45	58	26.10	6	48	58	27.84	7	52½	58	30.45
D	Pipe layers	1	8½	60	5.10	1	8½	60	5.10	1	8½	60	5.10	2	16	60	9.60	1	9	60	5.40	2	16	60	9.60
E	Pipe layers helpers	3	25	55	13.75	3	25½	55	14.03	3	25	55	13.75	2	16	55	8.80	2	16	55	8.80	2	16	55	8.80
F	Timber cost ft. lg.																								
G	Timber men	2	16	60	9.60	2	16	60	9.60	2	16	60	9.60	2	16	60	9.60	2	16	60	9.60	2	16	60	9.60
H	Timber men helpers	2	16	55	8.80	2	16	55	8.80	2	16	55	8.80	3	24	55	13.20	2	16	55	8.80	2	16	55	8.80
I	Back filling	5	40½	55	22.28	7	56	55	30.80	7	56	55	30.80	6	48	55	26.40	6	48	55	26.40	6	38	55	20.90
J	Pump men	2	18½	55	10.18	1	8	55	4.40	3	26½	55	15.37	2			8.40	2			8.40	1	10½	4.00	4.00
K		1			.66	3			8.70	2			4.70	1		66	.66	1		66	.66	3			9.24
		1			4.00																				
L	Engineer on boiler	1			1.20	2		60	8.10	2		60	8.10	2		60	6.00	2		60	6.00	2		60	8.10
		1	11½	60	6.90																				
M	Watchmen	2			1.33	3			5.33	3			5.55	2			5.33	2			5.33	2		4.00	5.33
		1			4.00																				
N	Teamsters	1	8	1.10	8.80	1	8	1.10	8.80					1	8	1.10	8.80	8	8	1.10	8.80	1	7½	1.10	8.25
O	Bricklayer — sewer																								
P	Bricklayer — manholes									1	7½	1.22½	9.18												
Q	Bricklayer — helpers																								

Distribution	Monday 16		Tuesday 17		Wednesday 18		Thursday 12		Friday 13		Saturday 14	
No. ft. 15″ pipe laid	15″	18′	15″	24′	15″	24′	15″	10′	15″	22′	15″	18′
Cost 15″ pipe per lin. ft.	.90		.90		.90		.90		.90		.90	
Laying pipe		18.85		19.13		18.85		18.40		14.20		18.40
Laying pipe per lin. ft.	1.05		.80		.79		1.84		.65		1.02	
Excavation 12 ft. deep		74.06		67.92		76.87		65.98		67.72		57.40
Excavation per lin. ft.	4.11		2.83		2.83		6.60		3.08		3.19	
Cost of timber		6.00		8.00		8.00		3.40		7.00		6.00
Timbering		18.40		18.40		18.40		22.80		18.40		18.40
Total cost of timbering		24.40		26.40		26.40		26.20		25.40		24.40
Timbering per lin. ft.	1.36		1.20		1.20		2.62		1.15		1.36	
Pumping		15.84		13.10		20.07		9.06		9.06		13.19
Pumping per lin. ft.	.88		.55		.84		.90		.41		.73	
Backfilling		22.28		30.80		30.80		26.40		26.40		20.90
Backfilling per lin. ft.	1.24		1.28		1.28		2.64		1.20		1.16	
Plant rental		1.00		1.00		1.00		1.00		1.00		1.00
Plant rental per lin. ft.	.06		.04		.05		.10		.04		.05	
Plant operators		8.10		8.10		8.10		6.00		6.00		8.10
Plant fuel, etc.		3.83		3.83		3.83		3.83		3.83		3.83
Plant per lin. ft.	.66		.50		.50		.98		.45		.66	
Truck and teams		8.80		8.80				8.80		8.80		8.25
Truck and teams per lin. ft.	.44		.33				.88		.40		.46	
Watchmen		5.33		5.33		5.55		5.33		5.33		5.33
Watchmen per lin. ft.	.30		.22		.23		.53		.24		.30	
Foreman		6.67		6.66		6.66		6.67		6.67		6.67
Foreman per lin. ft.	.37		.28		.28		.67		.30		.37	
Bricklayers — manholes						9.18						
Bricklayers — manholes per lin. ft.					.38							
				191.07		198.31		177.68		174.41		167.47
Total cost per lin. ft. 15″ sewer 12 ft. deep	11.37	189.16	8.93		9.28		18.66		8.82		10.20	

Foreman G. Gilbey 116 lin ft. of 15″ pipe 12′ deep at a total cost of $1,098.10 Per lin. ft. 11.21 Soil: Sand and gravel.

Letter "A" Foreman.
"B" Top pick and shovel men.
"C" Bottom pick and shovel men.
"D" Pipe layers.
"E" Pipe layers helpers.
"F" Timber cost.
"G" Timber men.
"H" Timber men helpers.
"I" Men employed on the backfill.
"J" Pump men.
"L" Engineers on boilers.
"M" Watchmen.
"N" Teamsters.
"O" Brick layers on sewers.
"P" Brick layers on manholes.

From this information the unit cost of these jobs, day by day, are compiled as shown on the specimen distribution sheet. (see table B)

For the purposes of payment of men the foreman is required to forward a weekly time sheet giving the number of hours worked by each man per week.

Previous to starting a sewer, a schedule is given to the foreman setting out the amount of work that is expected to be completed by him each day according to the amount of payroll of his gang. Weekly reports are given to the engineer showing the progress made, and these are compared with the schedule drawn up before commencing the work. This information is passed on to the foreman. An accurate check is kept upon the work at all times, and the foreman knows from week to week what is required of him to keep within the contract price, if there is a tendency to fall behind in his work. All employees, as stated, are township residents and are paid a minimum wage of fifty-five cents per hour for forty-four hours a week with time and a half for any overtime.

In order to compete with outside contractors, who bid on this work, it was found necessary to invest in mechanical equipment. This has been found to be beneficial in all respects. As an example, the entire cost of one piece of machinery was paid for by the saving in labour, etc., on one contract alone.

Up to the present time the sewer branch of the works department has constructed over three hundred thousand dollars worth of work at a considerable saving to the municipality, at the same time providing the residents with employment.

During the winter months of 1924 and 1925, in order to relieve the extreme unemployment situation, two additional foremen were placed on contracts, with two gangs each per week, each gang working three days per week. In this way as many as two hundred men at a time were employed.

At the termination of each job the staff prepare the cost sheet, according to the following form.

Credit is due to the resident and assistant engineers for the efficient manner which they carried out their duties. Grant R. Jack, A.M.E.I.C., is township engineer, and R. O. Wynne-Roberts, M.E.I.C., is consulting engineer to the Township Council of East York.

The Water Supply of the Border Cities

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and
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Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

In the south-western corner of Ontario there is an unusual situation,—eight incorporated municipalities lie side by side fronting along the Detroit river for a distance of about twelve miles and extending back about two miles. These municipalities, Tecumseh, Riverside, Ford, Walkerville, Windsor, Sandwich, Ojibway and Lasalle, are all on the same drainage basin, secure their water supplies from the same source, and have their own municipal governments but their problems are so inter-related that many of them cannot be solved independently.

The need for joint action and unity in handling some of these problems was recognized in 1916 which led to the creation of the Essex Border Utilities Commission. This body, composed of the mayors and elected representatives of all the Border Municipalities, more commonly known as the Border Cities, was empowered in 1916 by the Ontario Legislature to deal with the related problems of water supply and sewage disposal. Additional powers have since been secured from time to time until the health and general planning of the district come within the scope of its administrative powers. To the outsider it would seem that amalgamation would be the natural solution for the engineering and economic problems of the Border Municipalities. Different objections are offered by different municipalities to this idea but in the meantime there is a very evident desire to co-operate where possible in municipal undertakings.

The most important problem confronting the Commission after organization was the protection of the municipal water supplies. The upstream municipalities discharged their sewage above the waterworks intakes of those further downstream and owing to the rapid growth of the district this condition was yearly becoming more acute. Plans for further extension of sewers had been disapproved by the Provincial Board of Health owing to this situation and while it was recognized that sanitation must be provided, protection to the downstream municipalities was equally important. The problem was solved through the construction of five miles of intercepting sewers along the water front in which six municipalities participated and by which all sewage was discharged downstream with respect to the waterworks intakes of the Border Cities. Nine objectionable sewage outlets into the Detroit river were removed and when the International Joint Commission issues the mandate that the pollution of boundary waters must cease, the work on the Canadian side of the Detroit river is well under way.

There are two water supply organizations in the Border Cities, the municipally owned system of the city

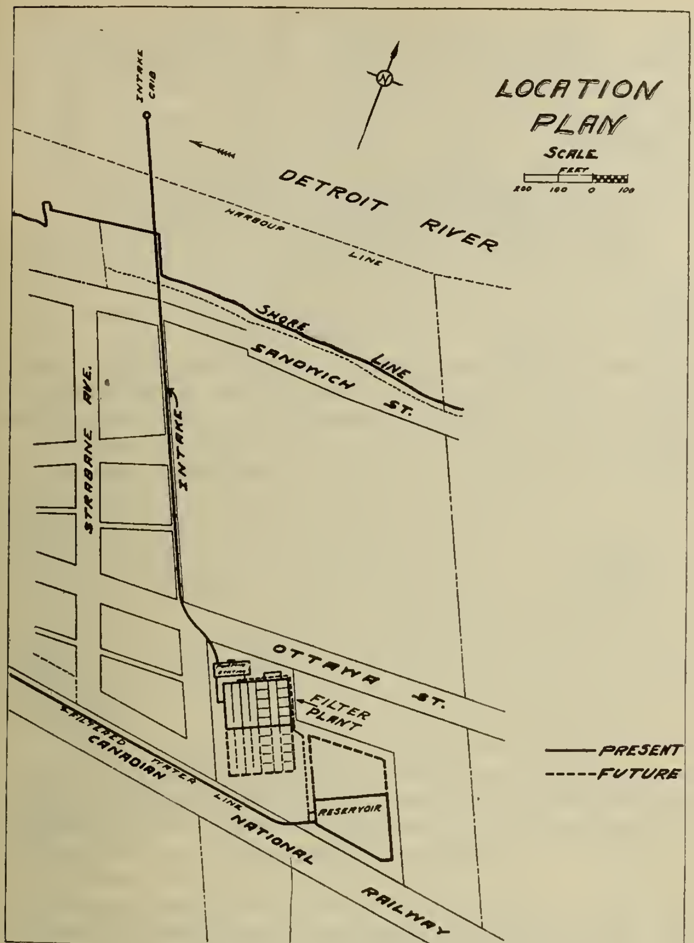

Figure No. 1.—Location Plan.

of Windsor and the privately owned works of the Walkerville Water Company. The area served by the former includes the city of Windsor and the towns of Sandwich, Ojibway, LaSalle and part of the township of Sandwich West, while the latter serves the towns of Walkerville and Ford City and a portion of the town of Riverside and the township of Sandwich East. These organizations have had a common problem in meeting the needs of the fastest growing communities in Canada. The population served has increased from 36,258 in 1915 to almost 90,000 in 1925, an increase of 148 per cent. or an annual increase of 15 per cent. Approximately one-quarter of the population is served by the Walkerville Water Company, the remainder by the municipal system of the city of Windsor. From present indications there does not appear to be reason why this population increase will not continue.

The history of water supply as a utility in the city of Windsor dates back just 52 years replacing the proverbial town pump at the river's edge. Fifteen years later the plant was destroyed but since that time has had a steady growth. The pumping units now installed have a capacity of 25 million gallons daily and plans are now maturing for a new 12 million gallon unit. The daily average output for 1924 was 10,160,000 gallons, equivalent to 170 gallons per capita.

The Walkerville Water Company is the outcome of action taken by Messrs. Hiram Walker and Sons to provide water for their employees. In order that this service might be extended the Walkerville Gas and Water Company was formed in 1892 for the purpose of supplying water to the citizens of Walkerville. The Walkerville Water Company has an installed pumping capacity of 19 million gallons per day. The average daily output for 1924 was just under 4 million gallons, a per capita use of 186 gallons. Industrial use accounted for 93 gallons per capita. From figures secured from various Ontario Cities last year, their maximum domestic rate of 10 cents per thousand gallons compares favorably with any system, either publicly or privately owned.

Like other communities situated upon the Great Lakes or some of their connecting rivers, the water supply of the Border Cities has intermittent turbidity due to wind action which is objectionable. The question of filtration has been under consideration by the Water Commissioners of the city of Windsor and by the Walkerville Water Company for almost ten years and both of these organizations have had independent reports submitted to them on this question by the late Winthrop Pratt of Cleveland. Detailed filter plans had been prepared for the Walkerville Water Company and also for the town of Ojibway, but final action had been deferred.

In 1917 a report was submitted by Mr. Morris Knowles of Pittsburg, then chief engineer of the Utilities Commission, on the joint question of sewage and water supply, in which he recommended the construction of an intake in the neighbourhood of Peche Island with one central filtration plant and pumping station to supply the entire district. The two present pumping stations were to be purchased by the Commission and were to be abandoned. This plan did not meet with general approval and no progress was made. In 1920 a board of three engineers was appointed, Mr. E. M. Proctor representing the city of Windsor, Mr. F. W. Thorold, the town of Walkerville, and Mr. Morris Knowles for the Essex Border Utilities Commission, to deal with the question of water supply for the entire district.

There appeared to be four possible solutions to the problem:-

(1) The construction of three filtration plants, one at Ojibway, one in Windsor and one in Walkerville.
(2) The construction in the city of Windsor of one plant to serve the entire district.
(3) The construction in Ford City of a new filtration plant and new high lift pumping station to distribute all water from this point.
(4) The construction in Ford City of a new intake and filtration plant which would furnish filtered water to the two existing pumping stations for distribution.

Project No. 4 received the unanimous recommendation of the Board. This involved the construction of an

Figure No. 2.— Filtered Water Line.

intake, a low lift pumping station, a 20 million gallons per day filter plant, a 2 million gallon pure water reservoir and a gravity main almost two miles in length to deliver the filtered water to the pump wells of the two present pumping stations.

Before this project could be proceeded with, it had to be submitted to the electors of the seven municipalities interested at that time. Since that time an eighth municipality, LaSalle, has been incorporated and is now participating in this joint project. The division of costs in any undertaking where a number of municipalities is involved is often a source of contention and may lead to the rejection of the proposed improvement. Under the Essex Border Utilities Act the vote of all municipalities must be favorable, failing which, the share of the rejecting municipality may be taken over by the other municipalities if they so desire. If more than two municipalities reject, it must be revoted on by all. The cost of this work was apportioned among the various municipalities on the basis of their estimated use in 1930. Provision is made in the Act under which the Utilities Commission functions by which this apportionment can be changed every two years. This project as submitted received the endorsement of the electors in all the municipalities in January, 1923. The citizens of Windsor were given the opportunity at the same time of voting for a separate plant to meet their own needs but the jointly owned plant received the favourable vote. Construction was started late the same year and it is expected that the plant will be in operation early this year.

As every water reacts differently to the process of filtration it was fortunate in this case that in 1917 the city of Detroit had carried out detailed examinations of the waters of the Detroit river drawn from their intake at the head of Belle Isle about 2 miles higher up the river than the proposed intake site of the Commission. These investigations were under the direction of the late Winthrop Pratt. Experimental filters with a capacity of 167,000 imperial gallons per day were constructed and

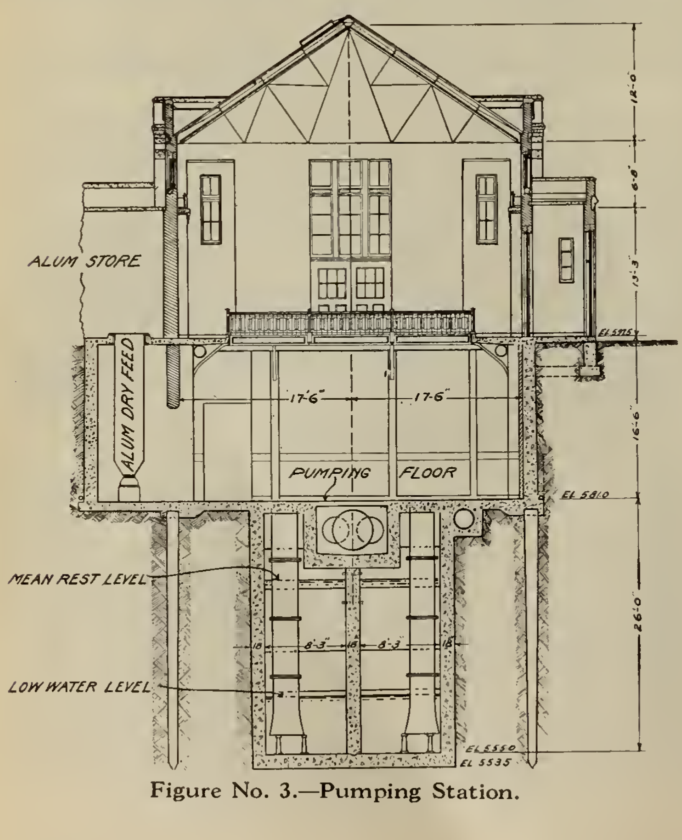

Figure No. 3.—Pumping Station.

kept in operation and under observation for an entire year. Samples of raw, settled and filtered water were collected four times a day and tested for turbidity, alkalinity and bacteria. The operating conditions were changed from time to time to determine the most favourable procedure in regard to time of mixing, period of sedimentation, rate of filtration, kind and amount of coagulant, rate of washing and effective size of sand.

The turbidities of the raw water averaged 30 parts per million with a maximum of 490 parts per million. These turbidities were reduced to almost zero when filtering at the average rate of 160 million gallons per acre per day using 0.80 grains of alum per gallon. In the raw water B. Coli was present in 25 per cent. of the 10 c.c. samples while in the filtered water this was reduced to 5 per cent. The period of coagulation or settlement was less than 2 hours. Mr. Winthrop Pratt's principal conclusions from the experiments were as follows:—

"1. The river water drawn through the present intake can be easily and satisfactorily purified by the process of rapid sand filtration. Its quality is well within the most severe standards fixed by sanitary authorities, for a filterable water.

2. It is feasible to use higher rates of filtration than has been the practice generally in the Middle West heretofore. This results in a decrease in the required area of filters and hence in a saving in the expense of constructing a filtration plant.

3. That instead of three or four hours sedimentation period, as has been the more general practice, less than a two hours' period will be ample, thereby making another large saving in construction cost.

4. That the use of a filter sand having an effective size of approximately 0.50 m.m. gives just as good results as the use of a finer sand and results in a large saving of wash water."

After reviewing the results of these experiments the design of the new plant was based on a rate of filtration of 127.5 million gallons per acre per day and a mixing and coagulation period of 2 hours. The filtration rate of the plant is 21 million gallons per day, that is 2.1 million gallons per day per filter. These rates allow 5 per cent. of filtered water for losses, back washing, and other purposes so as to provide a rated output of 20 million gallons per day. Parts of the plant difficult to construct at a later date or disproportionate in expense should provide for 42 million gallons per day. This applies to lands and easements, the intake, screens, the pumping station, switchboard, alum feed, the main conduits about the plant and the backwash system.

The Detroit river from which the water is derived is part of the Great Lakes system joining lake St. Clair to lake Erie. Its level at the side of the intake has varied during the last 15 years from elevation 569 to elevation 577, but surges in the pumping station are calculated to rise to elevation 579, and as a surge overflow could not well be constructed the possible surge level determined the elevation of the pumping station floor which was placed at elevation 581 and to provide for the surges it was necessary to have a suction well with a surface area as large as possible.

In addition to the filtration experiments referred to, various studies of the water in the Detroit river have been made. These show that there is serious contamination along the shore edges and a relative high degree of purity towards the centre of the stream. Lake St. Clair from which the water is derived being relatively shallow is easily disturbed by winds and the several rivers and water

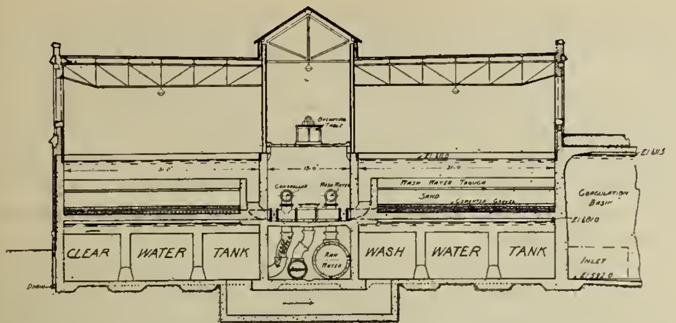

Figure No. 4.—Cross-Section of Filters.

courses which empty into it bring down large quantities of turbid waters particularly in the spring. The presence of Belle Isle protects the intake site from the very serious pollution on the Detroit side arising from its sewage which is discharged untreated into the river. While the river gets some direct contamination from the town of Riverside there is an intercepting sewer on the Canadian side taking domestic sewage from a point one mile upstream and discharging two miles lower downstream protecting the river from serious direct pollution in the vicinity of the intake but it has been observed that reversals of flow of the river have taken place for short periods due to head winds and in ice blockages and this is the most serious possibility.

The discharges from the very extensive shipping which pass close by the intake are a serious possible source of direct pollution. These possibilities of direct and indirect pollutions demand a filter plant maintained in the highest state of efficiency and everything possible has been done in the design and construction to this end.

The existing intakes of the city of Windsor and the Walkerville Water Company have met difficulties by choking due to frazil ice on the occasion of very cold strong winds blowing on open water and it is anticipated that the same difficulties might be experienced at the new intake and to this end the intake mouth which runs straight out from the pumping station with a small angle down stream into about 38 feet of water is terminated by a gradually expanding trumpet mouth 8 feet in diameter with rounded edges at its outer end so as to avoid high velocities of inlet current. But an intake in water running at 2 miles per hour inevitably produces eddies in the water and the formation and collection of frazil ice. Provision in the pumping station has been made to reverse the flow in the intake from the coagulating basins, which when full, are 38½ feet above the mean level of the river, the full pressure of which can be put upon the intake tunnel and pipe. No screens or covers of any sort are placed on the intake mouth because of possible ice difficulties, it being considered desirable to allow everything collectable to come through to the forebay of the screens in the pumping station where large objects would be easily lifted out, the smaller objects being removed by the screens.

The intake mouth is carried by a timber crib loaded with stone. Its placing introduced no serious difficulties. Alignment of it and the 48-inch intake pipes which were laid in a trench excavated in the bed of the river was secured with spherical joints. At the river edge, on Sandwich street, a shaft was sunk and the pipes were continued to it from the river in a short tunnel the entrance to which was protected by a coffer-dam. The remainder of the intake conduit was constructed in the form of an elliptical tunnel 48 by 60 inches driven in clay and lined with 9 inches of reinforced concrete. The total length of the intake conduit is 1,640 feet and it extends 480 feet out into the river.

The low lift pumping station and the filter plant forms a group of buildings of the same general character, and the site admits of the placing of a high lift pumping station which in the case of the second instalment of 20 million gallons per day will in all probability be used for a time at least as a booster station to drive the increased quantities of water through the 42-inch delivery main to the existing Walkerville and Windsor pumpings stations.

The necessity, for reasons of economy, that the first instalment of 20 million gallons per day be delivered by gravity to the existing pumping stations put conflicting conditions into the design. The filters had to be placed at a high level in order to provide the necessary gradient in the pipe line and provide for 10 feet loss of head in the filters and an equal amount in the pure water reservoir and the pumping station floor had to be down at such a level as to be able to draw water at the 42 million gallons per day rate with the river at the lowest level. Thus the water levels of the filters and coagulating basins stand 14 feet above the ground level and the pumping station floor level is 16 feet below ground level making both somewhat expensive to construct but the advantage of having all works together at a site not far from the river in excellent communication with both railway and road is apparent to any waterworks engineer.

The buildings are in one group, consisting of a low lift pumping station and screen house combined, a service building containing boiler house for heating, alum house and men's quarters, mixing and coagulating basins, office, laboratory, stores, garage and a filter house containing 10 rapid sand filters on top of an independent section of the pure water reservoir containing filtered water for backwashing. The pure water reservoir proper is independent and at a short distance away and is earth covered with grassed top and slopes but no embanking has been placed about the group of filters and coagulting basins. The top of the coagulating basins are covered with earth as a protection from frost but this is hidden by a parapdet wall faced with brick and stone. The roofing of the pure water reservoir is reinforced with steel on a three-way plan overlapping over the columns and the columns are staggered in successive rows. This arrangement works exceedingly simply.

The external covering of the buildings is of a specially selected colouring of composite red and brown or brindle rug brick with cut stone facings, plinths, cornices and copings. All parts of the concrete tank work which would otherwise have been exposed high above ground levels are faced with brick or stone leaving an air space averaging 1½ inches which protects the damp walls from frost penetration. Where the brickwork covers considerable plain areas these are relieved by panels of brick on edge with cut stone corners. The exposed tops of the filter walls are

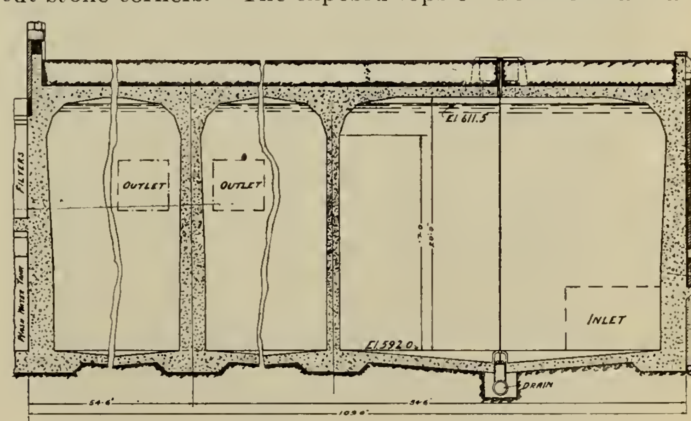

Figure No. 5.—Cross-Section of Coagulation Basin.

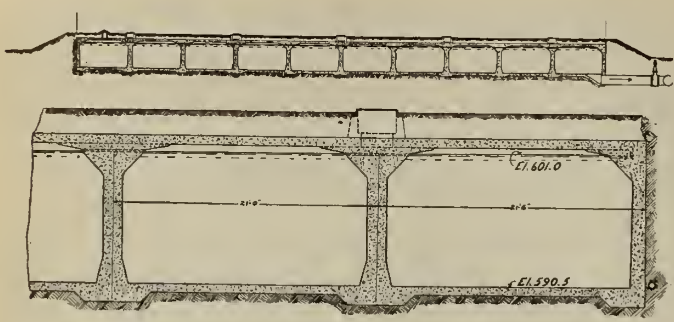

Figure No. 6.—Section of Reservoir.

faced with white glazed bricks and the inner walls of all principal buildings with brown glazed bricks up to a height of 4 feet, the remainder with buff colored brick. The principal floors, footways and stair treads are laid with terrazzo with a small portion of marble at the main entrance and stairways of the office building. The doors and window frames are either of metal or metal cover as kalemin. The roof of the pumping station is copper covered and the remainder of the buildings of composition over concrete except the portion over the filter operation gallery which is covered with wired glass. In the design and construction of these buildings every care has been exercised that the general appearance as well as the structural details and conveniences should be of the best class in waterworks engineering practice.

At certain seasons large quantities of weeds flow down the river and have caused considerable trouble at the existing intakes and to deal with this problem and also with floating ice two travelling screens of the "Link Belt" type have been provided in the pumping station. Each control an independent compartment of the suction well which can be isolated without stopping the supply being pumped from the other compartment. The pumps provided are driven by electric motors and consist of one 21-, one 14- and one 7-million gallons per day units, and a bed is provided for an additional pump of 21-million gallons per day capacity. This arrangement of three sizes of pumps gives considerable flexibility with a view to economical operation because of the methods of charging for electric power. The output of the pumps is controlled from an operating table either by hand or automatically by the level of the water in the coagulating basins.

For backwashing the filters two electric motor driven pumps of 5 million gallons per day each are provided either or both of which are started and stopped by push button remote control from each of the operating tables in the filter house. All gate valves in both the pumping station and filter house which have to be operated frequently are provided with hydraulic power using the pressure of the Walkerville Water Company service system with standby service in the pumping station. A small turbo generator operated by the water in the coagulating basins with independent wiring is provided for lighting in case of electric power failure. The subject of standby power in case of failure of the local Hydro-Electric System received much consideration and it was finally decided to omit this for the present because the provision of the 2-million gallon pure water reservoir would take care of most of the local failures and these could be reduced to a minimum by the provision of two lines, one a private line from the local substation in the town of Walkerville and the other from the nearby local distribution system on Ottawa street. In the event of prolonged failure of the main feeders of the Ontario Hydro Electric Power System, or of the substations, which have now become exceedingly rare, the existing intakes at the high level pumping stations could be brought into service again with the temporary disability of using unfiltered water. As chlorination is to be carried on at each high level pumping station this arrangement introduces no serious health hazard. The hydraulic supply for operating the gate valves is safe from interruption due to electric power failure except in a temporary way as the Walkerville Water Company has ample steam power standby.

The alum supply is of the dry feed type operated by electric motors and is applied after solution to the water as it enters the suction well from the intake tunnel. The dry alum is stored in the service building in the floor of which are openings to two hoppers which hold 6,000 pounds of powdered alum each for the two machines. It is intended that the filling of the hoppers be done by a day man and the capacity of the hoppers are such that they will contain sufficient alum to last from Saturday mid-day to Monday morning with a filtration rate of 42 million gallons per day. In the service building are provided two heating boilers one to use oil fuel, the other coal, and men's quarters with lavatory and shower baths are provided. In the pumping station a balcony at ground level 16½ feet above the pump floor is provided completely around the building. At one end this balcony is widened to carry the main switch board and at the other to provide for a machine shop.

The water from the low lift pumps passes through a 42-inch flow meter into duplicate mixing and coagulating basins built of reinforced concrete and brick faced on the outside. The mixing of the alum with the water is chiefly brought about by the action of the centrifugal pumps. The mixing basins are at the near ends of the coagulating basins and are deep channels with baffles at top and bottom leaving gradually widening spaces so that the alum treated water will be moving relatively slowly when it enters the coagulating basins. The coagulating basins are of the go and return type each passage being 25 feet 3 inches wide and 20 feet deep. Six sludge valves are provided in each basin to which the floors are sloped. The water enters the basins close to the bottom and leaves near the top through a valve chamber and concrete culvert leading to the filter house where it is distributed from a 5-foot concrete pipe placed together with a 30-inch main drain in a lower pipe gallery.

In the upper pipe gallery are placed the hydraulic gate valves for the rate controllers, the wash water pipes and hydraulic service pipes. An endeavour was made to have this pipe gallery more accessible and presentable than usual and to this end the operating gallery has been raised above the level of the filter walls so as to admit daylight and provide air circulation. Access is provided from a landing on the main entrance stairway.

The present filters are ten in number, each of 700 square feet in area, in two rows of five each with the operating platform and pipe galleries between them. While each filter can be operated independently each set of two filters opposite each other are operated together with one controller and one operating table with the necessary indicators, recorders, gauges, and meter but the backwashing is done to one filter independently while the other filter is in operation. The backwash water is metered by a flow meter. The operating tables face the entrance from the upper landing of the office building and are in the centre of the fairway of the operating platform leaving ample space on either side. This arrangement effects a considerable saving in expensive apparatus. It is possible to extend this idea to cover more filters but it introduces the difficulty to the operator of seeing the filters from the table and the necessity for backwashing all filters so grouped together at about the same period as a single controller to several filters overloads the filter with the least loss of head.

The underdrain system consists of 3-inch cast iron pipe laterals joining a manifold along the centre line of the filter. These pipe laterals are 7 inches apart and have brass nipples with 5/16-inch holes at 7-inch intervals placed on the undersides of the pipes. At the manifold where the depth of gravel covering is reduced, umbrella slot openings are provided. The whole is levelled up with two sizes of loose gravel and finally a 6-inch layer of cemented gravel which has passed through a 3-mesh per lineal inch sieve and caught on a 5-mesh. The proportion of cement by volume is one-twelfth. This forms a firm porous layer which with proper working can never be disturbed while backwashing. The porous cemented gravel is blinded with 2 inches of coarse sand or fine gravel on which the filter sand is placed. The total depth of gravel is 16 inches and the sand 28 inches. The sand has for the most part an effective size from 0.45 to 0.55 millimeters and a uniformity coefficient of 1.4 and comes from pits at Bay City, Michigan.

The pure water reservoir has been constructed in plan in the form of a rectangle with one corner cut off. The necessity for this arose from the form of the land acquired which owing to various limitations, historical, financial and political, has an exceedingly rugged boundary but when the plant is fully developed there will be very little of the area unoccupied.

The delivery main has been laid along the edge of the Canadian National Railway right-of-way which has a minimum width of 110 feet. The pipe is encased in concrete as it has to be capable of carrying over it the heaviest of locomotives. At the present an agreement with the railway limits the pressure in the main to 30 pounds per square inch, but it has been tested throughout to 110 pounds, so that if in the future this 30 pounds pressure allowance is augmented the physical conditions are satisfactory. The pipe for the most part is of rivetted steel plate 5/16 inch thick laid to a hydraulic gradient with a few short dips to avoid existing sewers and it is possible the pipe may run at some time only partly filled. Air valves of the double orifice type are provided where desirable. The connection to the Walkerville System introduced no difficulties as the pumps operate on a closed suction system and a large branch connection had already been provided to which the 24-inch branch is attached. The conditions at Windsor were not nearly so favourable as the pumps draw from a small open suction well, impossible to control by hand operation of the gates. In the event of a power failure when drawing water at the future maximum rate of 30 million gallons per day the Windsor pumping station would almost instantly be flooded or if automatic control closed the gates too quickly the main would be endangered. The situation was entirely unusual in waterworks practice for so large a quantity of water on so long a supply main. The situation was met by the provision of a regulating tank 25 feet square provided with the necessary valves for hand control, but also with duplicate automatic 30-inch float-operated safety valves specially designed for this work. These valves automatically maintain the water at a level not higher than some 8 inches below the floor of the pumping station and in the case of a power failure these valves close as the water rises in the tank but, when the pressure in the pipes increases due to momentum to the 30-pound limit, the floats immerse instead of closing the valves further. The excess water entering the tank then passes away by an overflow. Venturi meters measure the supply of water to the two high lift pumping stations.

The total cost of the work including everything is approximately one million dollars.

The extension of the main pipes from Windsor to Sandwich, Ojibway and LaSalle has been carried out for a further sum of $385,000. This work presented no unusual features.

The works described above were designed by the writers of this paper, William Gore, of Gore, Nasmith & Storrie, consulting engineers, Toronto, and by J. Clark Keith, chief engineer to the Essex Border Utilities Commission. A. W. Hammersley acted as resident engineer during the construction of the work.

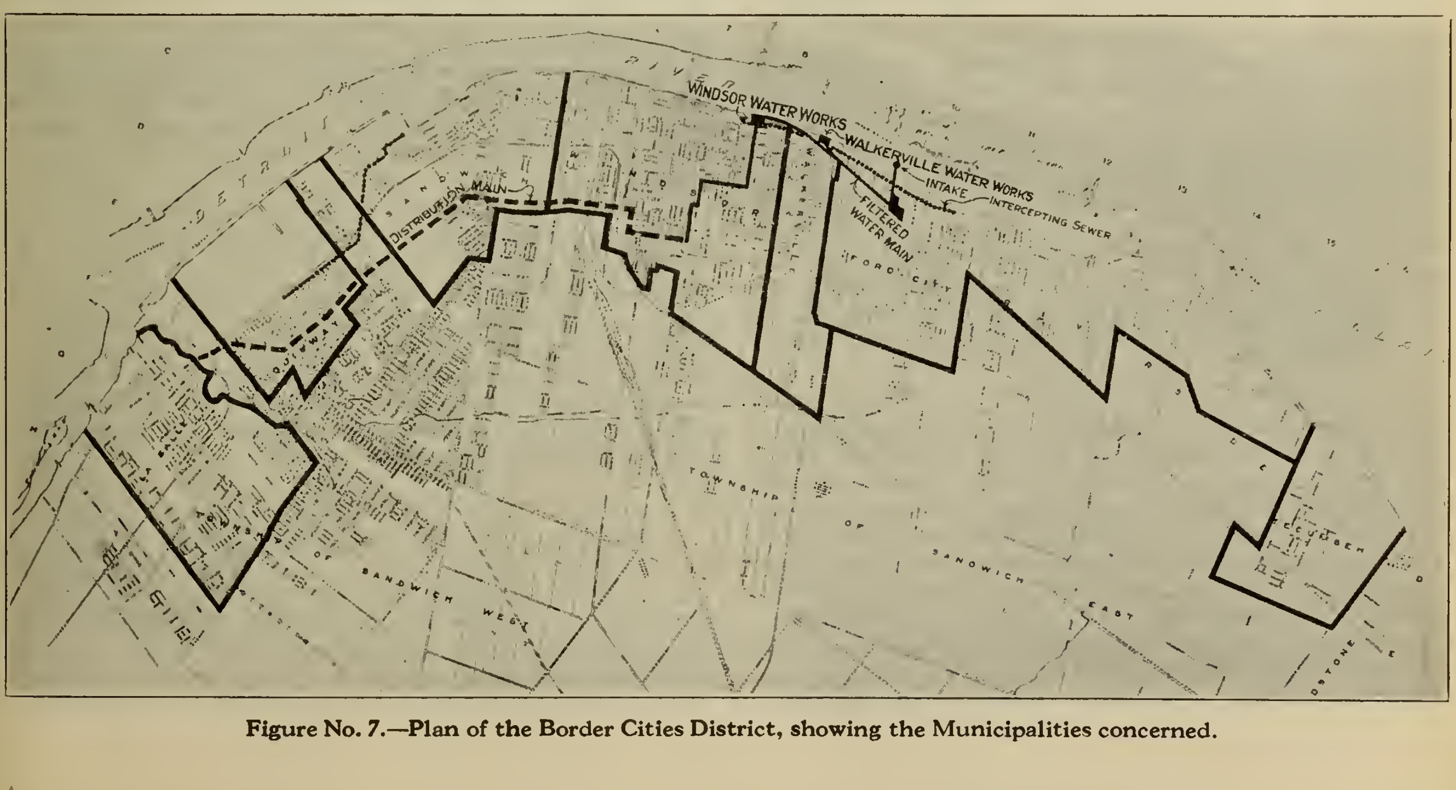

Figure No. 7.—Plan of the Border Cities District, showing the Municipalities concerned.

Influence of the Modern Highway

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Consulting Engineer, Toronto, Ont.

Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 29th, 1926.

Different periods in the world's history have been distinguished by attainments and achievements of varying types; such periods as the golden age of art, the age of crusading, revival of learning, the age of discovery, or the golden age of the drama. The present period is notable with respect to development in means of travel, transportation and inter-communication. When the history of the present epoch is written, we may well expect it to be known as the age of transportation.

To this era belong the steam and electric railway, the motor vehicle, the aeroplane, and the allied means of communication by telegraph, cable, telephone, the modern postal service, wireless, and radio; all means for the transferrence of goods, people, thought, to an extent scarcely surpassed by the most fantastic imagination of fiction.

When our ancestors crossed the Atlantic a century ago, the journey occupied from six weeks to three months, and was an adventure indeed. To-day this trip may be made in luxury in less than one week. Crossing the continent from Montreal to Vancouver, 2,937 miles, was then almost an impossibility, but has recently been accomplished in 72 hours by diesel-electric car. A century ago, a letter from India by the most rapid means of communication, might reach Canada in a year. To-day a cable message is delivered within a day.

The civil engineer should be, to the municipal unit, and to the field of transportation, what the architect is to the house. He should build and remodel for present needs, and should foresee and provide for future requirements. The introduction of the motor car, and its growing use, are bringing about changes and creating opportunities so gradually that they pass almost unnoticed, yet are of very great moment in the municipal plan. Without enumerating all influences, one has only to refer to the character and rapid extension of highway improvement; to changed methods of paving and the more scientific use of paving materials; to the width and design of roads and streets; traffic regulation; the distribution of population; or the influence of motor traffic on other forms of transportation, particularly on steam and electric railways. It is therefore fitting that the economics of the highway as represented by the road and the vehicle using it, should be the subject of careful observation.

Growing Use of Motor Cars

There is already a younger generation who find it difficult to realize that the motor vehicle is a very recent addition to our means of travel. They reflect, no doubt, that it must have been a very crude world indeed, without the family motor car, — comparable to an earlier day of oxen and stage coach. Yet the motor car is so modern that, in many ways, its ultimate influence is still a matter of conjecture.

It was in the year 1898 that the first gasoline driven motor car was owned by a citizen of Toronto, and Hamilton had an automobile owner in the same year. In 1903, the use of motor cars was considered such a menace on the public highways that their registration was commenced, and in that year 220 were recorded; but probably 60 per cent of these were owned outside of Canada. Registrations grew to 4,230 in 1910, of which 1,977 were owned in Ontario. For the current year it is estimated that 293,000 passenger cars will be registered, and 33,000 commercial vehicles and trucks: in all 326,000 registrations for the year, not including several thousand motor cycles. This is an average of one vehicle for each nine of population; and compared with population, is on a par with the state of New York. Massachusetts has one car for each 8.28 of population, and Iowa one car for each 4.29. The proportion of cars to population is greater in agricultural than in manufacturing communities. In Ontario, somewhat midway between the agricultural character of Iowa, and the industrial character of the New England states, it is evident that the condition of maximum saturation has not yet been reached.

Increased Value of the Road

The vehicle and the road are but parts of one machine. The value of the common road is proportional to the capacity of the vehicle which uses it. Prior to the day of the motor vehicle, the value of the road, as a factor in transportation, was represented by the working ability of the horse-drawn vehicle.

For haulage, the horse-drawn vehicle is represented by an average day's work of twenty-four miles, twelve miles loaded, twelve miles light; a working capacity of 18 ton-miles daily. Motor trucks carrying five tons, with 3½-ton trailer, or 8½ tons in all, are making trips of one hundred miles in a day. If the return trip is made empty, the daily capacity is 425 ton-miles. That is, the haulage capacity of the modern road is nearly twenty-four times as great as in the day of horse-drawn traffic.

In the case of passenger traffic, forty miles was a long day's journey for an ordinary driving horse, and with two in the carriage, was equal to 80 passenger-miles. This is comparable to the motor car travelling 325 miles in a day, with six passengers, and equal to 1,950 passenger-miles. Again, for passenger traffic, the capacity of the common road is twenty-four times as great as in the day of horse-drawn traffic. This increase of efficiency throws light on the great strides now being made in the building of roads through the open country.

Road Expenditures

In keeping with the increased carrying capacity of the highway, expenditures in construction and maintenance have largely increased. In Ontario, expenditure on rural roads in 1900 was about $2,000,000. annually. In marked contrast to this was the outlay in excess of $175,000,000. during the period 1912-1925. During the same period, 1912-1925, the adjacent province of Quebec spent $68,000,000. on roads; and all provinces of the Dominion have augmented their road expenditures in proportion to their resources.

The advanced types of construction in use, and the general results of the large expenditures being made, are indicated by the following schedule drawn from official sources, and giving the mileage of various surfaces on rural roads in Ontario and Quebec at the end of 1924:

Type of surface	Ontario	Quebec
	miles	miles
Gravel	24,624.12	4,088.16
Broken stone	3,052.00	627.47
Macadam with oil or tar carpet coat	617.26	946.31
Tar or asphalt penetration	551.32	138.03
Asphaltic concrete	450.91	62.53
Sand clay	none	145.43
Other surfaces	2.00	none
Total miles surfaced	29,297.61	6,007.93

In addition to the foregoing surfaced roads, Ontario has 22,470 miles of graded earth road, and Quebec, 16,000 miles. While these are the two leading provinces of the Dominion, other provinces have been putting forth a similar effort to improve road conditions in accordance with their requirements.

New Demands on the Road Surface

Before the coming of the automobile, the water-bound Macadam and Telford surface was regarded as a high standard of construction, for roads of the open country. In some portions of the continent, gravel was available, and was regarded as a useful, if less durable, substitute. The most damaging form of traffic, was the rutting effect of narrow tires, and the pounding of steel shod horses' hoofs. The Macadam was invariably "water-bound"; that is, bonded by a mortar of dust and water. This mortar was being continuously restored and re-cemented, by the grinding effect of steel tires, combined with nature's rain-fall.

But with the self-propelled motor vehicle, new conditions arose, in which the wear of horse-drawn traffic has passed into insignificance. This new form of destruction, was the dust, removing effect of the motor vehicle, which lifted and scattered the bonding material of water-bound Macadam, developing the road into a pitted surface of shallow holes, finally leaving it a ravelled mass of loose stone. This difficulty was first met in Italy and then in England, by covering the Macadam with a carpet coat of tar, and this system of surface treatment was later followed in England by tar penetration, then by other forms of mixed bituminous construction.

The motor truck came into being with the perfecting of the gasoline engine, and has increased steadily in numbers. Many of these were of abnormal weight, and required of the roads not merely an armoured surface, but augmented depth and strength of foundation to carry the increased load. The weight of trucks is commonly restricted by law, a weight of 14 tons being ordinarily adopted in the United States. In Ontario the maximum weight of a loaded vehicle is restricted to 10 tons, no axle to be loaded in excess of 7 tons, and no wheel in excess of 600 pounds per inch of tire.

The decline of horse-drawn traffic, and growth of motor traffic are indicated by the following census statistics at several stations on the Ontario provincial highways.

Windsor-Quebec bdy. highway	Daily average Horse-drawn vehicles	Total daily average all vehicles
South of Windsor at Howard Ave.		
1914	112	214
1922	50	1,186
1924	17	2,578
1925	9	1,727
Binkley's Corners between Hamilton and Dundas		
1914	321	484
1922	120	3,130
1924	97	5,761
1925	38	2,867
Long Branch (Toronto-Hamilton)		
1924	85	7,858
1925	57	9,133
Corner of Danforth and Markham (Kingston Road)		
1922	133	4,779
1924	108	2,920
1925	132	4,233
West of Belleville		
1914	155	223
1922	173	1,048
1924	56	1,175
1925	30	936
West of Brockville		
1914	277	414
1922	158	821
1924	86	1,216
1925	29	1,068
Near Cornwall		
1922	199	842
1924	141	1,015
1925	164	1,367
Toronto-Jarvis Hy. via Dundas St.		
Bloor and Dundas Streets, Islington		
1914	250	612
1922	60	1,751
1924	41	4,570
1925	15	4,240
Toronto-Severn Highway (Yonge Street)		
Langstaff Corner		
1914	88	337
1922	38	1,190
1924	36	4,132
1925	19	3,630

Width of Highways

Increased traffic has naturally turned attention to the width of highways. Of this, there are two phases: (1) The width of roadway graded and paved for vehicular traffic; and, (2) the total width of highway allowance reserved for all purposes.

The latter of the two, the highway allowance, has been generally surveyed in Ontario, with a width of 66 feet, but this has been commonly encroached upon by fences of adjoining property owners, so that the width has been frequently reduced to from 50 to 60 feet. The road reservation of 66 feet, (one chain), appears to have been arbitrarily selected because of convenience in chain measurement by the surveyor.

The width of 66 feet was found by experience to be well adapted to conditions of horse-drawn traffic, before the day of universal telephone and telegraph service and intensive motor traffic. In Michigan, to diminish the blocking of roads by snow-drift, the main highways are being widened to 150 feet in the northern part of the state, and to 100 feet in the south where land is more expensive. In Ontario, many main roads now have a width of 86 feet which is markedly beneficial to winter traffic, and is a minimum width which will provide space for adequate drainage, telegraph and telephone wiring systems, permanent tree growth, and foot-paths, in addition to reasonable increase of vehicular traffic. The need of foot-paths is everywhere becoming apparent on main highways, but unfortunately, as on parts of the Toronto-Hamilton highway, their construction has been delayed because of insufficient space within the road allowance of 66 feet.

Provincial highways of Ontario are generally graded to a width of 30 feet between open ditches, with the central 20 feet paved for traffic. Modern methods favour the adoption of a width of 10 feet for each lane of traffic. Where a double lane is not sufficient, experience indicates that a three-lane width tends to unsafe conditions and accidents: and that increase from a two-lane width should be to a four-lane width, from 36 to 40 feet wide.

Surface of the Motor Road

European practice, and particularly that of England, has developed the use of tar and tar mixtures spread over the surface of old Macadam. These old stone roads, well settled and compressed under traffic, made an admirable base for such protective treatment. The use of asphalt in Europe was largely confined to bituminous limestone and sandstone, one of the best known deposits being that of Val de Travers in Switzerland. This material was ground to powder, heated, spread and rolled in a manner and with results similar to the artificial mixtures of the American continent.

On this continent, tar was adopted at an early stage following over-seas practice. But in addition, asphaltic pitch and asphaltic oils were similarly used with a growing measure of success. The cement-concrete surface for main highways originated on this continent. Indeed the use of pitch asphalt, asphalt oil, cement concrete, and even the well-maintained gravel road, are among the contributions of the American continent to the modern motor road.

Sheet asphalt was first used on this continent about the year 1870; an artificial mixture of sand and Trinidad asphalt based on the use of bituminous rock asphalts of Europe. In American practice the sand and asphalt were heated separately, intermixed, then spread over a strong foundation, usually of concrete, to a depth of two or three inches.

In adapting asphalt to main country roads, much was learned from the early use of sheet asphalt. For instance, many early pavements developed a rippled surface, and it was found that the grading of the sand was as important as the quality of the asphalt. The asphalt pavement crept into a wavy, distorted surface, and this was overcome by using an open binder course, with a dense mixture for a wearing surface. Asphalt on little travelled streets cracked and disintegrated, and it was learned that asphalt needed a certain amount of traffic to keep it ironed out. A suitable mixture was found necessary to meet extremes of temperature; one which would not become excessively soft in hot weather, and which would not be brittle under low temperatures.

Nearly coincident with the coming of the motor vehicle, was the introduction of what is now generally known as "hot mix", and "stone-filled" asphalt. This is comparable to a sheet asphalt composed of sand and bitumen, to which a limited amount of crushed stone is added, of diameter up to 1-inch or 1½-inch material. The crushed stone is intended to provide a less slippery and more durable surface. With this type of surface is associated the theory of maximum density of aggregate: that is, a pavement composed of stony aggregate from fine dust to coarse stone, and so graded that all interstices are filled with stony material, but each particle thinly coated with bitumen to bond it to its neighbours. The object was to make a compact mixture, impervious to moisture, and strongly resistent to the weight of traffic. These features were originally incorporated in a patented specification, but the essential patents having expired, the principles are in general use in "hot-mix" pavements.

It is distinctive of the ordinary form of sheet asphalt, and of "hot-mix", (which is now commonly known as asphaltic concrete), that they are mixed hot and immediately taken to the road to be spread and rolled while still heated. There is another form of asphaltic surface which is mixed hot, but by special treatment may be allowed to cool, and applied to the road in a cold condition. In England, one form of such a material is well known under the proprietary name of "Tarmac", a mixture of tar and slag. On this continent, a proprietary pavement known as "Amiesite", is of a similar character. It obtains its mobile quality when cool by the use of fine crushed stone, (in place of sand), which has been coated with kerosene before the hot asphalt is intermixed with it. Used for a number of years in the United States, the methods of manufacture in Canada, are bringing it into prominence as a pavement having exceptional and interesting qualities.

It is notable that in the early use of bituminous penetration, based on the tar Macadam of England, there were many cases of failure on this continent. Many of these roads were built in America as one work, comprising a new earth grade, a comparatively thin, (four or six-inch), stone base, and a two or three-inch wearing surface of broken stone, with tar or asphalt poured into the interstices. The inevitable failure followed, and bituminous penetration came in for much condemnation. The new earth grades settled, the thin foundations followed, surface depressions developed which held water, the road became rough, and was ultimately broken up by heavy trucks and fast motors, a traffic for which the road was not designed. American road-builders were slow to learn the lesson that success in England was largely due to the fact that the tarred surface rested on an old, well-settled road-bed, and that similar conditions must be created here before the bituminous surface would support traffic. Roads of this type in Ontario, have been created very largely by a process of development, the foundation being subjected to traffic for two or three years with carpet treatment, before the penetration surface is laid.

The concrete pavement as applied to main country roads, is purely a new-world development. A few cement-concrete pavements had been laid on town and city streets, prior to 1908, notably in Windsor, Ontario. These were of a two-course type, very similar to the concrete sidewalks which had been in common use for a quarter century. But it was in Wayne county surrounding the city of Detroit that the modern cement concrete pavement came into being. The distinctive features of the Wayne county work, were:

(1) A one-course mixture, the full depth of the pavement;
(2) A mixture rich in cement using proportions of 1:1½:3; whereas in ordinary concrete a mixture of 1:3:5 had previously been employed.
(3) Carefully selected, clean aggregates.

Experience with cement-concrete used in this way, to meet the needs of motor traffic, was little short of revolutionary in highway methods. It set standards of quality and cost, which have largely governed the use of all materials.

Since the early use of the cement concrete pavement, there has been considerable refinement in methods, and superior results are now being obtained. A notable advance was made as a result of extensive tests in the state of Illinois, from which a more scientific section was evolved to meet the needs of heavy truck traffic.

Sanitary Conditions on the Street

The horse has been largely replaced on urban streets by motor vehicles, except in a limited degree for draft and delivery purposes. Statistics for Ontario show that the number of horses owned on the farms has increased from 617,309 in 1900, to 644,138 in 1925; but their use is largely confined to farm operations. The extent to which the horse has been withdrawn from use on the road is indicated by the disappearance of the blacksmith shop from rural corners and villages, and in place of the smithy is the garage. Farmers are largely using the motor in place of the driving horse, and local centres on Saturday night are lined with cars, in place of the horse and buggy of twenty years ago.

Improved sanitary conditions are an outstanding result of the withdrawal of the horse from urban streets. The menace of offensive street dust has been greatly lessened. It is no longer necessary to permit a thick layer of refuse to accumulate throughout the winter, to be removed in the spring. The garage has taken the place of stables with their adjacent piles of manure. Filth-carrying flies have had their breeding places lessened in stables and on the streets. Much less street refuse reaches the sewage disposal plant, but the problem of oil waste has taken its place.

Street cleaning has become a much simpler operation, and the amount of refuse to be removed has been substantially reduced. The number of men composing the old "white-wing brigade" has been greatly lessened. The following statistics from Toronto are representatives:

Year	No. of men employed	Refuse removed cubic yards	Miles of paved street
1914	440	139,000	323.02
1924	138	75,000	446.41

That is, in 1914 one man was required for each three-quarters of a mile of pavement for street cleaning operations. In 1924, the average is one man for 3¼ miles. In 1914 the refuse removed from streets was 430 cubic yards per mile annually; in 1924, the amount was less than 168 cubic yards per mile, or about 39 per cent of that removed in 1914.

Distribution of Population

The combined influence of the motor vehicle, and radial electric railway, of recent years has tended to the wider distribution of city population in suburban districts, and to the growth of satellite towns surrounding large cities. Men of wealth, by means of the motor car, have been enabled to adopt a rural method of living in well-appointed country homes. Their offices and places of business are often in congested "sky-scraper" areas, but the distance from office to home is traversed night and morning in a motor car.

A more striking manifestation of this influence, however, is to be seen in the number of small houses which gradually dot the country side around large centres of population, and which as they accumulate, are gradually grouped under the term of "shack-town". This is a form of modern pioneering which is deserving of all encouragement. Working men who take their families into the suburbs of a city under such conditions, are not devoid of ambition, nor are they willing to live permanently in a shack. Rather they are men of courage who are willing to accept the inconvenience of a pioneer shack for a time, in order that they may ultimately own a good home. They first pay a deposit on a plot of land and build a shack on it. By thrift they become able to pay for the land, and then by their own labour, are able to commence the building of the house that ultimately takes the place of the shack. Soon they are owners of a home and garden, in open air surroundings, a home that tends to the well-being of a sturdy family. The history of "shack-towns" as a rule is that they develop into districts of comfortable homes for labouring men.

The labouring man employed in the city can do this because of the facilities of a radial line within easy reach; or because he can buy a second-hand car for $100., to carry him to and from work. Shack-town, and its tendencies, are part of the problem of town planning.

Influence on the Steam and Radial Railway

Modern highway traffic has had a marked influence on other forms of transportation, particularly on the electric radial and inter-urban railway and on the steam railway. There are numerous examples in Canada of electric railways which have succumbed to the influence of the motor vehicle, and the end is not yet. The eastern states show many similar examples, where electric railways are rusting in idleness, not a wheel turning. Even steamship traffic on the Great Lakes has been yielding to the same pressure. Steam railways are finding a serious inroad upon their receipts through the loss of short-distance travel and transportation. The situation is unfortunate both for the public and for the companies affected.

The disarrangement arises out of the growing use of the privately owned motor car, the motor bus, and the motor-truck. The citizen of Toronto, for example, desiring to do business in Hamilton, can step into his car at his Toronto office or residence, and drive directly to the office of the man he desires to see in Hamilton. In Hamilton he can drive from place to place at his convenience. He is not tied to the railway time-table, and there is no tedious waiting for delayed trains. He goes and returns rapidly, comfortably, and for these reasons the short-distance railway journey is forsaken for the private motor car.

The motor truck is carrying much of the milk, fruit, farm produce, merchandise, brick, steel, for short hauls in competition with steam and electric railways, and lake transportation. Distances up to and exceeding 100 miles are covered in this way by the motor truck.

The reason is not that the motor truck, in actual mileage costs, is cheaper than the railway. On the contrary, the motor truck in straight running cost is not and never can be a competitor of the railway. But railway terminal costs are high, while the motor truck has practically no terminal charges. Delivery by truck is from door to door, costs of rehandling are eliminated, and delivery is made by the truck in one-third to one-half the time required by the railway.

The motor bus traverses the main highways, stops at gate-ways, the better class of busses are enjoyable to drive in, and to them electric railways are yielding much of their former revenue.

The president of the New York, New Haven and Hartford Railway has estimated on the basis of carefully ascertained statistics, that in the state of Connecticut in 1922 there was a potential loss to his railway of over $21,000,000. from the competition of the privately owned motor car, the motor truck and the motor bus. The case is no doubt extreme, but is indicative of the influence of motor transportation.

Railway companies have pointed to the low rate of taxation applied to motor trucks and motor busses, and the advantage they enjoy of the comparatively free use of the highway, while railways have their tracks to build and maintain.

On the other hand, the public reply that railways have been largely subsidized, — sufficiently in most cases to build their tracks. Also, that the citizen who pays taxes for the building of highways, is as much entitled to the benefit of cheap use of these highways by the truck he hires, or the bus he patronizes, as is the owner of a private car or truck.

The writer is of the opinion that the difficulty of the older transportation companies cannot be successfully met by any attempt to tax the truck or bus off the road. This principle, if generally applied, would mean the end of all progress. The situation is unfortunate, and until it is adjusted, inconveniences must necessarily arise.

The public are not always benefited by these changes. For example the well-heated electric car is more reliable, and is preferable for winter traffic. During January, February, and portions of December and March, at least three months of the year, steam railway and electric transportation are desirable, and in many cases a necessity. Yet the best service cannot be given by these, if service can be given at all, without a continuous patronage of the public throughout the year. Indeed many electric railways were formerly operated at a loss during the winter, for the sake of the profit of heavy summer traffic. The public need the winter railway service, but they cannot have it because of having withdrawn their summer patronage.

The solution may not be so much one of eliminating competition by arbitrarily adding to the cost of highway transportation, as one of increasing the service which steam railways can perform. Also there may be necessary, a clearer recognition of the respective fields in which the motor bus and the radial railway should be encouraged to function. It is long since steam railways have succeeded in materially reducing terminal costs, or lessening terminal delays, and in this an opportunity would seem to lie. The radial railway can best function in providing fast transit from satellite towns to a large urban centre, carrying passengers to the business hub at a speed and with convenience which private cars and motor busses cannot materially surpass. It is to be emphasized that the function of the radial railway is not that of a rural street railway. The "rural street railway" suggests frequent stops, and therefore slow service. The radial railway is essentially suited to fast inter-urban traffic, rapidity of service must be provided, and to this end frequent stops must be eliminated. Nor can inter-urban passengers be successfully dumped at, or taken from the terminus of a city street railway. To do so is to invite well-merited failure. If the electric radial railway is to co-operate with the facilities of the modern highway, rapid transit must by some means be continuous to and from the urban centre. Having determined economic limitations, suitable restrictions can be applied, to the advantage, not to the detriment, of the public. Co-operative rather than competitive measures are needed.

Future Development

"We judge of the future by the past." This brief outline of some phases of the highway situation has had its origin in a wish to suggest the possible lines of future development, rather than to assume the role of a prophet in regard to them. It is scarcely reasonable to assume that, in the brief period in which the gasoline engine has been in effective use on the highway, a maximum of efficiency has been reached on the part of the vehicle. As vehicle efficiency increases, as their number grows, the highway will be enhanced in economic value. Highway research is in progress, but is scarcely more than in its infancy. The field is new and the possibilities of the development of new ideas, and the more scientific application of old, are everywhere apparent. It is still a field in which much progress may be anticipated.

Some Phases of Industrial Relations

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Industrial Relations in its simplest form is the relation between men and management,—the human relation in industry,—sometimes called "Human Engineering".

The usual conception of engineering in its broad sense is that of an exact science governed by definite laws and reasoning from cause to effect and from effect to cause. Human engineering may be considered a science, but it is far from exact. It deals with the minds and motives of men and the problems are more involved because of the many unknown quantities entering into the equation.

The solutions of these problems are as varied as the human element which is the principal factor to be considered first and always in every organization of men in industry.

A thorough, systematic, and continuous study of the wants and needs of men is a prerequisite of proper and intelligent administration of "Industrial Relations".

The medium through which this administration is carried on may vary as the type of management organization varies in different concerns but there should be, especially in every large company a definite unit of organization having charge of this important function. This unit is frequently called the Industrial Relations Department or Personnel Department.

The function of an Industrial Relations Department has been aptly expressed as "the direction and co-ordination of the human relation of any organization with a view to getting the maximum necessary production with a minimum of effort and friction, and with proper regard for the genuine well-being of the workers".

A department having such purposes and duties is essentially a "staff' unit of organization, although there are some elements of "line" duties which are, generally speaking, of a character pertaining to a "service" department. An Industrial Relations Department has therefore the functions of; advisory service to the management in the preparation and adoption of employee relations policies, responsibility for the administration of those policies, and a personnel service to the line organization to promote the ultimate successful operation of all the elements entering into these manifold and important relations.

Notwithstanding the extent to which the Industrial Relations Department may function in its administrative capacity, it must be constantly borne in mind that the final responsibility for any successful plan of employee relations rests fairly and definitely on the line organization. It is an integral part of operations and must be handled as such by those having responsibilities of management and supervision of men. It constitutes a major problem of administration and is of vastly greater importance than machinery or materials. It is essential that all executives, both major and minor, are well versed in the elements and principles of personnel policies, and it is no small part of the duties of those in charge of Industrial Relations Departments to thoroughly "sell" the entire supervisory force on the whole plan under their administration, not only as to fundamentals but as to details of operation. I wish to emphasize the necessity for proper attitude of mind and full understanding of the objectives of these policies on the part of those who are in charge of the working force. This particular phase of the subject is of special interest to engineers and engineering students for the reason that, if the estimate made by the dean of one of our engineering schools is reasonably accurate, 75 per cent. of the graduates of engineering schools subsequently occupy positions of an adminstrative character and are leaders or advisors of large groups of men. Engineers should therefore prepare themselves for these responsibilities by acquiring a knowledge of the fundamentals of industrial relations, preferably in my opinion, as a part of the curricula in engineering colleges.

The question of whether, and how much this subject should have a place in engineering courses has been much discussed both by industrialists and by deans and professors in our engineering colleges. Whatever policies may be followed in this connection in the various colleges, which will differ according to the weight given to this subject in its relation to other subjects, there is evident a growing tendency to give a place in engineering college curricula to the fundamentals of industrial relations as an important phase of management to which so many engineering students and engineers aspire and attain.

In order to present more clearly the various phases of industrial relations and the functions of the department responsible for the development and carrying out of personnel policies, I desire to outline to you the specific undertakings now in operation in the Commonwealth Edison Company, a public utility employing about 9,000 people supplying electricity in the city of Chicago. In citing our own experiences it is not intended to convey the impression that our plan is the best or that it should be followed by other companies. Each one should decide for itself what policies should be adopted to provide for its particular needs.

The Industrial Relations Department of the Commonwealth Edison Company was established January 7th, 1921, headed by the manager of industrial relations reporting to the president. To the manager was specifically assigned the administrative responsibility for developing and carrying out a comprehensive personnel and employment policy in the company service, and for the management of the units of the company organization performing functions of personnel adminstration. He is also responsible for co-ordinating the work of these units of organization and the personnel activities of company committees and employees' associations. The heads of departments were "directed to co-operate with the manager of industrial relations in such manner as to aid in the accomplishment of the purposes for which this department has been established in our organization".

The specific functions of the department may be divided into three parts: 1—Administrative functions, which include the operation of the Employment Division, Medical Division, Safety Division, Education and Training Division, and the Employees Service Division. 2—

Co-operative functions having to do with various employee activities, which include the Employees Representation Plan, the Edison Club, the Edison Symphony Orchestra, Edison Round Table, Lake Lawn Vacation Resort, Employees Suggestion System, Good-Will Service System, Commonwealth Edison Post, American Legion, two Companies in the Illinois National Guard, the lunch room, and recreation rooms for men and for women. 3—Thrift, insurance and service annuity plans, which include the Commonwealth Edison Mutual Benefit association and the company's plan of co-operation therewith, Group Insurance, Employees' Savings Fund, Building Loan and Savings Association, and the service annuity system.

Administrative Functions

Under the first division of administrative functions, while not attempting to enumerate the detailed duties and responsibilities of the divisions of the department, the scope of each of them may be summarized as follows:—

Employment Division:—Recruiting, interviewing, testing, selecting, and placing of new employees; arranging transfers and promotions, reviewing separations; classifications of employees, job specifications, wage studies, and employees' records.

Medical Division:—Conducts physical examination of all applicants for permanent employment and for membership in Mutual Benefit Association, also semi-annual physical inspection of all employees. Furnishes surgical and medical attention to employees injured while on duty, and emergency health service on request. Compounds medical and surgical supplies, conducts first aid classes for Safety Division, also maintains visiting nurse service.

Safety Division:—Conducts safety meetings, instruction in first aid, resuscitation and rescue methods and maintains safety bulletin service; receives and handles through committees safety suggestions made by employees; inspects tools, materials and equipment, methods, rules, specifications and properties; maintains records and statistics of accidents, time lost and analysis of accidents; inspects physical properties and fire apparatus and conducts fire drills.

Education and Training Division:—The principal educational work is conducted for the department by the Chicago Central Station Institute, and consists of courses for technical students and graduates of universities; special classes for instruction and training of employees in various departments; correspondence courses; special training of salesmen; and classes in National Electric Light Association courses. In addition there is, of course, much specific job training carried on in the departments, and we have recently started a course of training for public relations in the departments having employees who have frequent contact with customers and the general public. This training is being carried on by the case method in groups of twenty or twenty-five employees.

Employees Service Division:—The functions of this division are the administration of relief and aid work; disability and death benefits, (exclusive of those covered by workmen's compensation), under the company's plan of co-operation with the Mutual Benefit Association; the office of the Edison Club; the group life insurance; co-operative buying; employees publications; and miscellaneous service for employees.

The "Dean of Women is reponsible for promoting the well-being and representation of the women employees. She administers all employment activities for women employees and has charge of the company library and the lunch room.

Co-operative Functions

We believe in the policy of encouraging self-expression, self-development and ambition on the part of employees, and that participation in these various employee organizations will be of material benefit to them, not only in their daily work but in the fulfillment of their responsibilities as representatives of the company in their own communities and as citizens. It has been said that "the greatest source of undeveloped power in America is the soul of man". With this thought as the incentive, and because it is good business and not altruistic or partaking in any sense of paternalism, these employees' activities have been encouraged and developed:

Employees Representation Plan:—The motive actuating the establishment of the plan is definitely expressed in the following Premable to the Constitution: "We, the employees, the management, and the directors, of the Commonwealth Edison Company, realizing that in a large organization it becomes increasingly difficult to maintain the close personal contact between the employees and the management, which was possible in our organization when it was smaller, and desiring to continue and develop the mutual understanding and harmonious relations which have prevailed in the past, do hereby jointly adopt the Employees Representation Plan provided for in this Constitution".

The specific objects of this Employees Representation Plan are: (1) To establish a medium which will serve as the equivalent of the close personal contact between those of all ranks in a smaller organization, by affording opportunity for elected representatives of the employees and appointed representatives of those having responsibilities of management to meet frequently for the purpose of free and frank discussion of problems of mutual interest to the management and the employees. (2) To furnish by such medium a definite channel through which the employees individually or collectively, and either personally or through representatives, may take up with the management for discussion and recommendation, questions in reference to rates of pay, hours, conditions of work, or any other subject of interest to them as employees. The general objects are: (1) To promote mutual understanding, harmony and a spirit of co-operation among those of all ranks in our company organization. (2) To insure fairness and justice to the employees, the management, the stockholders and the public.

The Edison Club was organized to promote the friendly acquaintance of all Commonwealth Edison Company employees. The club fosters the "Edison Spirit" among its members through social and recreational good times and activities, to the end that their mutual relations shall be the happiest and most harmonious, and that active goodwill for and from the public shall continually increase. Big "good-time" party meetings are held during the year with an attendance of four to five thousand members and their friends. Other social gatherings are limited to members only. Twice during the year, at Christmas and at the Field Day merrymaking, the parties are open to all employees and members of their families. Any permanent employee of the company is eligible to membership in the club, and the dues are one dollar and a half per year. The company contributes very liberally to the support and maintenance of the various social, recreational and educational activities carried out by this employees' organization. The following are the principal recreational activities in which club members participate: Baseball league, bowling league for men and for women, billiard league, chess and checkers league, rifle league, basket ball league, tennis league and golf.

Seven handsome silver trophies have been donated by President Insull to be competed for each year by members or teams of the following leagues: bowling, base ball, golf, billiards, tennis, rifle shooting and revolver shooting. Medals are given to the winners of the individual cups and to the members of the winning teams each year, the names of the individuals or team winners being engraved on the trophies.

The Edison Symphony Orchestra, starting in 1910 as a group of fifteen amateur musicians in the company, has developed to an organization of one hundred, having complete properties and one of the largest musical libraries in Chicago. The orchestra gives a series of monthly popular public concert, each year in Orchestra Hall in the interest of civic music, and through this and other public appearances has become well known to music lovers and is considered to be the largest and finest orchestra supported by a corporation anywhere. The orchestra is under the supervision of the manager of industrial relations.

The Edison Round Table:—The Company issues and distributes to employees the Edison Round Table, which is the official organ of the Edison Club and contains accounts of all meetings and activities of the club and its various sub-organizations. It is also the company house organ and disseminates general knowledge about the business and policies of the company and news of the activities of individual employees and of organizations whether or not included in the Edison Club. Copies are sent to the departments and distributed to all employees interested.

Lake Lawn Vacation Resort:—About three years ago the Commonwealth Edison Company, together with the Peoples Gas Light and Coke Company, and the Public Service Company of Northern Illinois acquired property on the shores of lake Delavan, Wisconsin, where facilities are provided for employees to spend their vacations. These facilities include hotel service and cottages equipped for house-keeping purposes, where employees may secure accommodations according to their means and have the opportunity of enjoying a vacation under ideal conditions at a reasonable cost. The recreational facilities afforded include boating, bathing, fishing, tennis, base ball, golf and dancing.

Employees Suggestion System:—For the purpose of furnishing an incentive to employees to give closer attention to the various problems that arise in connection with their daily work or the general operation of the company, a revised "Suggestion System was adopted in February, 1925, which provides substantial awards in cash for valuable suggestions and in proportion to their value. During the ten months this system has been in operation 3,274 suggestions have been received and the total cash awards amounted to $3,267.50. The largest award for any one suggestion was $500.00 and the average $10.15.

Good-Will Service System:—This was established in June 1924 for the purpose of providing a systematic means for employees to report to the management any requests for information or any criticism of the company or its service received by the employee, while at his work or off duty. This information is transmitted to the proper department and is followed up to be sure it receives prompt attention. This system has proven to be a worth while addition to the mediums adopted for giving better service and improving public relations.

Commonwealth Edison Post, American Legion:—The company encourages and assists the Commonwealth Edison Post of the American Legion which has a membership of 1,100 and is the largest in the state.

Illinois National Guard:—The company has encouraged membership by its employees in the Illinois National Guard and sponsors one Company of Infantry and one Company of Engineers made up, officers and men, of Commonwealth Edison Company employees.

Lunch Room:—The company maintains a lunch room in its main office building and in each of the large generating stations where employees may obtain good food at reasonable cost.

Recreation rooms are provided in the Edison building for the men, where facilities for chess, checkers and other table games, including billiard and pool, are available during the noon and evening hours. A recreation room is also provided for women employees where various activities, which include millinery and dressmaking classes are carried on.

Thrift, Insurance and Service Annuity Plans:—The average wage earner has three principal causes of worry. (1) What will happen in case he is disabled through sickness or accident and is deprived of his usual compensation. (2) What will happen to his dependents in the event of his death. (3) What will happen when he becomes too old to continue work. These worries are ever present and increase as the individual's responsibilities are increased; therefore the desirability of insurance and thrift plans as a means of eliminating these worries becomes a question of paramount importance for the peace of mind and the efficiency of the workers.

The Commonwealth Edison Mutual Benefit Association, a voluntary organization of the employees, was formed as a co-operative society to provide at the least possible expense, income during periods when incapacitated for duty by illness or accident and, in the event of death, to provide benefits for their dependents. Any permanent employee who has been with the company six months or more is eligible for membership subject to his acceptance on physical examination.

Dues and benefits:—Members pay as dues a small percentage of their straight time semi-monthly pay, this rate increasing with member's age. After the first week of disability, benefit payments are made by the association during the continuance of the disability, (not exceeding two years) varying from 50 to 10 per cent. of the employee's rate of pay. Death benefit payments are made by the association equal to one-half of the member's annual pay. All funds and payments are guaranteed by the company.

Co-operation by the Company:—Under the company's plan of co-operation with the Commonwealth Edison Mutual Benefit Association all disability benefits allowed employees under the rules during the first week of disability are paid by the company. Disability benefits in addition to those paid by the association, in cases extending beyond one week, are also provided for members, in certain cases equalling one-half and in other cases the full amount paid by the association. The periods of continuation of such disability payments are based on length of service. Death benefits are paid by the company, to beneficiaries of members, based on length of service, ranging from 10 per cent. of the annual salary, (not in excess of $3,000), for one year's service to 100 per cent for fifteen years of service, and 1 per cent. additional for each year in excess of fifteen. The plan of co-operation also provides payment by the company of disability and death benefits for employees who are not members of the Mutual Benefit Association equal to one-half of those paid by the company to members.

Group Life Insurance:—In December 1922, acting on a recommendation of the General Joint Council under the Employees Representation Plan, the company presented to its employees life insurance policies under the group insurance plan in place of the Christmas remembrance previously given to employees in the form of a turkey. Under this group insurance plan every employee who has been with the company one year automatically receives an insurance certificate for $500 under the company's group policy on the first anniversary of his entering the company's service, and thereafter the amount of his insurance under the plan increases in accordance with the following table:

12 to 18 months	$ 500
18 to 24 months	750
2 to 3 years	1000
3 to 4 years	1200
4 to 5 years	1300
5 to 6 years	1400
Over years	1500

The company pays the entire cost of this insurance, which is in addition to and independent of all benefits under the Commonwealth Edison Mutual Benefit Association and the company's plan of cooperation therewith, and also of any compensation to which the employee may be entitled under the Workmen's Compensation Act. Every employee is eligible without physical examination and regardless of age, or kind of work in which engaged. Each individual policy is payable to the beneficiary named by the employee. Service annuitants also are included in this plan.

Shortly after this plan became effective a number of employees desired to purchase additional insurance under the group plan and in pursuance of this suggestion an arrangement was made with the insurance company to write a supplementary policy covering all employees who desired the additional group insurance for an amount equal to the amount presented by the company under its original policy at Christmas time.

The amount of life insurance in force, including that provided by the Mutual Benefit Association, and the company's plan of cooperation therewith, is approximately $12,000,000. The amount provided under the group insurance policy paid for by the company and the additional group insurance paid for by employees is approximately $15,000,000, or a total of $27,000,000 of life insurance which is a little over $3,000 per employee. The total amount of life insurance payments made during the year 1924, for 46 deaths, was $182,000 or approximately $4,000 per deceased employee. There was paid out in disability benefits under the Mutual Benefit Association, and the company's plan of cooperation therewith, $131,000, of which $49,000 was paid out by the Mutual Benefit Association for disability after the first week and $26,000 by the company. In addition to this $105,000 was paid out by the company for disability lasting less than one week.

Employees' Savings Fund:—For the purpose of encouraging thrift and of giving employees an opportunity of becoming stockholders in the company, the Board of Directors, on January 15th, 1909, adopted a plan for the creation of an Employees' Savings Fund. Under this plan any permanent employee of the company, who has been in its continuous service for a period of one year or longer may become a subscriber and shall pay into the fund, in semi-monthly installments, an amount equal to three or five per cent of his salary, as he may elect. The full subscription period is five years. At the end of this period the subscriber, (or his estate), will receive the total amount paid by him to the fund, with interest compounded semi-annually at the rate of 6 per cent per annum, either in cash or in stock of the company at $110 per share. In case of prior termination of payments, because the subscriber leaves the company's service or is discharged, the accumulated payments with interest as above stated will be paid in cash; but if the subscriber elects to discontinue his subscription agreement while still in the employ of the company the interest rate will be reduced from six to four per cent. This plan enables employees to obtain stock of the company at a price materially below the market value of the stock, and at the same time provides a plan for systematic definite savings. As a result of the operation of this plan and through other mediums about 6,000 or over two-thirds of the total number of employees are stockholders in the company.

Commonwealth Edison Building Loan and Savings Association:—This association was organized by the employees in February, 1923, under the Building and Loan Association laws of the state of Illinois. It provides a medium for systematic saving in any amount the employee desires according to the number of shares he may subscribe for. The money paid in by employees is loaned to those desiring to buy or build homes. About 1,800 employees are shareholders of whom 155 are borrowers. A total of $600,000 has been loaned to these employees for the purpose of financing their own homes.

Service Annuity System:—In order to make some special provision for faithful employees who have completed certain periods of service, the company adopted a Service Annuity System effective January 1st, 1912. Under this system employees who have reached the age of 60 years may be retired, and at the age of 65 are automatically retired, unless in special cases the committee having the operation of the plan in charge continues the employee in active service. The annuity is based on the number of years of continuous service times 1½ per cent. of the average annual pay of the employee during the highest five years. This annuity is paid by the company, the employees do not contribute to the plan.

Recognition for continuous service is given in the form of service badges with appropriate decoration for each five years of service or multiple thereof. At the end of 1925 there will be in the hands of active employees 3,295 service badges indicating five or more years of service. There were 5,822 employees in the service as of December, 1920, five years ago, and the percentage of the employees then in the service who are remaining after five years is 56.6. The company takes pride in the large number of its employees who have long records of faithful service and these employees likewise take a proper pride in their service records.

When the active period of service has expired, the employee is transferred to the Service Annuity Payroll. It is a mark of distinction and it is considered that the employees have earned by virtue of their long continued service, not as deferred payment for services rendered, a place of honour in the ranks of the service annuitants.

In conclusion:—Mutuality of interest on the part of the employee and of the company is an essential feature of the success of all the employee activities, and the company's part in connection therewith, including recreational, educational, social, thrift and insurance. All of them are voluntary so far as the employee's participation is concerned.

The success of any comprehensive plan of industrial relations depends upon the feeling which must come from within the employee creating the desire for better things and a better standard of living and a happier state of mind in his work. The attitude of management in the operation of such a plan is equally important and must include the elements of frankness, sincerity and the underlying principles of a square deal for all concerned.

The company firmly believes that its policy of a centralized Industrial Relations Department; of giving the employees a voice in their own affairs through the Employees Representation Plan; of fostering and promoting recreational, social, and educational activities; of encouraging thrift and stock ownership; of aiding in the provision for adequate protection in case of disability or death; and of providing a service annuity for old age; has materially increased efficiency, augmented loyalty, encouraged continuous service, improved public relations and has developed a happy and prosperous Edison family.

Reduction of Flexural Stresses in Fixed Concrete Arches

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Paper presented before the General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

The fixed masonry arch is a statically indeterminate structure affected by three external redundant conditions depending on the elastic properties of the material or materials of which the rib is made.

The essential difference between an arch and a beam is that in the case of the arch moment stresses due to the direct loading could be suppressed by selecting the curve of the arch axis so that the resultant thrust would pass through the center of gravity of the sections through the arch. Furthermore, because of the redundant conditions depending on the elasticity of the materials, the stresses due to the elastic deformations must also be suppressed in order to obtain a fixed arch free from bending moment stresses.

The first part of the problem of reducing the flexural stresses to a minimum which involves the designing of the arch axis so that it will coincide with the equilibrium polygon of the loads, is treated in this paper under the section on determination of the arch axis. The principle involved is accepted as the rational basis of design for arches to-day.

European arches have been designed in accordance with this principle since the beginning of the development of concrete arches in the latter part of the last century. Important modern American arches planned by specialists in the art are designed in the same manner, but it is to be regretted that the necessary data have not been made available to the engineering profession at large in this country. Most of the treatises on reinforced concrete construction contain a thorough discussion on the analysis of the stresses in arches by the elastic theory, together with worked out examples of calculations, but the matter of the design of the arch axis itself has in most cases received scant attention.

The second part of the problem of reducing the flexural stresses in arches relates to the elimination of those stresses due to the elastic deformation of the structure. This matter has received a great deal of attention in Europe and the underlying principle has been embodied in the design of arches during the last twenty-five years. The practice, however, has not yet been adopted in America, although its importance has been fully acknowledged by leading American engineers. In his treatise on "The Kinetic Theory of Engineering Structures", David A. Molitor refers to the elimination of flexural stresses due to elastic deformations as follows: "If an arch ring could be built in such a manner that its resultant polygon would pass through the center of the ring at the crown and springing points at the time of releasing the false work, a large proportion of the redundant stresses could be eliminated. In other words, the bending moment at the critical points would then be almost zero for symmetrical loading, reserving the strength for the unsymmetric live load and other contingencies affecting the shape of the arch ring".

Two different methods making it possible to obtain large reductions of flexural stresses are in use at the present time in Europe. The first method consists of providing temporary hinges at the skewbacks and at the crown during the period of construction until the arch is fully loaded and the rib shortening effect due to the shrinkage has taken place. Subsequent to the filling of the hinge gaps the arch becomes fixed. The usual type of temporary hinge consists merely of reinforcing bars, the device being known as semi-hinge construction.

In "Reinforced Concrete Construction", Vol. 3, George A. Hool makes the following statement: "The use of hinges and hinged construction of any type in connection with concrete bridge construction is still in its infancy in the United States, although it is one of the most important features or devices which has ever been introduced in concrete bridge construction".

Semi-Hinges

As examples of the best types of semi-hinges, those of Considère, Mesnager, and Freyssinet may be mentioned.

The Considère hinge has been successfully used throughout Europe for over twenty years by the Con-

Figure No. 1
Reinforced Concrete Bridge at St. Pierre du Vouvray crossing the Seine River, France. The Arch of the Bridge is 430 feet in length, and in the centre it reaches a height of 90 ft. above the water.

sidère Construction Company, whose activity as bridge builders is well known.

The Mesnager hinge, due to Augustin Mesnager, member of the French Institute, and Inspector-General of the French Department of Ponts et Chaussées, is fully described in this paper. The construction is very simple and the eccentricity of the resultant remarkably low. The Mesnager hinge has been successfully used in the following structures:

Arch covering over St. Martin canal, Paris, carrying a heavy earth fill across a clear span of 91 feet. The length of the arch covering is about 800 feet.

140-foot span arch over Canal St. Denis, Paris.

Sapiac bridge, Montauban, one arch of 175-foot span and one of 185-foot span.

Noce bridge, Truchino, Italy, one arch 100-foot span.

Airship hangar at Montebourg, France, span 82 feet.

Reinforced concrete hall in Lausanne, Switzerland, span 115 feet.

The Freyssinet hinge, details of which are also given in this paper, is a more recent feature of arch construction and is particularly adaptable to long spans, its limiting thrust carrying capacity being well over 200,000 pounds per lineal foot. The Freyssinet hinge was used by its originator at the Boutiron bridge, near Vichy, France. This bridge consists of two concrete arches of 223 feet and 238 feet respectively. The crown thickness of the center span is 21 inches and the thrust on the hinge is 218,000 pounds per foot.

Elastic Deformation Effects Reduced

The second method of reducing the flexural stresses has been developed by M. Freyssinet and has resulted in the creation of new standards of proportions for concrete arch bridges. Briefly stated the method consists of adjusting the position of the arch axis and compensating its length after erection by means of hydraulic jacks placed in a gap left in the rib at the crown. In other words, by applying a set of external forces of chosen intensity to the rib, the latter may be placed in any desired state of equilibrium. By introducing concrete slabs of proper thickness in the gap opened at the crown by the pressure of the jacks the arch is held in the desired position. A detailed outline of the method is given in this paper.

The method of rib compensation has been tried out for fifteen years and found entirely successful. Besides the large reduction in cross section of arch ribs obtained, the method developed by M. Freyssinet renders possible the construction of very much longer concrete arch spans than could be heretofore contemplated.

M. Freyssinet states that by the use of his method, and under the 1916 regulations of the French Department of Public Works, plain concrete arches of 1,115-foot span and reinforced concrete arches of 2,723-foot span can be constructed without special difficulties.

A list of the more important bridges designed by M. Freyssinet where his compensating method has been used follows:

St. Pierre du Vouvray bridge, over the Seine River, concrete arch of 430-foot span, the longest concrete arch in the world yet completed.

Plain concrete arch of 315-foot span over the river Lot at Villeneuve, France.

Three-hinged triple spans of 223 feet, 238 feet, and 223 feet over the river Allier near Veutre, France, and a like structure over the river Allier near Boutiron, France.

In the fall of 1924, construction work started on another concrete arch bridge designed by M. Freyssinet which will outdistance the St. Pierre du Vouvray bridge by some 200 feet. It is the Plougastel bridge, near Brest in Brittany, with three record breaking spans of over 600 feet. The tendered price for this arch was 7,340,000 frs. while the lowest bid for a steel bridge was 11,360,000 frs.

The designer of these bridges has also won the competition for the construction of the Viaduct du Bernard which involves a main arch of 560 feet, carrying a meter gauge railway track. It is stated by the designer that the ribs of the Bernard Viaduct would only be sufficient for a 330-foot span if the ordinary method of construction had been adopted.

Reference is often found in American engineering literature to the slender proportions of European arch bridges compared to those built in this country, although it is generally acknowledged that the European engineer is at least as conservative as his confrere on this side. The difference is certainly not due to the method of the analysis based on the elastic theory, which has been highly developed in this country. The writer believes that the difference is due to the fact that methods or devices whereby the flexural stresses in fixed arch rings may be reduced have not yet been investigated in this country.

Determination of the Arch Axis

The problem of making the arch axis coincide with the equilibrium curve of the loads upon the arch must be solved by successive approximations. The data usually given will fix the span and the rise within narrow limits and permit the complete design of the floor system. The size and the position of the arch ring, however, are depending on the yet unknown equilibrium curve and must be assumed.

The weight of either the earth filling, in closed spandrel, or of the supports, in open spandrel, and the weight of the ring will vary with each approximation.

The equilibrium curve is a function of the load and a first approximation of the curve may be made if the limits of the possible load variations over the span are established.

Consider the hypothetical case of a uniform load distribution. It is required to find the shape of the arch axis so that the pressure is uniform over all normal cross-sections. The span l and the rise f are given, also the uniform load w. What is the position of a point A through which the equilibrium curve will pass? The vertical reactions are equal to $\frac{wl}{2}$, and if the distance of A to the origin O of the curve, on the horizontal axis is X, the moment of the vertical reaction about X is $\frac{wlx}{2}$. If H is the horizontal thrust, Hy is the moment of the thrust about A. This moment acting counter-clockwise is negative, remains the moment of the load between O and A which is equal to $-\frac{wxx}{2}$ acting in the same direction as Hy.

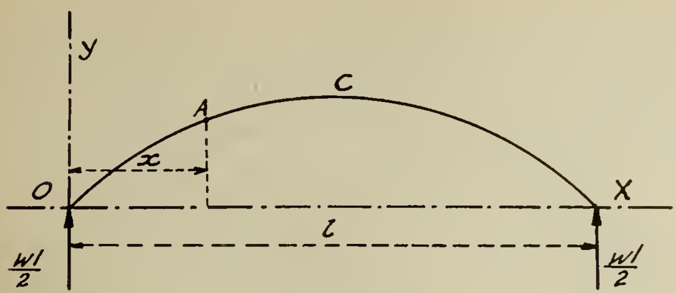


Figure No. 2

We have then: $\frac{wlx}{2} - Hy - \frac{wx^2}{2} = 0$ ....(1)

Solving for the crown thrust, $H = \frac{wl^2}{8f}$ ....(2)

Placing this value of H in (1), the ordinate at any point is

$$y = \frac{4fx}{l^2}(l-x) \qquad (3)$$

Equation (3) is the equation of the parabola.

If we transfer the origin to the crown the equation becomes

$$y = \frac{4fx^2}{l^2} \qquad (4)$$

If the load at the springing became infinite the equilibrium curve would be a circle. The radius R of a circle passing through the crown and the springing points of the same parabolic axis may be found from the property of the semi-circle. In figure No. 3 the semi-chord $\frac{l}{2}$ is a mean proportional between the two segments f and $(2r)-f$ of the diameter.

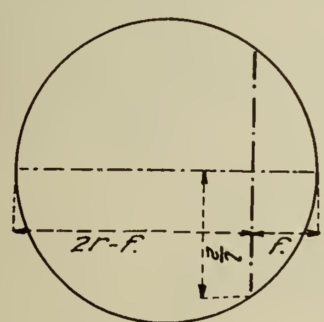


Figure No. 3

Whence, $\frac{l^2}{4} = f(2r-f)$

from which, $r = \frac{l^2}{8f} + \frac{f}{2}$ ....(5)

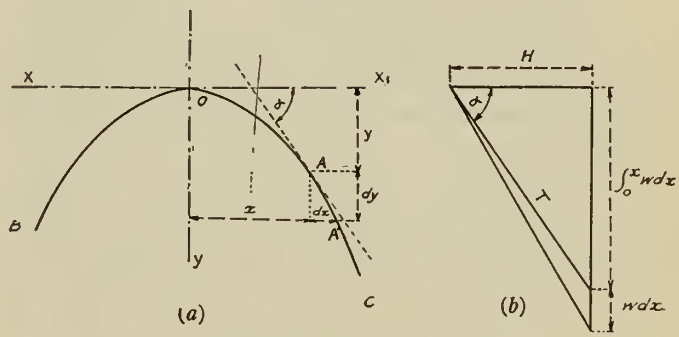
The equilibrium curve sought will lie between these two curves and a first approximation of the arch axis may be made between these limits. Assuming that a design based on the first approximation indicated above has been made and the loads taken off, then the analytical method of finding the equilibrium curve may be applied in order to obtain the true curve corresponding to the given load system. If the true curve does not coincide with the one selected in the first assumption, the design is revised, the axis of the ring is made to fit the equilibrium curve, the loads taken off the revised design and compared with those previously found. The equilibrium curve corresponding to the revised load system is determined, the loads compared, and the process repeated until sufficient accuracy between the load system and the resulting equilibrium curve is obtained.

Determining Equilibrium Curve Analytically

If we consider a linear arch loaded with a distributed load, the equilibrium curve may be found analytically as follows:

Let w equal the load per unit of horizontal distance, H, the crown thrust, T, thrust at any point A with coordinates (x, y) with respect to the horizontal and vertical axis through O.

The total load on the arch between the crown O and the point A is equal to $\int_0^x w\,dx$



Figures Nos. 4a and 4b

If α is the angle between the horizontal axis $o\,x$ and the tangent at A,

$$\tan\alpha = \frac{dy}{dx} = \int_0^x \frac{w\,dx}{H} \qquad (6)$$

If A' is a point on the curve whose co-ordinates are $(x+dx)$ $(y+dy)$ the increment in $\tan\alpha$ between A and A', is equal to:

$$d\frac{dy}{dx} = \frac{w\,dx}{H} \text{ or } \frac{d^2y}{dx^2} = \frac{w}{H} \qquad (7)$$

which is the equation of any linear arch whose axis coincides with the equilibrium curve of the load.

The results found above for the parabolic shape may be readily obtained by integrating (7).

Since $\frac{dy}{dx} = 0$ when $x = 0$, $\frac{dy}{dx} = \frac{wx}{H}$.

Integrating again, $y = \frac{wx^2}{2H}$, since $y = 0$ when $x = 0$......(8)

When $x = \frac{l}{2}$, $y = f$ and (8) gives $f = \frac{wl^2}{8H}$

Solving this last equation for the crown thrust, we get $H = \frac{wl^2}{8f}$ which is identical with that found in (2).

The thrust at any point is found from the triangle of forces, figure No. 4b,

$$T = \sqrt{H^2 + (wx)^2}.$$

When, as it is the case in practice, the load w is not uniform per unit of horizontal distance, but increases from the crown to the skewbacks, the equilibrium curve may always be obtained by this method providing w can be expressed as an integrable function of x.

Transformed Catenary Form

If it is assumed that the value of w between the crown and the skewback is proportional to the ordinate from the arch axis to a horizontal line XOX, at some distance d above the crown, the equilibrium curve of such a load system is the transformed catenary.

The distance d represents the intensity of the crown load and the distance Y, the increased intensity which occurs between the crown and the skewback. In order to obtain such a load distribution, the following assumptions must be made.

(1). In solid spandrel construction, the weight of the filling must be taken as acting vertically.
(2). In open spandrel construction the spandrel supports must be equally spaced and of like cross section.
(3). The increment in rib thickness along the ring must be proportional to the variation of y, although the thickness at the skewback may have any assumed value.
(4). The weight of the floor system must be constant per unit of length.

The equation of such a curve can be obtained from the general method expressed by equations (6) and (7) as follows:

The distance d is represented by OO', the load intensity at any point A is equal to $w\,y'$, w representing now the load per unit of area between the arch ring $B\,O\,A\,C$ and the horizontal line $X_{/} - X'_{/}$ at a distance d above the crown.

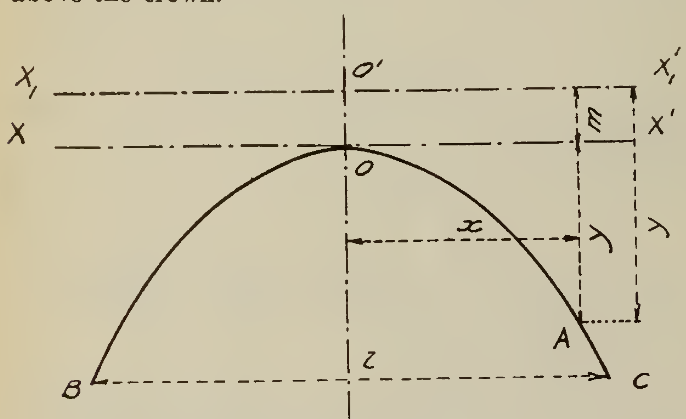


Figure No. 5

The equation of the curve becomes:

$$\frac{d^2y'}{dx^2} = \frac{wy'}{H} \quad \text{......(9)}$$

If we substitute y for y', equation (9) may be written:

$$\frac{dy}{dx}d\left(\frac{dy}{dx}\right) = \frac{w}{H}y\,dy \quad \text{......(9a)}$$

When $\frac{dy}{dx} = 0$, $y = d$, integrating (9a)

$$\frac{dy}{dx} = \sqrt{\frac{w}{H}(y^2 - d^2)} = \frac{1}{m}\sqrt{y^2 - d^2} \quad \text{......(10)}$$

$$\text{where } m^2 = \frac{H}{w} \quad \text{......(11)}$$

Equation (10) may be written: $\frac{dy}{\sqrt{y^2 - d^2}} = d\,\frac{1}{m}$

when $x = 0$, $y = d$, integrating again: $Log_e\left(\frac{y + \sqrt{y^2 - d^2}}{d}\right) = \frac{x}{m}$

which may be written in the exponential form:

$$y = \frac{d}{2}\left(e^{\frac{x}{m}} + e^{-\frac{x}{m}}\right) \quad \text{......(12)}$$

If the four assumptions made above are adhered to, then (12) represents the equation of the equilibrium curve. The loads per lineal foot at the crown and at the skewback are taken off from the drawings. The crown load P_c is then equal to wy_0 and the skewback load P_s equal to wy', in figure No. 6.

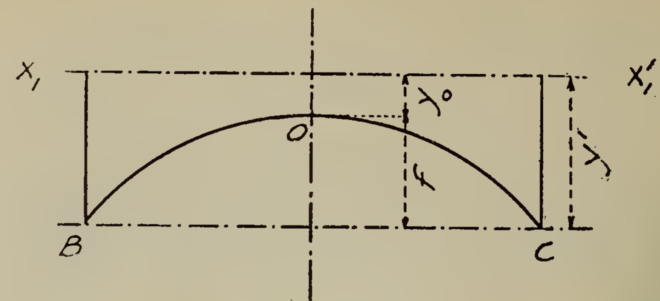


Figure No. 6

The expression $\left(\frac{e^{\frac{x}{m}} + e^{-\frac{x}{m}}}{2}\right)$ in (12) is a hyperbolic function, namely $cosh\,\frac{x}{m}$

We have then: $\frac{y_1}{y_0} = cosh\,\frac{x}{m}$ ......(13)

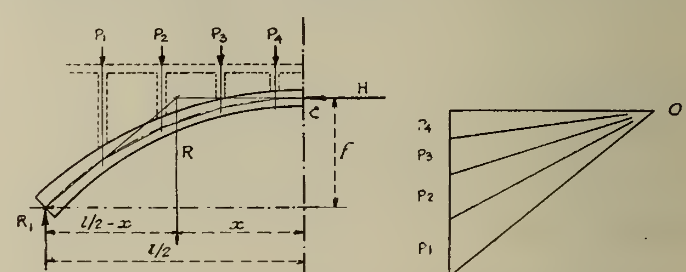
and when $x = \frac{l}{2}$, $\frac{P_s}{P_c} = \frac{wy^1}{wy} = cosh\,\frac{l}{2m}$ ......(14)

The value of $cosh\,\frac{l}{2m}$ is taken from tables of hyperbolic functions and the value of m obtained from (14).

The value of y_0 is obtained from the relation $\frac{y_1}{y_0} = \frac{f}{y_0} + 1$, $P_c = wy_0$ gives w and equation (11) can now be solved for the crown thrust H.

Graphic Determination of the Equilibrium Curve

Assuming that a design of the complete arch has been made where the axis of the ring is located between the limits of the parabolic and the circular curves already referred to, the equilibrium curve may be found by means of resultant polygons. For symmetrical loading, half the arch only need to be considered.



(a) (b)

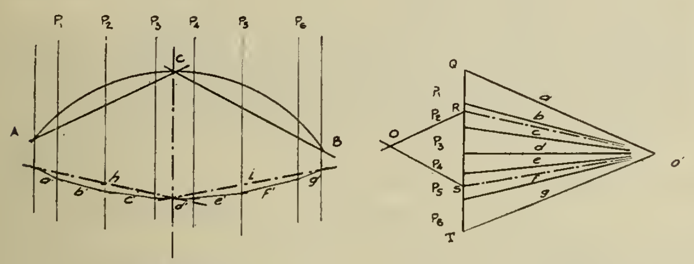
Figures Nos. 7a and 7b

The tabulated loads for each point are drawn to scale on a vertical load line and the pole distance H laid off horizontally from the crown point. The horizontal thrust H may be found graphically or by computation. For symmetrical arches and loading the value of H is readily calculated. In figure No. 7a, the lever arm x of R is obtained by taking moments of the loads P_1........P_4 about C and dividing the sum of the moments by $R = \Sigma_4^1 P$. Then, by taking moments about A, we have,

$$H = R \times \frac{\left(\frac{l}{2} - x\right)}{h}$$

The equilibrium polygon is now drawn through the points A and B, centres of the skewback and crown sections. The axis of the assumed ring is corrected to fit the equilibrium polygon and the loads recomputed, the process being repeated until the polygon corresponds with the loads. In order to obtain sufficient accuracy the arch should be drawn to a scale of ⅜ inch = 1 foot and the force polygon to a scale of 1 inch = 3,000 pounds.

The determination of the equilibrium polygon in the case of unsymmetrical arches can be made graphically. The complete arch and loading must now be considered, the loads being drawn to scale on a vertical load line as before.



(a) (b)

Figures Nos. 8a and 8b

Assuming any pole o' the preliminary force polygon $a \ldots\ldots g$, (figure No. 8b), and the corresponding equilibrium polygon a' g', (figure No. 8a) intersecting verticals through the center of the skewback sections are drawn.

The two closing lines h and i of the preliminary equilibrium polygon intercept the vertical through the center of the crown section and the adjacent rays of the equilibrium polygon. Parallels to the closing lines h and i drawn through the assumed pole O' intersect the load line in R and S. The two segments $Q\ R$ and $S\ T$ on the load line represent to scale the magnitude of the vertical components to the respective skewback reactions.

Lines $A\ C$ and $B\ C$ are now drawn through the centers of the skewbacks and crown sections, and parallels to these lines, through the ends of the segments $Q\ R$ and $S\ T$ will intersect at the true pole O. The true equilibrium polygon passing through points $A\ C\ B$ can be drawn from the true force polygon drawn from the pole O. The true equilibrium curve is a smooth curve tangent to the points of intersection of the equilibrium polygon.

Influence of Redundant Conditions upon Stresses in Arch Ribs

If a fixed arch rib whose axis has been made to follow the equilibrium curve of the loads is analyzed by the elastic theory, bending moment stresses will be found along the rib.

These moment stresses are due to the elastic deformations of the rib which are caused by:

(*a*)—Rib shortening due to compression of the material under the thrust.

(*b*)—Rib shortening due to the setting of the concrete.

(*c*)—Compression of the abutments.

(*d*)—Variation of temperature.

When the rib is hinged during the period of construction, that is until the structure is fully loaded and the concrete has set, then bending moment stresses due to A, B and C will be eliminated.

The rib hinged at the crown and at the skewback is free to rotate about these points under the influence of the stresses. When the false work is lowered, the crown joint will move downward through a small angle α which can be accurately computed. The resultant of the external forces passes through the hinges, and the rib, when properly designed, is subject to uniform compression only. The effect of the downward movement through the angle α need not be considered in practice.

After the filling in of the hinge openings, whereby the arch, temporarily hinged, becomes fixed, the bending moment stresses acting on the structure will be only those due to live load concentrations and the variations of temperature.

In concrete arches, the ratio of the dead load to live load is large, and the moment stresses due to the latter, are small. The combined moment stresses due to temperature and live load are not sufficiently large to cause the resultant to move outside of the middle third of the arch rib except in very short spans.

Symmetrical Parabolic Arch

In order to assign definite values to the stresses in fixed arch ribs built with and without temporary hinges, the symmetrical parabolic arch uniformly loaded will be analyzed.

Simplified formulae corresponding to those given by Professor J. Melan in his book "Theorie des Gewölbes und des Eisenbetongewôlbes im besonderen" are employed to determine the moment stresses due to the thrust in the rib built monolithic with the supports. The method is based upon the deflections of curved ribs.

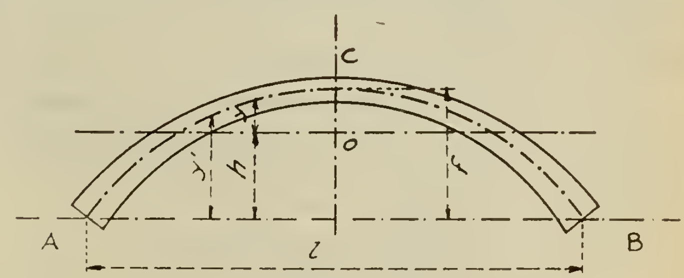


Figure No. 9

The supports being fixed, the rotation there is equal to zero and

$$\int_A^B \frac{M}{I} ds = \int_A^B \frac{M}{AI\cos\phi}\, dx = o \ldots\ldots\ldots\ldots\ldots\ldots (15)$$

The moment M equals He, where e is the eccentric distance between the rib and the equilibrium curve. We may write then:

$$\int_A^B \frac{e}{I\cos\phi}\, dx = o$$

For the purpose of this analysis, the value of $I\cos\phi$ is assumed to be I_0, a constant, I_0 being the value of the moment of inertia of the rib at the crown.

The formulas hereafter given are derived for a system of co-ordinate axes whose origin O is at the centre of gravity of the elastic weights $\frac{ds.}{I}$ The symbols are shown in figure No. 9. The distance h from the horizontal axis to the closing chord is equal to,

$$h = \frac{1}{l}\int_A^B y' dx = \frac{2}{3} f \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (16)$$

The equation for the crown thrust becomes,

$$H=\frac{\int_A^B \frac{M_1 y}{I} ds}{\int_A^B \frac{y^2}{I} ds+\frac{v}{r}\int_A^B \frac{dx}{A}} \quad \ldots\ldots (17)$$

where $\frac{v}{r}$ is the ratio of the co-ordinate of curvature centre to radius of curvature of the arch axis. The value of the integrals are as follows:

$$\int_A^B y^2 dx = \int_{-\frac{l}{2}}^{+\frac{l}{2}} f^2 \left(\frac{1}{3}-4\frac{x^2}{l^2}\right)^2 dx=\frac{4}{45}f^2 l.$$

$$\int_A^B \frac{}{} M_1 y\ dx=\frac{1}{8w}\int_{-\frac{l}{2}}^{+\frac{l}{2}} (l^2-4x^2) f\left(\frac{1}{3}-\frac{4x^2}{l^2}\right) dx=\frac{1}{90}wl^3 f.$$

M_1 being the moment in a simple beam uniformly loaded.

Solving for the crown thrust:

$$H=\frac{1}{8}\frac{wl^2}{f}\cdot\frac{1}{1+\frac{45}{4}\times\frac{I_0}{A_0 f^2}}=\frac{1}{8}\frac{wl^2}{f'} \quad \ldots\ldots (18)$$

wherein the value of the ratio $\frac{v}{r}$ is taken to *1*, and A_0 is the mean cross section and of the arch axis. The rise of the equilibrium curve is:

$$f'=f\left(1+\frac{45}{4}\cdot\frac{I_0}{A_0 f^2}\right) \quad \ldots\ldots (19)$$

The distance between the parabolic axis and the equilibrium curve is now:

$$\frac{1}{3}(f'-f)=\frac{15}{4}\frac{I_0}{A_0 f} \text{ at the crown} \quad \ldots\ldots (20)$$

$$\text{and } \frac{2}{3}(f'-f)=\frac{15}{2}\frac{I_0}{A_0 f} \text{ at the skewbacks} \quad \ldots\ldots (21)$$

If the depth of the rib at the crown is d, then the crown intercept above the parabolic axis is $5/16\ \frac{d^2}{f}$ and the skewback intercepts below the axis are $5/8\ \frac{d^2}{f}$

The crown moment is therefore equal to:

$$M_c=H\times\frac{5}{16}\frac{d^2}{f} \quad \ldots\ldots (22)$$

The stresses in the material are found by the formula:

$$f_a=\frac{H}{A}\pm\frac{My}{I} \quad \ldots\ldots (23)$$

where f_a = stress per unit of area, A, area of section, $\frac{I}{y}$ = section modulus.

Assuming $f=\frac{l}{10}$, = depth of section $=\frac{f}{10}$

we obtain for the maximum crown stress:

$$f_a=\frac{H}{A}(1+0.19) \quad \ldots\ldots (24)$$

The skewback intercept is twice that of the crown and the maximum stress there is:

$$f_a=\frac{H}{A}(1+0.38) \quad \ldots\ldots (25)$$

Equations (24) and (25) give only the stress due to the load and the elastic deformations resulting from it.

Temperature and Rib-Shortening Effects

The effect of temperature variation and the rib shortening due to the setting of the concrete must be added. We neglect the compression of the abutments.

Taking an average value for E of 2,500,000 pounds per square inch and assuming the average compressive stresses throughout the rib to be 350 pounds per square inch, the shortening due to the load and the elastic deformations resulting from it, per unit of length, is.... .00014

The effect of a fall of temperature of 40° Fahrenheit will cause a shortening per unit of length of.. .00028

The shortening due to the setting of the concrete at three month, according to Considère is per unit of length.......................... .00029

The total shortening per unit of length is....... .00071

The total shortening is 5.1 times greater than that due to the loading alone.

The values of the crown and skewback moment stresses, equations (24) and (25) are therefore multiplied

The total maximum crown stress intensity is,

$$f_a=\frac{H}{A}(1+.969) \quad \ldots\ldots (26)$$

and the total skewback stress is,

$$f_a=\frac{H}{A}(1+1.94) \quad \ldots\ldots (27)$$

At the crown, the maximum stress is about double that due to the centric thrust alone and the minimum stress is almost zero.

At the skewback, the resultant lies outside of the middle third and the compression stress is almost three times as large as the stress due to the centric thrust.

If the rib is made of 1:2:4 concrete having a safe working strength of 600 pounds per square inch, the crown section must be proportioned so that the average compression due to the thrust is limited to 300 pounds per square inch. The skewback thickness will be 1.5 times larger at least. In the case under consideration, temporary construction hinges will reduce the bending moment stresses by an amount equal to 60 per cent of the total moment stresses considered.

At the crown, the maximum compression stress becomes:

$$f_a=\frac{H}{A}(1+.388) \quad \ldots\ldots (28)$$

The crown section may be proportioned for an average unit stress of 435 pounds per square inch, as compared to 300 pounds per square inch when hinges are not used.

Determination of Angle of Rotation of Arch Ribs

The angular movement of arch ribs about hinges at the crown and at the skewback under the influence of shrinkage, rib shortening and variations of temperature, does not materially affect the rib stresses. The maximum value of the angle of rotation, should be ascertained, however, before designing the semi-hinges made of reinforcing bars.

The following method of calculating the angle of rotation is based on that given by M. Mesnager in his book Cours de Béton Armé.

In figure No. 10, the distance $B'.B.$ represents the total shortening of the half arch. Under the influence of the arch shortening, point B moves to B' and the half arch turns around point A until B' reaches B'' because of similar motion on the right side of the axis $O\ B$. The angle of rotation being very small, we admit

$$\alpha=\frac{B\ B''}{A\ B'} \text{ or } \frac{B'\ B''}{A\ B} \quad \ldots\ldots (29)$$

Also the arc $B'-B''$ is assumed equivalent to the distance $B'\ B''$. The two triangles $B\ B'\ B''$ and $A\ B\ O$ are similar.

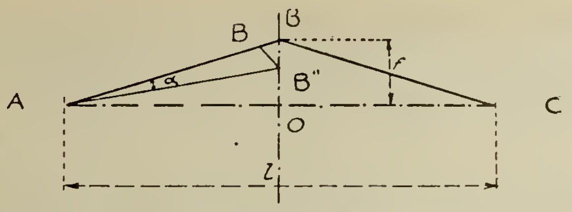


Figure No. 10

We have then:

$$B'B''=BB'\ \frac{l}{2f}\ \ldots\ldots(30)$$

Putting this value of $B'\,B''$ in (29) we have:

$$\alpha=\frac{B}{A}\frac{B'}{B}\frac{l}{2f}\ldots\ldots(31)$$

If we take the coefficient of shortening of 0.00071 obtained previously in the analysis of the parabolic arc, the shortening from A to B is $0.00071\times A\ B$.

Assuming $\frac{l}{f}=10$

The numerical value of α becomes:

$$\alpha=7.1\times 10^{3}\times\frac{1}{2}\ldots\ldots(32)$$

The value of the angle of rotation α at the skewback is the quotient of the shortening in the half arch and the length to rise ratio. At the crown, the angular deformation from the left and the right half arch are added and the value of the angle of rotation is twice that at the skewback.

Flexible Semi-Hinge

The semi-hinge is merely an open joint in the arch rib. A narrow opening is left in the concrete through which sufficient reinforcing steel is provided to carry the full thrust of the structure and to take care of the shearing stresses due to unequal loading. The hinge must be flexible enough to allow the rib to rotate when the false work is removed.

When the hinge openings are filled with concrete, rotation is no longer possible and the arch becomes fixed.

The semi-hinge is perhaps the most simple and the cheapest device yet found to reduce the bending stresses in arch ribs. It is extensively used in Europe and particularly in France where this device originated. There are at present in use several different methods of arranging the reinforcing bars across the gap of the hinge.

In the Considère hinge the main bars are placed near the edge of the section and across the hinge gap in a direction parallel to the arch axis. The Mesnager hinge consists of bent bars, (figure No. 11), placed across the central axis of the rib at the center of the gap.

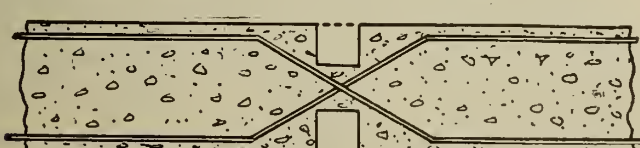


Figure No. 11

Results of tests upon this hinge were published by its inventor, Augustin Mesnager, Membre de l'Institut, Inspecteur-Général des Ponts et Chaussées, etc., in the Annales des Ponts et Chaussées, 1907, Vol. 2, page 180.

The tests pieces consisted of rectangular concrete sections 6 feet 2 inches long by 1 foot 4 inches deep, notched at the centre on both sides of the center axis, the thickness of the concrete there being 3.5 inches. The reinforcing consisted of 13/16-inch bars bent as shown on figure No. 11. The width of the gap in the middle of the piece was 3.5 inches, the ratio of the diameter of the reinforcing bars to width of gap being ¼. The elastic limit of the metal was 42,600 pounds per square inch.

In order to test the hinge under conditions similar to those that would obtain in an arch bridge, the hinge was bent through an angle of 2/100, that is three times more than the calculated value of angle α. Under a load of 300,000 pounds corresponding to 41,200 pounds per square inch, cracks began to appear along the reinforcing indicating slipping of the bars. The concrete was cracked on the tension side and chipping was noticeable on the compression side. The ultimate load put on the hinge was 323,000 pounds or 44,000 pounds per square inch. A second specimen similar to the one described above was next tested by alternately reversing the position of the wedges placed at the end of the piece to obtain the bending effect. After submitting the piece to a load of 144,000 pounds or 21,300 pounds per square inch, the wedges were reversed, the operation being repeated several times.

In order to ascertain the behaviour of the bars alone, the concrete in the gap was broken off, the piece being under load. An increase in flexibility was observed. The loading was increased gradually, the first crack along the reinforcing appearing at 235,000 pounds or 32,000 pounds per square inch. It is to be noted that the method of failure of the two specimens was alike and that by adding transverse reinforcing, which is recommended in practice, still higher strength may be obtained. In practice M. Mesnager limits the stress in the hinge bars to 11,400 pounds per square inch. The embedment required for bond stress is equal to 45 diameters. By hooking the ends of the extrados and intrados bars in the hinge gap, continuity of reinforcement is obtained through the rib and the gap section is made equally strong in tension and compression.

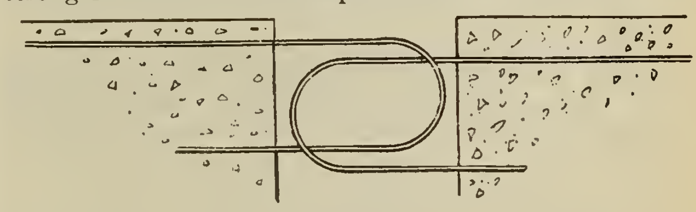


Figure No. 12

This device was first proposed and used by M. Freyssinet, the designer of the St. Pierre de Vouvray arch, the longest concrete arch yet constructed.

The eccentricity of the resultant for the ratio of diameter of reinforcing bars to width of gap equal to ¼ used in the tests is 1.51 inch. In practice, the width of the gap is made equal to five times the diameter of the bars and the resulting eccentricity under the working stresses used is 1.37 inch.

It is to be noted that the eccentricity of the resultant at the hinge decreases for a given size of bars as the width of the gap increases. If in the above test pieces, the width of the gap had been made equal to ten times the diameter of the bars, the eccentricity would have been reduced by 50 per cent.

The thrust intensity per unit of width that can be carried by semi-hinges made of reinforcing bars is proportional to the diameter of the bars used.

In the Canal St. Martin arch, M. Mesnager used forty 0.78-inch diameter bars per lineal meter to carry a thrust intensity of 220,000 lb. The larger size bars recommended for this type of hinge are 1¼ inch round with which a maximum thrust intensity of 100,000 pounds per lineal foot can be carried, allowing sufficient room in the hinge for tie bars and drainage openings.

The saving on the cost of construction made possible by the use of this hinge, determined by actual bid, M. Mesnager states is about 25 per cent.

Concrete Semi-Hinge Construction

When the thrust intensity per lineal foot exceeds 100,000 pounds the Freyssinet concrete hinge may be used.

The high compressive strength of hooped concrete is taken advantage in this form of hinge shown in figure No. 13. The concrete on each side of the hinge gap is heavily hooped in a transverse direction, the hoop bars being tied by stirrups. The cross bars are shear members. The bearing area of the concrete hinge core is one third that of the full rib section. M. Freyssinet uses a working compression stress of 2,500 pounds per square inch in the concrete core. The hooping is made of 5/16-inch bars.

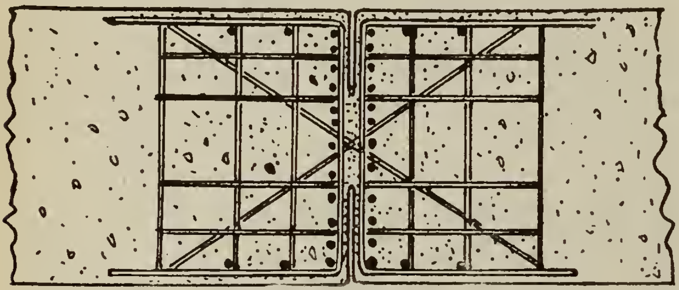


Figure No. 13

The hinge shown in figure No. 13 was used in the Boutiron arch bridge previously referred to. Semi-hinges of this type can be used for thrust intensity of over 200,000 pounds per lineal foot.

Shearing stresses at the hinge in both types of hinges described above must be considered. In the Mesnager hinge stirrups are usually employed, whereas in the concrete hinge diagonal bars across the gap are provided.

Reducing Flexural Stresses by Rib Compensation

As previously stated this important method is due to the French engineer M. Freyssinet who has published a complete account of it in Le Génie Civil.

The analysis of the elastic deformation of a parabolic rib given herein shows that the material of which the rib is made is subject to an elastic shortening when the false work which so far supported the rib is lowered and the rib placed under load.

M. Freyssinet defines the elastic conditions of the rib under load as follows:

(1). The angular change at the end of the rib axis is equal to the angular change of the corresponding support.

(2). The length of the axis is equal to that realized during the construction and modified by the elastic shortening, the linear defoimation of the supports, the shrinkage and the variations of temperature.

It is evident that the total work done in the rib under these assumptions, is much higher than it would be if the work of the elastic deformations could be suppressed. However, the conditions resulting from the elastic state of the rib created by lowering the falsework need not to be accepted as final if it is possible to control the elastic state of the rib and to select the one which will cause minimum stresses in the rib material.

Control of the Elastic State of the Rib

The arch rib is cut in two places and two groups of hydraulic jacks are placed in the joints thus formed. The pressure exerted by the jacks is independent of the rib deformation and the amount of opening of the two joints is a function of the applied pressure. Also, the pressure intensity exerted by one group of jacks is a function of that exerted by the other group and the position of the groups of jacks with reference to the rib axis may be varied at will.

In this way it is possible to vary three elements of the arch, namely, the length of the neutral axis and two angular deformations at two different points of the rib.

These three variable elements are then introduced as variable parameters in the three equations of the redundants. The unknowns in the system may be given any selected values corresponding to an arbitrarily chosen elastic state of structure.

The value obtained by solving the three parametric equations may be then realized by the application of the pressure from the jacks and the structure put in the chosen elastic state.

In the case of the symmetrical arch one of the redundants disappears by reason of the symmetry, and one joint placed at the crown is sufficient to obtain the desired result. In this case the two variable parameters of the elastic equations are simply the pressure and position of the jacks placed at the crown.

Practical Equalization of Stresses

By drawing the curve envelope of the total intradosal and extradosal stresses along the rib it will be found that in general at the crown the latter stresses are by far the highest and that the reverse is true at the skewback. This is due to the fact that the moments due to the elastic shortening compress the extrados at the crown and the intrados at the skewback. It is then possible to determine the magnitude of the moments to be introduced by the jacks in order to reduce the stresses along the rib to a minimum value, approximately equal for both the intrados and extrados.

Where the dead load moments are eliminated by proper design of the arch axis, and when it is not considered necessary to compensate the live load effects, the correction of the axis simply consists of lengthening the rib by an amount equal to the shortening caused by the elastic deformations.

As previously mentioned, the factors causing elastic deformations are rib shortening under load, shrinkage, variations of temperature and movement of the abutments. The structure is designed by the usual method of the elastic theory, the effects of live load concentrations being determined by influence lines and the effect of those elastic deformations which have been compensated are left out of the calculations.

The corrections may also be applied to the total stresses in the rib, which in this case includes bending moments due to loading. At the Villeneuve sur le Lot arch, M. Freyssinet states that important reductions of static moments were obtained in this way.

Application of Theory of Rib Compensation

In order to calculate the lengthening of the rib required to eliminate the effect of the elastic deformations, numerical values of the rib shortening caused by these deformations must be known.

Although the effect of the shrinkage of the concrete in setting has not received a great deal of consideration in this country, yet it is one of the most important factors causing elastic deformations.

We have seen that the shrinkage coefficient admitted by Considère at three months exceeds that of a fall of temperature of 40° F.

M. Freyssinet's observation on arches indicates yet higher values of shrinkage coefficient. The curve representing the shrinkage in a structure exposed to the air was found to swing on either side of a line of mean intensity with increasing amplitude until the maximum is reached after a long period of time. The maxima on the curve corresponds to the end of dry periods and the minima to wet periods. The amount of shrinkage varies with the nature and the proportion of cement, the characteristics of the sand and aggregates, the climatic conditions and the exposure of the structure. The observed shrinkage coefficients are as follows:

Bbl. of Cement per c.y. in place	Limits of Shrinkage
1.56	.0004 to .0006
1.78	.0005 to .0007
2.00	.0006 to .0008

If the total compensation was attempted before the effect of the shrinkage is fully felt on the structure dangerous stresses might result. Corrections from 3/4 to 4/5 of the full effect have been employed. The figures for the three mixes given above being respectively 0.0004, 0.0005, 0.0006. It is estimated that at the time the bridge is put in service the assumed values are within 0.0001 of the actual shrinkage.

In structures exposed to the air, the greater part of the shrinkage will occur during the first 60 days and the remainder only slowly through a long period of time during which the strength of the concrete will considerably increase. The rib shortening effect may be accurately determined if the value of the modulus of elasticity of the concrete is known. The modulus may be determined directly by means of test blocks.

The total shortening effect may also be obtained by observing the amount of opening in the joint at the crown under a known increment of jack pressure, before the arch begins to rise. In this case the result includes the elastic deformation of the abutments.

The amount of compensation to be applied to the ribs is determined, as already noted, from the analysis of the rib under the most severe conditions of loading, assuming that the rib shortening and other elastic deformations have reached their maximum values. The conditions of maximum loading do not usually occur at the time of striking the centres, and moreover, the rib shortening effect would not have reached its final stage at that time. It is therefore necessary to make a study of the elastic conditions of the unloaded rib after the compensation, taking into account the conditions most likely to prevail at the time. From this study, the amount of compensation that can be applied without creating dangerous stresses elsewhere in the rib can be ascertained.

It is to be noted that it is not necessary that the full compensation be carried out at the time of striking the centres if a smooth construction joint is provided at the crown. The gaps in which the jacks are placed can be left open under the roadway and the compensating operations continued whenever the rib shortening effect approach the final stage.

Such an operation was carried out at the Veutre bridge by M. Freyssinet. This bridge consists of three arches, the centre span being 240 feet in length with a rise of only 17 feet. The bridge was completed in January, 1911, and at that time the shrinkage amounted to only 0.0001. The amount of compensation then applied amounted to 0.0004. During the summer of 1911, the actual shrinkage was about equal to the compensation, but the shrinkage continued and in 1913 it had increased to 0.0008, with a resulting deflection of about 4 inches at the crown. The ribs were raised to the original position without any interruption of traffic and eleven 3 m/m steel plates added at the crown. Since that time the bridge has not required any further attention.

The fact that the centres are destroyed through flood or other cause do not prevent the jacking operations to be carried out.

The Veutre bridge was compensated after completion of the work, whereas at Villeneuve, owing to the war, the operation had to be carried out before the spandrels and the deck were built.

Details of Construction

The magnitude and the position of the external forces to be applied to the crown joint of the rib are determined from the study of the elastic state of the unloaded rib after compensation. High local compression stresses of a temporary nature are set up during the jacking operations which necessitates the use of richer mix and hooped or transverse reinforcing in the vicinity of the jacks.

The face of the open pocket in which the jacks and the metal wedges are placed is usually reinforced with a two-way reinforcing mat placed at right angles to the direction of pressure.

A mix having an ultimate strength of 5,700 pounds per square inch without reinforcing is used for a short distance back of the joint.

M. Freyssinet has used pressure as high as 4,270 pounds per square inch under the jacks and does not consider it the highest that can be used.

The average rib pressure is also increased under the wedges employed to block the opening of the crown joint, because the wedges do not occupy the whole rib section. It is possible however, to limit the increase of pressure there to much smaller values than under the jacks. By providing brackets on the side of the rib, or by increasing the section of tubular arches, increased compression stresses at the joint are entirely avoided. The former method is to be used at Bernard bridge and the latter was used at the St. Pierre de Vouvray bridge.

M. Freyssinet had made use of wedges of wood or iron and of hydraulic jacks to create the required pressure. The jacks however, were found to be the most practical methods. The jacks used were made of steel forgings 16 inches outside diameter by 6 inches in hight and having a maximum motion of 3⅛ inches. They are designed for a pressure of 500 metric tons. Each jack has two orifices which permit interconnection with the other jacks of the group in order to equalize the pressure. If the jacks are also directly connected to the pump, it is possible, by means of valves to vary the pressure in each jack and thereby shift the point of application of the external force. In this case, care must be taken against accidental pressure drop in one of the jacks whereby dangerous stresses might result. The best precautionary measure consists of using a number of steel wedges for the temporary blocking of the joint. The wedges can always be kept tight during the jacking process and prevent any movement of the rib should the pressure accidently drop. At the Villeneuve bridge where two groups of jacks were used for the operation a third group was kept in reserve. Careful record is kept of the behavior of the ribs during the jacking. The observations should cover the range of pressure in each group of jacks and the corresponding rib deformations, opening of joint, local deformation, movements of the abutments and variation of crown elevation.

Whenever the result of these observations shows that the desired elastic state of the rib has been reached, the joint is filled in. If it is possible to determine beforehand the exact amount of joint opening required, precast slabs of suitable thickness can be used to block the opening. The joint is opened a little over the required amount to permit the introduction of the slabs.

At the Veutre bridge, metal wedges were used to block the joint temporarily until the quick setting cement filling had hardened sufficiently to take the load.

Results Obtained by Method of Rib Compensation

The factor of safety of a simple structure statically determinate can usually be increased simply by increasing the cross-sectional area or the moment of inertia. The stresses due to the elastic deformations of a fixed arch cannot however be reduced in this way, because the moment stresses due to these deformations are proportional to the moment of inertia and increase with the depth of the section.

In the analysis for the determination of the maximum rib stress, M. Freyssinet includes all the elements affecting the equilibrium of the structure, that is:

(A). Compression due to the dead load.
(B). Effects of live load.
(C). Moment stresses from the dead load that can be limited by proper design of the axis to the elastic shortening of the rib under the thrust.
(D). Rib shortening due to shrinkage and possible movement of the abutments.
(E). Temperature variations between the mean temperature and the temperature at which the rib is closed.
(F). Variations of mean temperature.

Stresses due to A depends entirely on the curvature of the axis and the care taken to reduce the weight of the deck and the spandrel supports. B is a function of A, the stresses due to B are reduced if the ratio of the weight of the rib itself to the live load is increased. Stresses due to B remain constant when the span increases, the live load per lineal foot remaining constant. Live load stresses also decrease when the rise f increases, but in this case, stresses due to D and E also increase.

Stresses due to D increase with the span, the amoun. of cement in the mix and the ratio rise to span $\frac{f}{l}$. Both E and F are proportional to $\frac{f}{l}$.

The method of rib compensation makes it possible to eliminate stresses due to C, D and E. If B is kept constant when the span is increased, the reductions in C, D and E will only increase A, and the limiting possible span length depending on A is increased proportionally.

Table No. 1 gives the stresses at the crown and skewback and the characteristics of two of the longest bridges designed in accordance with the method of rib compensation. For the purpose of comparison the stresses that would occur if the ordinary method of construction had been employed are shown in the table. The stresses are grouped under items A to F, the wind stresses being considered separately.

Table No. 1

	Villeneuve Bridge				St. P. Vouvray Bridge			
	Crown		Skewback		Crown		Skewback	
	Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
D.L. Compression.	547	547	401	401	445	445	313	313
DL Bending	-90	90	-20	20	—	—	—	—
Live Load.	190	78	159	192	200	200	232	216
Total.	647	715	540	613	645	646	545	529
Rib Shortening	85	-95	-81	74	61	-75	-73	61
Shrinkage	284	-320	-277	249	218	-256	-242	206
Temperature Variation.	171	64	55	148	94	51	48	123
Total.	540	331	-303	471	368	-280	-267	390
Correction Rib Shortening	-85	95	81	-74	-81	75	73	-61
Correction Shrinkage.	-227	256	222	-199	-170	206	193	-165
Correction, mean Temperature.	-57	64	55	-50	-43	51	48	-41
Total.	-369	415	358	-323	-274	331	314	-267
Max. fiber stress, ordinary method of decentering.	1187	364	237	1084	1013	351	279	918
Max fiber stress, Mr. Freyssinet method of decentering	818	779	595	761	768	668	593	651
Wind stress, 30.6 Lbs. per sq. ft.	not considered.				161	161	112	112
Span. ft.	321.				430.			
Rise, ft.	42.7				82.			
Rib section, width x depth, in ft.	9.94×4.75		9.94×7.87		8.2×8.2		8.2×16.4	
Weight at Crown, ribs only, Lbs per L.F.	14100				6700			
Total weight at Crown, Lbs per L.F.	23200				12800			
Live Load	One meter gauge track Uniform load 1080 Lbs L.F.				Uniform load 1250 Lbs L.F.			

The large reduction of total stress obtained by the method of rib compensation as shown in table No. 1 is the more remarkable because of the fact that the abutments were considered fixed.

A value of 2×10^{9} was used for the modulus of elasticity. The total shrinkage estimated at 5×10^{-4} and the correction made for for a shrinkage of 4×10^{-4}. Influence lives were used to determine the live load effect. It was assumed that the rib temperature at the time of the filling of the joint would be near the maximum, and that the temperature drop coefficient would be 3×10^{-4}. The mix in the two bridges was 350 kgs. per cu. m., or 1.56 bbl. per cubic yard of concrete in place.

Proportions of Long Span Arches

With the large increase of span of concrete arches rendered possible by the method of rib compensation, the resistance of these bridges to sideways buckling becomes an important factor. The slender proportions of the arch ribs of M. Freyssinet's bridges were adopted after careful consideration of the effect of deflections, lateral forces and wind stresses. The wind stresses can be easily computed and their intensity does not increase with the span because the section modulus about the horizontal axis increases at the same rate as the bending due to wind, when all the dimensions of an arch rib are multiplied by a given factor.

The transverse moment due to the thrust is the most important factor to be considered, and it must be shown that there is a definite limit to the deflections due to the transverse moment before the rib can be considered safe against sideways buckling.

If Z is the value of the deflection at any point and N the thrust along the neutral axis then $N Z$ is the bending moment. This moment $N Z$ produces a deflection Z' and a moment $N Z'$ which introduces again further deflections and moments.

If the series $(Z+Z'+Z'')$ has a limiting value, then the rib has a definite position of equilibrium. If the series do not converge there is danger of sideways buckling.

It is pointed out that the initial value of Z is never zero. Even if it was possible to construct a rigourously plane rib, warping would be caused by the wind stresses and the elastic deformations, particularly those due to difference of temperature on the two faces of the rib.

The value of $N Z$ due to these factors can be found by noting the action of the rib under the jack pressure. It is possible to correct the lateral displacement by shifting the position of the resultant of the jack pressure, the experiments made at Villeneuve showing that both lateral and vertical displacements can be controlled by the jacks.

Advantages of the Method.

The method of the rib compensation has been tried out with complete success over a period of fifteen years. It greatly simplifies the construction of concrete arches giving a far better control of the position of the ribs than the older methods using wedges or sand boxes. It is a logical step forward in the art of reducing the bending moment stresses set up during construction, which, with the older methods, necessitates costly increase of cross sectional area and a corresponding increase in the cost of the false work. Because of the fact that the moment stresses due to the elastic deformations increase with the moment of inertia of the section, it is evident that a given increase of cross sectional area does not increase the factor of safety of a fixed arch in the same way it does in a simple beam, the net result being a waste of material. Another advantage of the method is that it is possible to remedy possible movements of the abutments without impairing the strength of the structure in the least. The longest concrete arch bridge in the world was erected by this method and still longer compensated arches are under construction at the present time. The method offers truly remarkable possibilities to the builders of concrete bridges.

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The St. Maurice Valley Branch

The official inauguration of the St. Maurice Valley of *The Engineering Institute of Canada*, the twenty-fifth branch to be formed, took place at Three Rivers on the afternoon of Saturday, January 16th, 1926.

In the unavoidable absence of President Arthur Surveyer, Vice-President K. B. Thornton took charge of the proceedings, and was accompanied by Arthur Duperron, A.M.E.I.C., representing the Montreal Branch, and by the general secretary.

The establishment of the new branch was authorized by Council on January 27th, 1925, following an application made, in accordance with the by-laws, by ten corporate members of *The Institute* resident in the St. Maurice Valley. For various reasons the official inauguration of the branch did not take place for some time, but it is evident that the activity and enthusiasm of the members in Three Rivers, Shawinigan Falls and Grand'Mere has not been checked by the delay.

Through the kindness of Mr. Arthur Bettez, mayor of Three Rivers, the City Hall was available for the meeting, which was called to order by Mr. Thornton at 3.30 p.m.

His worship the Mayor delivered a graceful address of welcome in French and English, and said that on behalf of the city of Three Rivers he was delighted to welcome the members, and would afford any assistance in his power to further the activities of the branch.

The Mayor's remarks were suitably acknowledged by Mr. Thornton, who expressed the regrets of President Arthur Surveyer at his inability to be present, and the President's best wishes for the future progress of the branch.

The chairman then called upon the secretary to read the minute of Council authorizing the establishment of the branch, which runs as follows:

"An application for the establishment of a Branch of *The Institute* in the St. Maurice Valley District was presented as follows:

Three Rivers, January 26th, 1925.

To the Council,
The Engineering Institute of Canada,
Montreal, Que.

Gentlemen:—

We, the undersigned corporate members of *The Engineering Institute of Canada*, in conclusion of a meeting held in Trois Rivières on January 26th, 1925, wish to take advantage of the privileges granted by By-law Section 48 and form into a local Branch including members resident in the St. Maurice Valley district:

F. O. White, M.E.I.C.
C. R. Lindsey, A.M.E.I.C.
J. Henri Valiquette, A.M.E.I.C.
Bruno Grand Mont, A.M.E.I.C.
J. A. Bernier, A.M.E.I.C.
C. H. Jetté, A.M.E.I.C.
C. E. Gélinas, A.M.E.I.C.
Henri Dessaulles, A.M.E.I.C.
J. E. A. Warner, A.M.E.I.C.
Louis McCoy, A.M.E.I.C.

The application was approved, the Secretary being instructed to complete the necessary organization. The decision as to the name of the Branch being left with the Council, it was resolved that this Branch be known as the St. Maurice Valley Branch of *The Engineering Institute of Canada.*"

The secretary also read the sections of the *Institute's* by-laws dealing with branch affairs.

The chairman explained that in accordance with the by-laws an Executive Committee would have to be elected, which would include a chairman, vice-chairman, and secretary, and not less than three elected members, and he asked to the members present for nominations for these officers.

Ellwood Wilson, M.E.I.C., nominated C. E. Gélinas, A.M.E.I.C., city engineer, Three Rivers; S. W. Slater, A.M.E.I.C., chief engineer, St. Maurice Paper Company, Cap de la Madeleine; Henri Dessaulles, A.M.E.I.C., Shawinigan Falls; J. H. Valiquette, A.M.E.I.C., city manager, Shawinigan Falls; H. O. Keay, M.E.I.C., manager of research, Laurentide Company, Grand Mere, and Ellwood Wilson, M.E.I.C., chief forester, Laurentide Company, Grand Mere, as members of the Executive Committee.

No further nominations being made, it was moved by Mr. Ellwood Wilson, seconded by Mr. H. Kirsh, that the above named gentlemen be elected as members of the Executive Committee of the St. Maurice Valley Branch, and the resolution was passed unanimously.

The chairman suggested that the election of chairman and vice-chairman might perhaps be postponed, as some of the gentlemen elected on the Executive Committee were unavoidably absent from the meeting, but that in the interim Mr. Gélinas should be requested to act as secretary. This was unanimously approved, and Mr. Gélinas accepted the task.

The chairman then reminded the members present that *The Engineering Institute of Canada*, founded originally in 1887 as the Canadian Society of Civil Engineers, had changed its status and greatly widened its sphere of development in 1918 when its name was changed to *The Engineering Institute of Canada*.

He drew attention to the decentralized system of organization of *The Institute* and pointed out that this imposed upon the branches certain responsibilities which were recognized by Council, as was evidenced by the by-laws dealing with the organization of branches.

The branches thus had a considerable measure of autonomy, and one of the first tasks of the new Executive Committee would be to draw up suitable branch by-laws for the approval of Council. These should be in accordance with the by-laws of *The Institute* as regards matters of general policy, but could be framed so as to suit local interests and requirements in so far as purely branch matters were concerned.

He thought that the St. Maurice Valley was a very fitting place for the development of a branch of *The Institute*, as that Valley was now playing such an important part in the industrial development of the province of Quebec. This development had originally been made possible by investigations and explorations by engineers, and was now proceeding with the assistance of and under the direction of members of the profession.

He trusted that the formation of the branch would result in the development of a strong esprit de corps among the engineers engaged in similar lines of work in the district, and was sure that it would be of the greatest benefit to all members of the engineering profession.

He had great pleasure in presenting to the newly elected Executive Committee the Charter, authorized by Council, and bearing the seal of *The Institute*, constituting an expression of their authority to carry on the activities of a branch of *The Engineering Institute of Canada*.

The Charter was gratefully accepted by Mr. Gélinas on behalf of the St. Maurice Valley Branch.

Arthur Duperron, A.M.E.I.C., spoke as the delegate of the Montreal Branch, and presented to the meeting the following resolution which, on the motion of Mr. C. J. Desbaillets, seconded by Mr. George MacLeod, was unanimously passed at a meeting of the Montreal Branch on Thursday, January 14th, 1926:—

> "The Montreal Branch of *The Engineering Institute of Canada* desires to convey to the newly formed St. Maurice Valley Branch its hearty congratulations, and its best wishes for the prosperity and progress of the twenty-fifth Branch of *The Institute*."

Mr. Duperron then made a pleasing address in French, in the course of which he said that it was a pleasure to take part in the congratulations on the formation of the new branch, and pointed out that the government of the province of Quebec had always taken an enlightened attitude in its policy of developing the natural resources of the province. That government had, throughout, encouraged and supported *The Institute* in the development of the status of the engineering profession, and as a result we now had in the province a body of competent and experienced engineers whose professional abilities compared well with those of other countries.

He trusted that the continuation of this policy would develop the prosperity of the province and of the Dominion, and regretted greatly that Mr. Lefebvre of the Quebec Streams Commission, who was always greatly interested in the St. Maurice Valley, could not be present. On behalf of the Montreal Branch he wished all success and prosperity to the newly formed branch.

Mr. Thornton then called upon Mr. Gélinas to take the chair and hold the first meeting of the branch.

Mr. Gélinas expressed the gratitude of the members present for the action of Council and also for the congratulations and good wishes conveyed by Mr. Thornton and Mr. Duperron, and thought that he would be safe in assuring Council that the newly formed branch would be a most active and lively one. He read a telegram of regret just received from Dr. Surveyer, and stated that when making arrangements for the present meeting it was at first thought that about fifty members would be interested, but on inquiry it appeared that there were in the district a much larger number of engineers who were apparently eligible for membership in *The Institute*, and he believed that there would be little difficulty in obtaining a much larger membership.

Mr. Keay pointed out that one of the great advantages of the branch organization of *The Institute* was that this provided organized local bodies of engineers who were available to deal with problems of local interest, and who were at the same time able to take part in the engineering activities of the country as a whole by contributing both to the proceedings of the branches and also to those of the general meetings of *The Institute*. He felt sure that the common interests of engineers in the Valley would be well served by the new branch, and they would, at the same time, feel that they were an active part of a national Dominion-wide organization.

Mr. Thornton remarked that arrangements were being made for promoting the interchange of papers between different branches, and suggested that the new Executive Committee should communicate in this regard with headquarters and with the Montreal and Quebec branches.

Mr. Sabbaton of the Laurentide Company suggested that it was important to lose no time in approaching the considerable number of engineers resident in the St. Maurice Valley who are not now members of *The Institute*, and thought that the formation of a membership committee should be one of the first acts of the new executive. He asked that the secretary would see that the Executive Committee was furnished with the necessary application forms and literature for this purpose.

Mr. Lauriault, of the Three Rivers Technical School, inquired as to the relationship between *The Engineering Institute* and its branches, and the Corporation of Professional Engineers of the Province of Quebec.

Mr. Thornton, as vice-president of that Corporation, stated that the relation was a very cordial one, and that the functions of the two bodies were essentially different, the Corporation of Professional Engineers being charged with the protection of the legal interests of engineers in the province of Quebec, whereas *The Engineering Institute*, as a Dominion-wide body, was occupied with the professional and technical welfare of engineers for the whole Dominion. He was glad to note that the relations between *The Institute* and the professional associations in the other provinces of the Dominion were just as satisfactory as those with the Quebec Association. He pointed out further that in all of the professional associations a very large proportion of the members were loyal and active members of *The Engineering Institute.*

There being no further business, the meeting adjourned at five o'clock p.m., and through the kindness of the Mayor and Mr. Gélinas the members present had the privilege of visiting the new pumping station and filtration plant of the city of Three Rivers, now just approaching completion.

Among those present were the following members and guests:—

L. C. Anderson
Chas. L. Arcand, A.M.E.I.C.
John A. Barckley
Carl G. Bjerkelund
J. E. Bonoventure
T. G. W. Boxall
Ernest Butler
W. J. Carson
D. S. Christie
E. A. Cowan, S.E.I.C.
A. I. Cunningham, A.M.E.I.C.
J. L. Davison, S.E.I.C.
E. A. Delisle
A. Duperron, A.M.E.I.C.
J. E. Fleury
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C. E. Gélinas, A.M.E.I.C.
W. E. Hall
F. Hart
H. O. Keay, M.E.I.C.
H. Kirsh
W. E. Lauriault
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D. C. Macpherson, S.E.I.C.
J. A. Michaud, A.M.E.I.C.
Roméo Morrissette
Frank Panneton
A. D. Ross
Frederic A. Sabbaton
J. Irving Smith
L. Sterns, Jr.E.I.C.
L. S. Tuck, A.M.E.I.C.
R. A. Vincent
Ellwood Wilson, M.E.I.C.

The Association of Consulting Engineers of Canada

A new organization of engineers, with the above title, was incorporated by Federal Charter in June of this year, with the following as its first members:—

H. G. Acres, M.E.I.C.	Toronto
de Gaspé Beaubien, M.E.I.C.	Montreal
J. L. Busfield, M.E.I.C.	"
F. B. Brown, M.E.I.C.	"
Henry Holgate, M.E.I.C.	"
L. A. Herdt, M.E.I.C.	"
R. S. Kelsch, M.E.I.C.	"
R. S. Lea, M.E.I.C.	"
W. S. Lea, M.E.I.C.	"
T. R. Loudon, M.E.I.C.	Toronto
F. C. Laberge, M.E.I.C.	Montreal
G. K. McDougall, M.E.I.C.	"
C. N. Monsarrat, M.E.I.C.	"
R. A. Ross, M.E.I.C.	"
J. M. Robertson, M.E.I.C.	"
Arthur Surveyer, M.E.I.C.	"
W. G. Swan, M.E.I.C.	Vancouver
Lesslie R. Thomson, M.E.I.C.	Montreal

The objects of the Association are by Charter,—

"To promote ethical standards and practical efficiency in all branches of consulting engineering as a profession, and to increase the usefulness of consulting engineering to the public at large."

Consulting engineers have felt frequently the lack of a distinctive organization which could speak with authority for their own especial group, and this need has led to the establishment of the association.

The association does not propose to encroach on the field of *The Engineering Institute of Canada* by preparing or discussing professional papers, by holding technical meetings, or by embarking upon any other similar activities. The acquisition and spreading of technical and professional knowledge by means of papers, meetings, transactions, etc., is beyond the scope of this new body.

The constitution provides that consulting engineers of acknowledged standing are eligible for membership in the association, which is limited to engineers of at least 35 years of age qualified in any recognized branch of the engineering profession, who are members of *The Engineering Institute of Canada* and of the Professional Engineering Corporation of the province in which they reside, and who are chiefly engaged in consulting engineering work. Engineers employed upon or connected with contracting, sales, or promotion, (except in a strictly advisory or supervisory capacity and whose compensation is for professional service and not contingent on profits) are not eligible for membership.

Special Privileges as to Publications of Other Engineering Societies

The attention of members of *The Engineering Institute of Canada* is directed to the exchange arrangements made with the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Civil Engineers, and the American Society of Mechanical Engineers, whereby our members are able to subscribe for their journals or transactions, and can purchase their other publications, at the same rates as those paid by their own members.

While this scheme has been in effect since 1921, it does not appear to have been fully utilized by our members, many of whom, it is felt will be glad to add to their libraries one or more of such important technical periodicals.

Subscriptions may be sent, either directly to New York, or through Headquarters. The following list of rates gives in the first column the amounts payable by members of *The Engineering Institute* for the various publications.

	Rate to Members	Rate to Non-Members
American Institute of Electrical Engineers		
Journal, single copies	$0.50	$ 1.00
" per year	5.50	10.50
Transactions, per year, paper	5.00	10.00
" " cloth	5.00	10.00
Year Book	1.00	2.00
Pamphlets	.25	.50
American Institute of Mining and Metallurgical Engineers		
Magazine, single copies	0.50	1.00
" per year	5.00	10.00
Transactions, per volume, with pamphlets, paper	2.50	5.00
(Other publications, same rate to E.I.C. members as to A.I.M.M.E. members.)		
American Society of Civil Engineers		
Proceedings, single copies	0.50	1.00
" per year	4.00	8.00*
Transactions, "	6.00	12.00†
Year Book	1.00	2.00
(Other publications 50 per cent reduction on catalogue price to E.I.C. members.)		
American Society of Mechanical Engineers		
Journal, single copies	0.50	0.60
" per year	4.00	5.00
Transactions, per year	6.00	8.00
Year Book	1.00	2.00
(Other publications, same rate to E.I.C. members as to A.S.M.E. members.)		

**If subscription is received before January 1st, otherwise $10.00.*

†If received before February 1st, otherwise price $16.00.

National Research Council

The work of a body like the National Research Council of Canada does not lend itself readily to modern methods of publicity, and it is doubtful whether the results the Council has already achieved are adequately understood by the general public.

A large proportion of the modest grant given by the Dominion Government is expended in providing for studentships at various universities, in this way encouraging post-graduate work, and training a body of scientific workers available for the conduct of investigations.

The Council also devotes its funds to assisting researches which may involve scientific questions connected with any branch of industry. An outstanding example of this has been the very successful work in connection with the determination of the cause of black discoloration in canned lobster, which had been the cause of great loss to the industry, and for which a satisfactory and simple remedy was found by an investigation organized and supported by the Council.

The Council is now proposing to develop this policy further, and is organizing local or provincial sub-committees for the purpose of ascertaining what problems involving physical or engineering questions now present themselves to various industries and await solution. Many such problems, of course exist, but have not yet been attacked, owing to the lack of funds, opportunity, necessary accommodation and equipment, or the want of a competent investigator.

The National Research Council is at present assisting many investigations, and is ready to consider sympathetically all applications for research assistance. This assistance may be of the following kinds:—(1) Furnishing expert opinions. (2) Arranging for the investigation of problems in some appropriate institution. (3) Arranging to provide or train an expert for special work. (4) Cooperating in certain cases of importance in the provision of financial aid for research.

Members of *The Institute* throughout Canada will be interested in this development, and it is hoped will be able to assist the work of the local committees by suggesting problems awaiting solution.

The list of local Committees, with their chairmen, to whom communications regarding this matter should be addressed is as follows:

Division	Chairman	Address
British Columbia	J. S. Plaskett, B.A., D.Sc., F.R.S.C.	Director, Astrophysical Observatory, Victoria, B. C.
Alberta and Saskatchewan	R. W. Boyle, M.A., Ph.D., F.R.S.C., M.E.I.C.	Dean, Faculty of Applied Science, Univ. of Alberta, Edmonton, Alta.
Manitoba	Frank Allen, M.A., Ph.D., F.R.S.C.	Prof. of Physics, Univ. of Manitoba, Winnipeg, Man.
Ontario	J. C. McLennan, O.B.E., Ph.D., LL.D., F.R.S.	Prof. of Physics, Univ. of Toronto, Toronto, Ont.
Quebec	A. N. Shaw, B.A., D.Sc., F.R.S.C.	Assoc. Prof. of Physics McGill Univ., Montreal.
Maritime Provinces	H. L. Bronson, B.A., Ph.D., F.R.S.C.	Prof. of Physics Dalhousie University, Halifax, N. S.

The President-Elect

In accordance with time-honoured custom, the name of one member has been submitted by the Nominating Committee for election as President of *The Engineering Institute of Canada* for 1926, that of George Alexander Walkem, M.E.I.C.

Major Walkem was born July 8th, 1872, at Kingston, Ontario, and was educated at the Kingston Public Schools, and at McGill University, taking his degree in 1896 in Mechanical Engineering. He has had varied and extensive engineering experience, serving his apprenticeship in the Kingston Locomotive Works and Kingston Foundry, working on the water intake pipe into Lake Ontario for the City of Toronto, and later, in the West on survey and track superintendence in steam and electric railways.

From 1901 to 1905 Mr. Walkem was Works Manager for the Vancouver Engineering Works Ltd., and in 1906 organized the Vancouver Machinery Depot Ltd., of which firm he is now Managing Director. He has been greatly interested in the development of the University of British Columbia and in 1922 gave his services to that University as lecturer in Industrial Management in the Department of Mechanical Engineering.

In addition to these interests he is President of the Gulf of Georgia Towing Co., Limited, and of the British Columbia Dock Company Limited, and takes a prominent part in the commercial and industrial life of Vancouver.

MAJOR GEO. A. WALKEM, M.L.A., M.E.I.C.
President-Elect of The Institute for 1926.

He rendered distinguished service during the Great War, leaving the Royal Engineers (Railway Troops) on demobilization with the rank of Major. His duties in Egypt and Palestine with the Railway Operation Division, R.E., included the charge of the Kantara Military Railway, and work in connection with its extension across the Sinai Desert, if not to Dan at least to Beersheba, with other branches to Jerusalem and Haifa. This involved a great deal of construction as well as maintenance work, and Major Walkem was mentioned in despatches by General Allenby.

The President-elect joined *The Institute* in 1906 as Associate Member and was elected Member in 1920. He served as a Councillor during 1921 and 1922, and was a Vice-President during 1923 and 1924, so that he brings to the President's chair ample experience of *Institute* affairs. His interest in professional matters is evidenced by his active connection with the Association of Professional Engineers of British Columbia, of which body he has for some time been a Councillor, and by a happy coincidence is this year the President. He has been a vigorous supporter of all movements in British Columbia for the advancement of the engineering profession, and was one of the original promoters of the Act incorporating the Association of Professional Engineers of British Columbia.

As one of the increasing number of engineers who take an active part in civic and public life, Mr. Walkem has been Reeve of Point Grey, which constituency he now represents in the Provincial Legislative Assembly. He finds time also for the support of social welfare work and is a Director of the Vancouver General Hospital and of the Children's Aid Society of Vancouver.

EMPLOYMENT BUREAU

Situations Vacant

Research Assistant Wanted

A research assistant on certain structural investigations in both steel and reinforced concrete is required. A graduate of an engineering college is preferred, but in any event he must be especially proficient in higher mathematics and in the making of precise measurements. Minimum salary, $150 per month. Give full details of qualifications and experience. Apply Professor C. R. Young, Electrical Building, University of Toronto, Toronto, Canada.

Construction Superintendents

Large paper company constructing in an outlying district a townsite, fifty thousand horse power hydro-electric plant and pulp mill requires a general construction superintendent; a dam construction superintendent; a mill construction superintendent; a carpenter foreman; a master mechanic; and a master electrician for pulpmill. Excellent opportunities for right parties. Applications must contain full record of previous employment and state salary expected and names of previous employers. Apply Box No. 150-V.

Situations Wanted

Electrical Engineer

Technical graduate, University of Toronto, 25 years of age, good personality, two years Westinghouse electrical engineering training, one year installation and maintenance, familiar with inspection and maintenance of electrical equipment, desires situation with public utility or industrial organization. At present employed. Apply box No. 202-W.

Sales Engineer

Advertiser desires to communicate with firms requiring the services of a technical representative or sales manager. Thoroughly experienced in sales work including organization, sales promotion advertising, correspondence, etc. B.Sc., age 30, married, speaking both languages. Apply Box 203-W.

BOOK REVIEWS

Economics of Highway Engineering

by H. T. Tudsbery. E. & F. N. Spon, London, 1925. Cloth 5½ x 8¾ in. 48 pp. 4/6 net.

This brief work is intended to interest highway engineers more effectively in the economic and financial side of their work, as distinguished from the purely technical aspect. Its four chapters deal respectively with Traffic increase and cost, Track, Vehicles, and Fundamental Principles, more particularly from the British point of view, and contain pertinent information regarding highway problems in Great Britain.

The Erection of Engineering Structures and Plant

by Harry Atkin. Chapman and Hall, London, 1925. Cloth 5½ x 8¾ in. 198 pp., illus. 9/6 net.

Forming one of a series of "Directly-Useful" books designed to offer hints and assistance regarding shop or constructional methods and processes which will be of service to technically trained men confronted with jobs outside of their office experience.

Much of the contents is of course familiar to a practical erector, but will be a welcome supplement to the native ingenuity and common sense of the engineer who has little experience in work of this kind.

How to Build up Furnace Efficiency

by Jos. W. Hays—17th edition. Published by the author, Michigan City, Indiana, 1924. Cloth 5½ x 7½ in. 534 pp., illus. $3.00.

In writing "How to Built up Furnace Efficiency" the author has adopted what he calls a narrative style of writing, and his method of presenting the subject is certainly unique; if presenting a thesis in an unexpected way is likely to stimulate interest in it, Mr. Hayes has succeeded admirably. One is not accustomed to look for jokes in a treatise on boiler plant operation, but in this book there are more jokes and amusing cartoons than will be found in *Puck*, *Judge* and the *College Widow* combined.

But there is more than entertainment in the book and we find on investigation that the whole question of combustion and its bearing on how to build up furnace efficiency is ably treated. There is just one difficulty about handling a subject of this kind in this way: the reader is in danger of losing the thread of the argument while looking for the next joke.

Chapter I treats of the available supply of coal in the world and contains the "Alphabet of Steam Engineering" which would not pass as high class poetry, but it contains some real facts.

The next chapter, known as Reel I, points out why fuel is wasted in the boiler room.

Reel II shows how fuel is wasted and two graphical charts make this quite clear.

Chapter III treats of finding fuel wastes, and the next chapter shows how to stop them.

The whole subject of the losses due to excess air is considered and the advantages of flue gas analyses pointed out. The method of analyzing gas by the Orsat apparatus and the operation of CO_2 recorders is taken up in detail.

There is a chapter on Marine boiler plants and another on the burning of oil and waste fuels. The author claims that firemen will read this book and understand it, and if so, a copy of the book should be placed in every boiler plant.

L. M. Arkley.

Wasserkraft — Jahrbuch

Richard Pflaum, Munich, 1924. Cloth 6 x 9¼ in. 612 pages. Illus., and tables. 24 mk.

The first issue of this year book gives a general survey of the present European situation as regards the utilization of water power, brief articles dealing with the position in all the principal European countries, including Russia and particularly Scandinavia and Switzerland.

These chapters are followed by a series of technical papers on the development of water powers, treating such subjects as preliminary calculations and estimates, stream measurement, difficulties from silt and detritus, the relations between water power requirements and those of navigation, the use of wood stave pipe, spillways, and other similar topics. The third part of the volume deals with present practice regarding cavitation difficulties, draft-tubes, runners, governors and methods of increasing the efficiency of existing turbines. A series of useful tables is given in an appendix.

While it treats the subject almost entirely from the European point of view, this volume will be found of considerable interest to hydraulic engineers on this side of the Atlantic.

THE

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St. John Branch, St. John, N.B.
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Quebec Branch, Quebec, Que.
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*C. H. WRIGHT, Halifax, N.S.

*For 1926   †For 1926-27   ‡For 1926-27-28

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R. J. DURLEY, Montreal

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THE

ENGINEERING JOURNAL

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THE INSTITUTE as a body is not responsible either for the statements made or for the opinions expressed, in the following pages.

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Report of Council for the Year 1925

During the past year the policy of Council has been one of steady development in so far as the financial resources of *The Institute* have permitted.

In view of the amount of arrears of fees outstanding it has been found necessary to make a special effort to regularize the situation in this respect, and Council, while giving careful consideration to the conditions of individual cases, has taken action which is resulting in a marked reduction of the amounts owing.

In the month of May, Mr. Fraser Keith retired from the secretaryship, carrying with him the regrets of the membership at the loss of his services, and their best wishes for his success and prosperity. He was succeeded by Mr. R. J. Durley, formerly secretary of the Canadian Engineering Standards Association.

During the year charters have been formally presented to the Hamilton, Kingston, London and Vancouver branches.

Council has authorized the formation of the St. Maurice Valley Branch, with headquarters at Three Rivers, Que., and its inauguration will shortly take place, bringing the number of branches up to twenty-five.

The Council desires to point out the very important part played by *The Journal* in the organization and work of *The Institute*, and the desirability of increasing and extending its usefulness to the membership, which can only be done by the provision of additional funds.

It is also thought desirable that the issue of *Transactions* should be resumed as soon as circumstances permit, as such a publication would preserve in a convenient and accessible form the more important papers presented to *The Institute*, together with an adequate record of the discussions upon them; material which, in *The Journal*, is necessarily scattered and in a form less suitable for permanent preservation.

A strong recommendation regarding this matter is contained in the report of the Finance Committee, and deserves careful consideration.

The Journal publishes in the branch news fairly complete abstracts of the papers presented at branch meetings, and finds space for printing some of these in full, together with the papers presented at the General Professional Meeting and at the Western and Eastern Professional Meetings. The diversity of subjects thus dealt with is shown by the fact that during the past three years — 1923, 1924 and 1925 — *The Journal* has published in full thirty-four papers dealing with civil engineering, surveying and construction subjects; fifty-two papers dealing with mechanical and electrical matters; four mining and metallurgical papers, and eleven treating of miscellaneous topics, including engineering education.

The work on the library catalogue has been continued during the year, and shelving is being installed which will render the books and periodicals recently catalogued accessible for consultation and use.

The Council has pleasure in drawing attention to the satisfactory progress of the work of the Committee on the Deterioration of Concrete in Alkali Soils, this being clearly shown by the paper on the subject to be presented at the General Professional Meeting in Toronto.

It is expected that the Committee on War Memorials will complete its work during the coming year, as the membership will be asked to contribute the comparatively small amount necessary to complete the amount required for the Bronze Tablet and Honour Roll.

MEETINGS

The thirty-ninth annual general meeting of *The Institute* was held at the Windsor Hotel, Montreal, on Tuesday, January 27th, 1925, and after the approval of the minutes of the previous annual meeting, and the appointment of scrutineers to report the results of the officers' ballot and auditors for the ensuing year, the report of Council for the year 1924 was considered and adopted.

The reports of the various committees and branches were presented and adopted, and following the morning session many of the members attended the luncheon of the Rotary Club of Montreal, at which J. D. Craig, M.E.I.C., Director General of Surveys, gave an interesting address on conditions in the Arctic.

During the afternoon session an invitation from the Toronto Branch to hold the 1926 annual meeting in Toronto was presented by Mr. Morrow Oxley, chairman of the Toronto Branch, and was accepted and approved.

The report of the scrutineers appointed to examine the ballot for the election of officers was presented, and the elections were confirmed, after which the President, Dr. Arthur Surveyer, took the chair and delivered a brief address.

On the evening of the 27th, a smoker was held at the Windsor Hotel, at which a varied programme was presented.

The first session of the general professional meeting was held on Wednesday, January 28th, and the entire day was devoted to the presentation of papers and discussions on the subject of engineering education.

The second professional session was held on the 29th, and was devoted to a discussion of the difficulties of construction under winter conditions.

Other functions in connection with the annual general professional meeting included a luncheon on January 28th, given to visiting members by the Montreal Branch, a dance and supper on the evening of January 28th, and visits to works of interest in Montreal and the vicinity.

Western Professional Meeting

The western professional meeting took place at Banff, Alta., July 11th to 16th, and was held in a camp pitched by kind permission of the Parks Branch, Department of the Interior, at the junction of the Bow and Spray rivers. Arrangements for the equipment, organization and operation of the camp were admirably carried out by members of the Calgary Branch, and about one hundred members and guests were in attendance.

The following papers were presented and discussed, and the meeting afforded a welcome opportunity for a gathering of the western members.

"Park Highways", by J. M. Wardle, A.M.E.I.C.

"Reconstruction of Lake Louise Hotel during winter 1924-25", by H. S. Bare, A.M.E.I.C.

"Vancouver Harbour Development", by Major Geo. A. Walkem, M.E.I.C.

"Alberta Natural Resources", by Edgar Stansfield, M.E.I.C.

"Aerial Photography", by F. H. Peters, M.E.I.C.

"Alberta Petroleum Geology", by Dr. O. B. Hopkins.

Maritime Professional Meeting

An equally successful maritime professional meeting was held in Halifax, October 8th and 9th, with a total registration of one hundred and forty-seven, very satisfactory arrangements being made by the executive of the Halifax Branch, who provided a programme of visits and excursions in addition to the professional work.

At this meeting the following papers were presented and discussed, the proceedings terminating with a very enjoyable and well attended dinner:—

"Short Electric Transmission Lines", by Gordon Kribs, M.E.I.C.

"Building and Care of Roads", discussion led by R. W. McColough, A.M.E.I.C.

"Marketing of Cape Breton Coal". by H. A. Hatfield.

Branch Meetings

The activities of the twenty-four branches have been well maintained during the year, particulars being submitted in the accompanying reports.

Roll of The Institute

During the year nineteen twenty-five, two hundred and twenty-nine persons have been elected to various grades of *The Institute*. These are classified as follows: eighteen Members, sixty-four Associate Members, thirty Juniors, one hundred and twenty-five Students and eight Affiliates. The elections during 1924 totalled 271.

Transfers from one grade to another in *The Institute* were as follows:—Associate Member to Member, thirty-five; Junior to Associate Member, twenty-seven; Student to Associate Member, twenty-six; Student to Junior, forty-seven; a total of 135 as compared with 78 in 1924.

A summary of these elections and transfers is given below. The names of those elected or transferred are published each month in *The Journal* immediately following the election, and are added to the official membership roll as acceptances are received.

Elections

	Members	Associate Members	Juniors	Students	Affiliates
January	3	4	5	..	2
February	..	..	..	35	..
March	5	19	3	14	2
April	..	3	3	5	..
May	1	6	5	4	3
June	1	6	2	4	..
July	..	..	..	..	..
August	..	..	..	..	..
September	1	7	3	10	1
October	4	10	5	30	..
November	2	8	2	13	..
December	1	1	2	10	.
	18	64	30	125	8

Transfers

	A.M. to M.	Jr. to A.M.	S. to A.M.	S. to Jr.
January	1	2	...	4
February	..	..	..	..
March	8	2	1	3
April	2	1	1	2
May	5	..	1	4
June	1	3	..	4
July	..	..	..	..
August	..	..	..	..
September	3	2	1	2
October	8	12	9	7
November	7	5	10	14
December	..	..	3	7
	35	27	26	47

Removals from the Roll

There have been removed from the membership roll during the year nineteen twenty-five, by resignation and for non-payment of dues, twelve Members, fifty-four Associate Members, twenty-two Juniors, one hundred and twenty Students, and six Affiliates, a total of 214.

Deceased Members

During the year nineteen twenty-five the deaths of twenty-eight of *The Institute's* members have been reported:

Honorary Member

Ruttan, Brig.-Gen. H. N., C.M.G.

Members

Bruce, Robert F. H.
Butler, W. R.
Cushing, Richmond Hersey
Edington, John
Foss, Charles O.
Hardman, John Ernest
Henry, A. R.
Marrs, Charles Hawkins
McArthur, J. J.
Molesworth, Arthur N.
Richardson, W. F.
Stewart, William J.
Thompson, Hedley V.
Tracy, Col. Thomas H.
Wise, Frederick A.

Associate Members

Calder, L. R.
Cameron, Charles F.
Daniel, Major Wm. Tulloch
Hagarty, R. E. W.
Lamb, Harry M.
Smith, Richard Henry
Starr, H. Graham

Juniors

Brinkman, F. L.
Taker, Frank O.

Students

Gagnon, A.
Padden, John E.

Affiliate

McLean, Donald M.

Total Membership

The membership of *The Institute* at present totals five thousand, one hundred and nineteen, while there are eighty-two applications which have been favourably received, the addition of the names of these applicants to the roll being delayed pending the receipt of their formal acceptance of election. The corresponding numbers for 1924 were, 5125, and 101, respectively. The corporate members total 3,651, as compared with 3,593 on Dec. 31, 1924.

The membership according to grade is shown in the following table:—

	Dec. 31, 1925	Dec. 31, 1924
Honorary Members	9	10
Members	1,162	1,139
Associate Members	2,486	2,451
Juniors	433	421
Students	984	1,061
Affiliates	45	43
	5,119	5,125
Elections — acceptance pending	82	101
	5,201	5,226

While the corporate membership shows an increase, and the total membership only a slight decrease, during the year 1925, Council desires to point out that the policy of removing from the list all members in serious arrears, which is now being put in effect, will result in some diminution of the apparent strength though not of the real strength, of *The Institute*.

Respectfully submitted on behalf of the Council,

Arthur Surveyer, m.e.i.c., *Chairman.*
R. J. Durley, m.e.i.c., *Secretary.*

Library and House Committee

The President and Council,—

During the past year the work of recataloguing the library has been continued, and the resulting card catalogue is now available for use, although, while the catalogue is practically complete as regards printed books, some work still remains to be done upon it in connection with periodicals and reports.

Through the kindness of the Director of the Engineering Societies Library, New York, we have again been it able to obtain the services of a qualified technical cataloguer. The work of cataloguing will be followed by the systematic arrangement of the books and sets of periodicals, for which purpose an expenditure not exceeding seven hundred dollars has been authorized for steel library shelving required to accommodate the large number of publications awaiting shelf room.

The thanks of *The Institute* are due to a number of individuals and organizations for the presentation of books and reports acknowledged herewith.

The expenditure on the library during the year amounted to one thousand four hundred and seventy-five dollars and thirteen cents, the bulk of which represents the cost of cataloguing work.

The expenditure on repairs and maintenance of the headquarters building during the year amounted to eleven hundred and thirty-five dollars and seventy-five cents, and included the cost of interior and exterior painting and the necessary repairs to roofing, etc.

During the year the gallery of portraits of *The Institute* has been enriched by the kind presentation by Mrs. P. A. Peterson of a portrait of her husband, the late Peter Alexander Peterson, Past-President. This painting by Robert Harris, r.c.a., has been suitably hung, and Mrs. Peterson's generosity fittingly acknowledged.

The Library and House Committee would welcome any suggestions which would increase the usefulness of the books and periodicals at headquarters to the general membership of *The Institute*, and believes that this object can best be effected by making the membership at large better acquainted with the conditions under which they can obtain books on loan, and information and data on various topics on applications to headquarters.

New books added to the library and contributions received during the past year, have been listed each month in *The Engineering Journal* and may be found on pages 134, 171, 190, 232, 258, 320, 363, 466 and 505. These are gratefully acknowledged, together with the following special donations:—

Presented by James White, M.E.I.C.
Twenty-seven publications of the Commission of Conservation.

Presented by A. Mossman from the library of his late son, Harold Alexander Mossman.
Twenty text-books listed in the April *1925 Journal*, page 190.

Presented by W. Bell-Dawson, M.E.I.C.
Collection of data concerning land surveyors' by-laws, etc. 1876 to 1890.
The Channel Tunnel. 1882.
Notice sur le modèle des Barrages de la Meuse. 1876.
The Forth Bridge. 1890.
Les chemins de fer en Amérique par E. Lavoinne et E. Pontzen. 1880.

Presented by J. W. Heckman, A.M.E,I.C.
A number of negatives and prints of old groups of members of The Institute.

A detailed list of the publications which are regularly placed in the reading room will be found on page fifty-three of the February nineteen twenty-four *Journal.*

Respectfully submitted,

O. O. Lefebvre, m.e.i.c., *Chairman.*

Finance Committee

The President and Council,

Your Committee begs to present the Financial Report for the year ending December 31st, 1925.

The financial operations for this period as compared with 1924 show a decrease in revenue of some eleven thousand dollars. This is due largely to the absence of special revenue from the July World Power Conference number of *The Journal*, an item in last year's revenue amounting to nearly eight thousand dollars. The decrease has been met by a reduction in expenditure, and the final result is a surplus of $1,964.77. This result is better than was contemplated by the Budget prepared at the beginning of the year, but it must be acknowledged that the surplus is in a great measure due to the fact that some legitimate expenditures have been postponed to this year's budget.

Your Committee has been instructed by Council that members in arrears must pay the amounts owing or have their names removed from the list of members. As a consequence your Committee is recommending the removal of a number of names from the Roll of *The Institute*. In this connection, thanks are due to officers of the various branches who are assisting in clearing the arrears.

The year's work shows that it requires extreme economy to keep the current expenditure within the present revenue, and while it is possible to continue to do this, the Committee is of opinion that ends are being made to meet only at a sacrifice. There is much that the E. I. C. as a representative body of Canadian Engineers ought to be able to record and place to the credit of their own country. But they cannot do this without some official record and publication of their Transactions. There is an increasing demand for the revival of such a publication for it is felt that while *The Journal* fulfils the demand for the circulation of current news, keeps the Branches informed of each others activities, and can be used to advantage for giving advance copies of Papers to be discussed, it does not appear to be satisfactory as a permanent record in public and private libraries where the papers of our most eminent engineers should be.

The cost of publishing one volume of Transactions is about $6,000.00, which is more than the present revenue of *The Institute* can afford. On the other hand, this and other expenses for the publishing of papers and discussions of which Canada may be proud seem to be most necessary if Canadian Engineers are going to take their legitimate place in their profession. It is, or ought to be, through the records of the National Institution that the achievements of Canadian Engineers should be known. The Finance Committee therefore feels bound to recommend to the incoming Council that some means be found to meet the expense of publishing Transactions either by a voluntary assessment or other suitable way.

It should also be pointed out that the fees of the E. I. C. are very much less in proportion than those of any other National Engineering Society, and the fact that the membership is so widely scattered geographically makes the problems of its financial policy more difficult. Nevertheless, it is felt that when the members solve important engineering problems, and when they accomplish engineering feats, these should be adequately recorded by *The Engineering Institute of Canada* and not by the Institutions of other countries.

F. P. Shearwood, M.E.I.C., *Chairman.*

STATEMENT OF ASSETS AND LIABILITIES AS AT DECEMBER 31st, 1925

Assets

Property			$ 89,041.64
Furniture			
Balance as at 1st January 1925		$ 3,409.71	
Net additions during year		1,111.10	
		4,520.81	
Less 10% depreciation		452.08	
			4,068.73
Library:			
Estimated value of books		4,153.12	
Less 10% depreciation		415.31	
			3,737.81
Stationery			470.34
Gold Medal			45.00
Investments:			
Canada Permanent Mortgage Corporation stock 20 shares par value $10.00 each		215.00	
Montreal, Light, Heat & Power Consolidated stock, 6 shares par value $100.00 each		120.50	
$1,000. Montreal Tramways, 5% debentures due 1st July 1941		950.30	
$8,000. Victory Loan Bonds 1934 cost	$8,136.71		
Less amount held for Special Fund	2,223.05		
		5,913.66	
			$ 7,199.46
Accounts Receivable:			
Advertising in *Journal*		3,562.66	
Advances to branches		400.00	
Sundry		99.15	
		4,061.81	
Less reserved for bad and doubtful debts		598.50	
			3,463.31
Arrears of fees, estimated			2,500.00
Cash:			
Canadian Bank of Commerce,—			
Current account		725.78	
Savings		318.60	
Petty cash on hand		100.00	
			1,144.38
Unexpired Insurance			84.80
Special Funds, as per Schedule No. 1 attached:			
Investments		9,092.39	
Cash in savings bank accounts		2,238.94	11,331.33
			$123,086.80

Liabilities

Mortgage on Property:		
Royal Institute for the Advancement of Learning	$ 20,000.00	
Less paid off during year	10,000.00	
	10,000.00	
Interest accrued to date	108.33	
		$ 10,108.33
Accounts payable:		
Sundry	837.06	
Amounts due to branches	888.97	
		1,726.30
Special Funds:		
As per Schedule No. 1 attached		11,331.33
Surplus Account:		
Balance as at 1st January 1925	87,956.34	
Add surplus for year	1,964.77	
	89,921.11	
Add amount retransferred from Mortgage Fund	10,000.00	
		99,921.11
		$123,086.80

Montreal, 14th January, 1926.
Verified as per our report of this date.
(Signed) Riddell, Stead, Graham & Hutchison, C.A.,
Auditors.

STATEMENT OF REVENUE AND EXPENDITURE FOR THE YEAR ENDED DECEMBER 31st, 1925

Revenue

Membership fees:		
Arrears	$ 4,311.64	
Current	25,842.10	
Advance	597.40	
Entrance	2,685.00	
		$ 33,436.14
Interest:		
On overdue fees	341.78	
On victory loan bonds	550.00	
On savings bank account	50.20	
On Montreal Tramways debentures	22.12	
		964.10
Dividends:		
Canada Permanent Mortgage Corporation stock	24.00	
Montreal Light, Heat & Power Consolidated stock	46.50	
		70.50
Publications:		
Journal:		
Subscriptions	8,275.86	
Advertising	24,233.74	
Sales	61.38	
		32,570.98
Year Book:		
Advertising	855.50	
		33,426.48
Refund of Expenses of Hall		690.00
Certificates		230.39
Badges		41.64
Expenses Refunded		23.95
		$68,883.20

Expenditure

Building Expense:		
Interest on Mortgage	$ 900.00	
Taxes	1,489.95	
Water rates	205.70	
Fuel	416.99	
Insurance	107.81	
Light and gas	290.46	
Caretaker — wages and service	1,027.00	
Repairs and expense	1,135.75	$ 5,573.66
Office expense:		
Salaries, secretary and office staff	13,110.31	
Office supplies and stationery	893.91	
Postages and telegrams	1,400.37	
Auditors' fee	200.00	
Telephone	231.88	
Messenger and express	76.49	
Miscellaneous expense	361.44	16,274.40
Publications:		
Journal	28,112.90	
Year Book	3,917.61	32,030.51
General Expense:		
Annual and professional meetings expense	2,486.84	
Travelling expense, secretary	1,286.21	
Branch stationery	190.91	
Students' prizes	100.00	
Library expenses and magazines	1,475.13	
10% written off furniture	452.08	
10% written off books	415.31	
Bank exchange and discount	210.20	
Examination expense	23.00	
Branch charters	5.25	
Gzowski medal	26.25	
Donations	100.00	6,771.18
Rebates to Branches:		6,268.68
As per schedule No. 2 attached		
Balance — Being excess of revenue over expenditure for the year ended 31st December 1925		1,964.77
		$ 68,883.20

Montreal, January 14th, 1926.
Verified:
(Signed) Riddell, Stead, Graham & Hutchison, C.A., Auditors.

Schedule No. 1. — Special Funds

Mortgage Fund

Balance as at 1st January 1925		$12,269.51	
Less loss on 1927 bonds sold	$ 46.46		
One-half of Mortgage paid off	10,000.00		
		$10,046.46	
			$ 2,223.05
Represented by:			
Victory loan, par value	$ 8,000.00		
Cost price		$ 8,136.71	
Less amount held for investment account		5,913.66	
			$ 2,223.05

Leonard Medal

Balance as at 1st January 1925	$ 529.05	
Add Bond interest	27.50	
Bank interest	1.03	
	557.58	
Paid for medal	26.25	
		531.33
Represented by:		
Victory bond	$ 500.00	
Balance in bank	31.33	
		$ 531.33

Plummer Medal

Balance as at 1st January 1925	$ 554.91	
Add Bond interest	27.50	
Bank interest	1.84	
	584.25	
Paid for medal	26.25	
		558.00
Represented by:		
Victory bond	500.00	
Balance in bank	58 00	
		$ 558.00

Prize Fund

Balance as at 1st January 1925	$ 527.56	
Add Bank interest	15.92	
		543.48
Represented by: balance in bank	$ 543.48	

Fund for Relief of Members' Families

Balance as at 1st January 1925		$ 1,439.67	
Add Bond interest		77.00	
Bank interest		1.71	
			1,518.38
Represented by: Victory bonds.	1,400.00		
Bank balance.	118.38		
	$ 1,518.38		

Past Presidents' Fund

Balance as at 1st January 1925	$ 2,697.31	
Add Bond interest	125.00	
Bank interest	8.29	
		$ 2,830.60
Represented by:		
Dominion of Canada C.N.R. 5%, 1954	2,489.55	
Balance in bank	341.05	
		$ 2,830.60

War Memorial Fund

Balance as at 1st January 1925	$ 2,225.40	
Prize awarded for the best design of record of service tablet	100.00	
	2,125.40	
Add Bond interest	100.00	
Bank interest	17.64	
	2,243.04	
Add Subscriptions for year	883.45	
		$ 3,126.49
Represented by:		
C. P. R. Coll. Trust 1934 bonds	$ 1,979.79	
Bank	1,146.70	
	$ 3,126.49	
		$11,331.33

Legislation and By-laws Committee

The President and Council,

During the year consideration has been given to the question of harmonizing Branch By-laws, and as a result of correspondence, and inquiry by the Secretary during his visits to various Branches, your Committee's conclusion has been confirmed that Branch By-laws cannot be absolutely standardized, and that freedom of action to the Branches is desirable so far as this is compatible with the By-laws of *The Institute.*

Your Committee therefore recommends that no action be now taken with a view to obtaining uniformity of By-laws among the various Branches, but that Branch Executives be requested to observe such uniformity so far as this is possible, having regard to local conditions and the main By-laws of *The Institute.*

Various suggestions have been referred to your Committee during the current year, as a result of which a number of amendments to the By-laws have been proposed, and are now before the membership for consideration. These proposals are printed at length in the January *Journal*, pp. 24-25, and relate to the following subjects:

Examinations. Your committee recommends the adoption of the amendments suggested by the Board of Examiners and Education, and considers these desirable as they provide a more logical series of examinations than those at present in force.

Signing of Cheques. An amendment to Section 16 is recommended in order to provide for the case where the Secretary, through illness or inability to act, is unable to draw cheques.

Treasurership. An amendment to Section 17 is proposed in order to give the Treasurer the right to attend Council meetings.

Election to Membership. The proposed amendment to Section 30 is recommended, because difficulty has arisen in the case of a number of persons elected to membership, who have failed to accept and make payment of their entrance fees within a reasonable time. It therefore seems advisable to amend Section 30 so as to provide that the entrance fee shall in all cases accompany the application for admission. This arrangement can most readily be made by a change in the form for application for admission. At the present time this form, known as Form A, states, "I will accept membership in the class to which I may be elected and will conform to the By-law requirements in connection therewith".

It is recommended that this undertaking be replaced by the following, which is a combination of the present Forms A and D, with some additions:—

"I, the undersigned, hereby agree to accept membership in the class to which I may be elected and will conform to the requirements of the Charter and By-laws, and I hereby promise to promote the objects of *The Institute* so far as shall be in my power, and to attend the meetings thereof as often as I conveniently can. In accordance with the Schedule of Fees accompanying this form, I enclose herewith the sum of dollars covering the entrance fee for the grade of , for which, in my opinion, I am eligible, and it is understood that should I be admitted to a higher class I will, on notification of admission, pay the additional sum covering the entrance fee for that grade.

If elected to membership, I hereby agree to subscribe two dollars annually for *The Journal* of *The Institute.*

It is understood that whenever I shall signify in writing to the Secretary for the time being, that I am desirous of withdrawing from *The Institute,* I shall, (after the payment of any arrears which may be due by me at that period, be free to resign my membership."

Expulsion and Discipline. The recommendations of the Committee on Professional Conduct with reference to Section 32 have been considered. In the present By-laws the rules governing the Code of Ethics as printed on pages 22 and 23 of the Year Book apparently have no connection with the rules which are given in Section 32 of the By-laws and which govern the action of Council when a complaint is received as to the conduct of any member.

It is therefore recommended that Section 32 be entirely rewritten and that the matter now printed in pages 22 and 23 of the Year Book and following immediately after the Code of Ethics be deleted. The version of Section 32 now proposed is in accordance with the opinion of the legal adviser to whom it was referred by Council.

Annual Fees. While recommending the payment of entrance fees with applications for admission, your Committee is of the opinion that the desire of the Finance Committee to secure prompt payment of annual fees, as indicated in their reports to Council, will be best attained by increasing the annual fees of all grades by the sum of one dollar, but allowing a reduction of one dollar if such annual fees are paid on or before March 31st.

Changes are accordingly recommended in sections 33, 34 and 37.

Arrears of Fees. In regard to arrears of fees, your Committee recommends that Section 38 be amended to accord with the provisions of Section 20 of the By-laws of 1916, since there have been continually a number of members in arrears for more than one year, and it has not been found feasible to apply Section 38 literally.

It is therefore recommended that the first paragraph of Section 38 be amended.

Branch By-laws. Your Committee recommends slight verbal changes in Sections 52 and 53.

Rebates to Branches. Your Committee has not thought it advisable to recommend any change in Section 57 regarding rebates.

Grades of Membership. Your Committee has had before it letters from the Chairman of the Saskatchewan Branch, dated March 30th, 1925, and from the Secretary of the Cape Breton Branch dated May 14th, 1925, regarding changes in the classification of Associate Member and Junior, but is of the opinion that no action should be taken at this time, as the classification question was settled so recently in accordance with the Report of the Committee on Policy.

Geo. R. MacLeod, M.E.I.C., *Chairman.*

The Engineering Sections Committee

The President and Council,—

A canvass of the various branches was made to find out if there was any desire on their part for the formation of sections. The committee indicated its willingness to co-operate in any way.

The answers indicated that the time was not opportune for pressing this matter, so nothing further has been done.

Respectfully submitted,

Chas. M. McKergow, M.E.I.C., *Chairman.*

Papers Committee

The President and Council,—

There are grave difficulties in the proper functioning of this committee. The widely scattered branches and the large number of members make its operation almost impossible.

Your committee therefore suggested to Council that the various members, who, with the exception of the chairman, are the secretaries of the various branches, send into the head office copies of the best papers delivered at their branch and that these be given publicity in *The Journal*. Further that these papers should be available for other branches if they desire to use them.

Respectfully submitted,

Chas. M. McKergow, M.E.I.C., *Chairman*.

Nominating Committee—1926

The following nominations to the Nominating Committee for the year 1926 have been made by the various Branches, have been noted by Council, and are herewith presented to be announced at the Annual Meeting in accordance with the By-laws.

Halifax Branch	F. A. Bowman, M.E.I.C.
Cape Breton Branch	W. E. Clarke, M.E.I.C.
St. John Branch	F. P. Vaughan, M.E.I.C.
Moncton Branch	F. B. Fripp, A.M.E.I.C.
Saguenay Branch	A. A. MacDiarmid, A.M.E.I.C.
Quebec Branch	Hector Cimon, A.M.E.I.C.
Montreal Branch	E. A. Ryan, A.M.E.I.C.
Ottawa Branch	C. P. Edwards, A.M.E.I.C.
Peterborough Branch	B. L. Barns, A.M.E.I.C.
Kingston Branch	R. J. McClelland, A.M.E.I.C.
Toronto Branch	J. G. R. Wainwright, A.M.E.I.C.
Hamilton Branch	H. A. Lumsden, M.E.I.C.
London Branch	E. A. Gray, A.M.E.I.C.
Niagara Peninsula Branch	L. L. Gisborne, A.M.E.I.C.
Border Cities Branch	W. J. Fletcher, A.M.E.I.C.
Sault Ste Marie Branch	J. W. LeB. Ross, M.E.I.C.
Lakehead Branch	F. C. Graham, A.M.E.I.C.
Saskatchewan Branch	R. N. Blackburn, M.E.I.C.
Lethbridge Branch	H. W. Meech, A.M.E.I.C.
Edmonton Branch	R. W. Ross, A.M.E.I.C.
Calgary Branch	J. H. Ross, A.M.E.I.C.
Vancouver Branch	A. K. Robertson, M.E.I.C.
Victoria Branch	E. P. Girdwood, M.E.I.C.
Winnipeg Branch	J. N. Finlayson, M.E.I.C.

Code of Ethics Committee

The President and Council,—

Your Code of Ethics Committee has the honour to report that in their opinion no further changes should be made in the present code until a further opportunity has been given to see how it works out in practice.

The matter of the administration of the code has been referred to the Committee on By-Laws, and we understand that they have recommended certain changes in the By-laws which would eliminate the paragraphs appended to the code relating to its administration.

We also understand that some cases coming within the scope of the code are now under consideration by Council, and we consider that it would be well to await the results of these and some further developments before any changes in the code are considered.

Respectfully submitted,

Frederick B. Brown, M.E.I.C.
F. P. Shearwood, M.E.I.C.
Committee.

Gzowski Medal Committee

The President and Council,

Your Committee on the Gzowski Medal has examined the papers published in *The Engineering Journal* from June, 1924, to May, 1925, inclusive, with a view to making an award of the Gzowski Medal for that period.

Some of the papers prepared for the World Power Conference, and published in the July 1924 number of *The Journal* are excellent and one of these might possibly have been selected, but by the rules governing the award they are barred from consideration.

There are a number of other papers which were considered by the Committee, and, as a result of careful deliberation, the consensus of opinion is that the paper entitled "Concrete in Sea Water", by A. G. Tapley, A.M.E.I.C., published in *The Journal* of November, 1924, is the one most worthy of the award. It presents the results of an original investigation and is of general importance.

A number of other papers were rated highly, and some of these are worthy of being considered as a contribution to the literature of engineering. Amongst others, and without making comparisons, and without ranking the papers in order of merit, the contributions of Messrs. Henry, Wynne-Roberts, Oxley, Fortin, Blair, Theuerkauf, Bronson and Smith, might be mentioned.

Some members of the Committee feel that until *The Institute* is able to resume the issue of Transactions the papers presented are not likely to be generally of Gzowski Medal calibre. It is felt that authors will not take the great amount of trouble and pains required to prepare a monumental paper if it is not going to be published in full and in permanent form. Under present conditions it is difficult to publish an exhaustive paper satisfactorily in *The Journal*, and your Committee feels that *The Institute* should endeavour to find ways and means to re-establish the publication of Transactions for this and for other reasons.

Respectfully submitted,

Frederick B. Brown, M.E.I.C., *Chairman*.

Students' Prize Committee

The President and Council,

Your Committee on Students' Prizes has examined the thirteen essays submitted to it, and takes pleasure in reporting as follows:

The thirteen papers fall into four groups under the headings of Electrical, Mechanical, General and Chemical, there being no papers submitted in the Mining section. The only paper in the Mechanical division is not considered good enough for an award. Your Committee therefore recommends that two awards be made in the General section, two in the Electrical division and one in the Chemical. At least seven papers in these three divisions are worthy of a prize, but as only five awards are permissible under the regulations, the following are your Committee's recommendations:

Electrical. "Automatic Control of Railway Substations" by E. Gray-Donald, S.E.I.C. "Electric Steam Generators and Their Possibilities" by J. Archambault, S.E.I.C.

General. "Hazards and Safeguards of Highways" by J. S. Webster. "Humble Window Glass" by S. S. Colle, S.E.I.C.

Chemical. "An Outline of Flour Manufacturing and Laboratory Tests of Mill Products" by M. Katz, S.E.I.C.

While these awards represent the consensus of opinion of the five members of the Committee, there are two other papers which are of considerable merit, and which are also of prize calibre, namely, "Elements of Automatic Telephony", by A. Lister, S.E.I.C., in the Electrical section, and "Location and Construction of Overhead Transmission Lines", by G. Rinfret, S.E.I.C., in the General section, and your Committee regrets that there are not sufficient prizes to include these two also.

The seven papers mentioned above are of a better grade than the average of those usually submitted.

The President and Members of Council, E. I. C.,

Your Committee wishes to draw the attention of Council to the fact that no papers for the Students' Prizes have been submitted from any point except Montreal. It is to be hoped that Students and Juniors in Toronto, Kingston and in other parts of Canada will in future be encouraged to submit papers for these awards. Perhaps some publicity might be given to this suggestion, as the preparation of these papers is important in the training of the young engineer. It may be that Student and Junior Members of *The Institute* do not realize that if in good standing at the end of the year ending June 1st, they are eligible for the competition.

It is pleasing to the Committee to note that Mr. E. Gray Donald has been successful for two years in succession in winning a prize in the Electrical section.

Respectfully submitted,

FREDERICK B. BROWN, M.E.I.C., *Chairman.*

Leonard Medal Committee

The President and Council,—

The Leonard Medal Committee has considered the various papers eligible for the medal and has decided by majority vote to recommend that the award be made this year to Mr. C. V. Corless for his paper "The Mineral Wealth of the Pre-Cambrian".

In making this recommendation the committee would like to record the fact that there were this year a very large number of papers presented which might be considered eligible for the medal and that the general quality of the papers reached a very high standard.

Respectfully submitted,

CHARLES CAMSELL, M.E.I.C., *Chairman.*

Plummer Medal Committee

The President and Council,—

The committee recommends that the Plummer Medal be awarded to Mr. C. B. Bronson for his paper on "Steel Rails", which was printed in *The Journal* of *The Institute,* December, 1924.

The committee also recommends:—

1. That, as chemical as well as metallurgical papers have to be read in awarding the medal, there should in future be a chemist on the Plummer Medal Committee.

2. That, if the consent of the donor can be obtained, the Plummer Medal shall be awarded, in future, for papers that have been presented either to *The Engineering Institute of Canada* or to The Canadian Institute of Mining and Metallurgy, as in the case of the Leonard Medal.

On behalf of the committee,

ALFRED STANSFIELD, M.E.I.C., *Chairman.*

Board of Examiners and Education Committee

The President and Council,—

During the year your board has given careful consideration to the examination schedules and has recommended to your consideration a change in the by-laws, which, if adopted, will make it necessary for candidates for the grade of Junior, who are not otherwise qualified, to take an examination in the fundamentals of engineering science along the lines of that now prescribed under Schedule B. It is felt that this examination can be more conveniently and appropriately taken by younger men than by those who have been in practice a sufficient length of time to qualify them, as regards experience, for the grade of Associate Member. The work of revising and extending these schedules so as to adapt them better to present conditions is well advanced.

Examinations were held as usual in May and November. The number of candidates was smaller than for some years, but they were evidently better prepared. The following table gives the results:—

Schedule	Number of candidates	Passed	Failed
B	2	2	0
C (railway engineering)	1	1	0
Total	3	3	0

Respectfully submitted,

H. M. MACKAY, M.E.I.C., *Chairman.*

Canadian National Committee of the International Electrotechnical Commission

The President and Council,—

The committee has held one special and three regular meetings during the year.

At the special meeting, held in March, the Constitution agreed upon in collaboration with *The Engineering Institute of Canada* was formally adopted, and arrangements were made for the Secretary to attend the Advisory Committee meetings at the Hague as Canadian delegate. The report of these meetings has already been published in *The Journal.*

The committee has been considerably enlarged during the year, comprising now thirteen members; and owing to the increase in the scope of its work, sub-committees are being appointed in order to take care of the different branches. As a result of the Hague Conference there has been greatly increased activity, particularly in the work of the committees on symbols, rating, prime-movers and transformer oils.

The committee has been in frequent communication with the central office on a variety of questions, and a number of decisions of the Commission are likely to be published during the coming year.

The work of the Commission steadily increases in scope so that several of the sub-committees now have more work in hand than the entire committee had a few years ago. The committee now has regular quarterly meetings, and may soon find even that number insufficient, whereas formerly more than a year would elapse between meetings.

Respectfully submitted.

HOWARD T. BARNES, M.E.I.C., *President.*

H. A. DUPRE, M.E.I.C., *Secretary.*

Report of the E.I.C. Members of the Main Committee of the Canadian Engineering Standards Association

The President and Council,

The Institute's nominees on the Main Committee of the C.E.S.A., are now as follows:—

Prof. C. J. McKenzie M.E.I.C., (retires March 1926).
F. B. Brown, M.E.I.C., (" March 1927).
Sir Alex. Bertram, M.E.I.C., (" March 1928).

During the year 1925 the Sectional Committees of the Association have been reduced in number from 13 to 7, and are as follows:—

Sectional Committee on Civil Engineering and Construction.
Sectional Committee on Mechanical Work.
Sectional Committee on Electrical Work.
Sectional Committee on Automotive Work.
Sectional Committee on Railway Work.
Sectional Committee on Ferrous Metals.
Sectional Committee on Mining Work.

The total number of working Committees and Panels is now 53, and the membership of the Association totals 425.

In May last the resignation of the Secretary, R. J. Durley M.E.I.C., took effect, on his becoming Secretary of *The Engineering Institute*, and Professor W. F. McKnight, A.M.E.I.C., of the Nova Scotia Technical College, Halifax, has been Acting Secretary since that time. It is expected that the appointment of a permanent Secretary will be made shortly.

The finances of the Association have been seriously affected by the withdrawal in March of the grant of $10,000 annually, which had been received from the Dominion Government, and it is fortunate that the National Research Council have been enabled to provide for the office accommodation and secretarial service of the Association. In order to facilitate this arrangement, the Main Committee of the C. E. S. A. has been constituted an Advisory Committee of the Research Council; the Association thus retaining its corporate existence, and functioning as before, but carrying on its work with the support and countenance of the Research Council, the necessary additional funds being secured from commercial and technical firms and other organizations interested in the work of Engineering Standardization.

Owing to the various changes mentioned above, the programme of work for 1925 has naturally been somewhat curtailed, and only two publications have been issued during the year. It is expected, however, that as soon as the new arrangements become effective, normal development will be resumed.

Publications issued in 1925:

No. C17-1925 Standard Requirements for Alternating Current Watthour Meters, constitutes the first report of the C. E. S. A. Committee on Watthour Meters. It applies primarily to alternating current watthour meters which have no special measuring attachments such as "maximum demand," etc.

The Requirements cover all the features of alternating current watthour meters on which it was found that an agreement could be reached by the Committee. The report also covers certain features of meter transformers on which agreement was found possible.

As the membership of the Committee includes representatives of all the manufacturers and most of the large power distributing organizations, it is hoped that the Requirements will be adopted by all concerned.

No. B18-1925. Standard Specification for Stove Bolts was issued in October, and constitutes the work of the Committee on Stove Bolts, the membership of which included representatives from manufacturers, tap and die makers, and the larger users. It is expected that the adoption of the standards as outlined therein will eliminate the difficulties and confusion which have heretofore existed.

A complete list of the Reports published by the Association to date, is as follows:—

C. E. S. A. Publications.

No. A 1-1922	Standard Specification for Steel Railway Bridges.
A1a-1922	Material Specifications, Steel Railway Bridges. (*Separate reprint.*)
C 2-1920	Standard Requirements for Distribution Type Transformers.
C 3-1924	Standard Specification for Galvanized Telegraph and Telephone Wire.
B 4-1921	Standard Specification for Wire Rope for Mining, Dredging and Steam Shovel Purposes.
A 5-1922	Standard Specification for Portland Cement.
A 6-1922	Standard Specification for Steel Highway Bridges.
D 7-1922	Standard Specification for Flexible Steel Wire Rope and Strand for Aircraft Purposes.
G 8-1923	Standard General Specification for Commercial Bar Steels.
A 9-1923	Standard Specifications for Reinforcing Materials for Concrete.
C10-1923	Standard Specification for Tungsten Incandescent Lamps.
D11-1924	Interim Report on the Manufacture, Testing and use of Gasoline for Automotive Purposes (with notes on Lubricating Oil).
B12-1924	Standard General Specification for Galvanized Steel Wire Strand.
E13-1924	Standard Specification for Railway Wire-Fencing and Gates.
C14-1924	Standard Specification for Reinforced Concrete Poles.
C15-1924	Standard Specification for Eastern Cedar Poles.
A16-1924	Standard Specifications for Steel Structures for Buildings.
C17-1925	Standard Requirements for A. C. Watthour Meters.
B18-1925	Standard Specification for Stove Bolts.

Mechanical Work

Machine Screw Threads. A committee has been organized for the purpose of preparing a report on the standardization of Machine Screw Threads in Canada.

Sheet Metal Gauges. A request having been received to undertake the standardization of sheet metal gauges, and the project having been approved by the Executive Committee, manufacturers of black and galvanized sheets in Canada were circularized, asking for their views on the matter, and their replies are now being awaited.

Cast Iron Pipe. The committee at work on this project has not yet reported.

Corrugated Iron Pipe. This subject, suggested by the Chief Engineer of a Provincial Highway Department, will be considered as soon as the Panel on Road Structures have completed their report.

Electrical Wire Gauges. A request has been received for the establishment of a standard Canadian wire gauge for electrical conductors, and information has been gathered as to work accomplished in other countries in this respect.

Electrical Work

Western Cedar Poles for Transmission Lines. A draft of the proposed specification has been prepared and circulated to members of the Committee for criticism.

Rating and Testing of Electrical Machinery. The two panels of this committee, on Large Power Rotating Machinery, and Rotating Machinery under ordinary conditions, have made progress, and it is expected that their reports will be submitted shortly.

Canadian Electrical Code. The preliminary draft of Part I of the proposed Canadian Electrical Code has been circulated to members of the several Provincial Committees: their comments have been tabulated and, together with copies of the draft of Part I of the Code, have been distributed to members of the C. E. S. A. Committee and chairmen of the Provincial Committees for consideration.

Power Transformers. Under the chairmanship of A. A. Dion, M.E.I.C., a committee on this project has been formed, combining the former Committee on Station Type Transformers and Panel C on the Rating and Testing of Transformers. Two meetings have been held and the work is progressing satisfactorily.

Automotive Work

Traffic Signals for Highways. Reports have been received from the three panels of this committee, and comments thereon have been circulated for consideration.

The question of the use of red light as a rear danger signal on vehicles was brought up by the Hamilton Chamber of Commerce and discussed by the Committee. In view of the recommendations contained in the American Engineering Standards Committee Final Draft Code of Colors and Forms for Traffic Signals for Highways and Vehicles, it was not considered that anything would be gained by giving the question further consideration at present.

Ferrous Metallurgy

Heavy Steel Castings. The preparation of a draft specification is in the hands of the Chairman of this Committee.

Structural Silicon Steel. A specification has been drafted, and the matter is receiving the attention of the Committee on Steel Highway Bridges.

Co-operation

The Association has appointed representatives to act on committees of the American Engineering Standards Committee dealing with the following subjects:

Numbering of Steel.

Galvanizing and Sherardizing of Iron and Steel.

The Association has also co-operated with the A. E. S. C. in the following matters:

Manhole Frames and Covers

Rating of Rivers.

Tubular Steel Poles for Electric Line Construction.

There has been the usual exchange of information with the other foreign standardizing bodies, and co-operation with the British Standards Association in the preparation of electrical standards.

Respectfully submitted,

Work in Progress

Civil Engineering and Construction

Moveable Bridges. The first draft of this specification is in the hands of members of the Committee on Steel Railway Bridges and the Committee on Steel Highway Bridges, and their criticisms and comments are under consideration.

Concrete and Reinforced Concrete. The various panels of this committee have not yet completed their reports on the sub-divisions of the work undertaken by them.

Reinforcing Materials for Concrete. Standardization of sizes of round and square reinforcing bars, as recommended by the U. S. Department of Commerce and the American Railway Engineering Association, has been considered by the Panel in charge of this matter, and the list of sizes will, it is expected, shortly be added to and form part of C. E. S. A. Specification No. A9-1923, as a favorable vote has been received from the Panel and from the Committee on Concrete and Reinforced Concrete.

Road Materials and Construction. Progress has been made by the panels of this Committee, dealing with the following subjects:—

Bituminous Roads. A draft specification has been prepared and is under consideration by members of the Panel.

Block Pavements. The Panel has completed its report, which covers brick paving, asphalt block pavement, granite block pavement, and creosoted wood block paving, and the specification is now in the hands of the Committee on Road Materials and Construction.

Broken Stone Roads. Comments are being received from members of the Panel on a specification for Water-bound Macadam Highway Pavement, including specification for Broken Stone and Tests for Broken Stone.

Concrete Roads. A draft specification will shortly be submitted to members of the Panel.

Earth Roads. A draft specification is being prepared by the Chairman of the Panel.

Foundations and Sub-Grade Preparation. This Panel has not yet reported.

Gravel, Sand and Sand-Clay Roads. Preparation of a draft specification is under way.

Road Structures. Draft specifications have been sent to all members of the Panel, and comments are now being received.

Classification of Items of Highway Expenditure. The Report is practically completed; a few minor amendments are under discussion.

Definitions of Road or Highway Terms. Comments on this Report are under consideration.

Respectfully submitted,

Alex. Bertram, M.E.I.C.

Committee on the Deterioration of Concrete in Alkali Soils

The President and Council,—

Your committee begs to report that during the past year the following papers bearing on the work of our committee have been prepared and published:

No. 1—"Disintegration of Portland Cement in Sulphate Waters", by T. Thorvaldson, R. H. Harris, D. Wolochow — Journal Ind. and Eng. Chem. *17* — 467 (1925).

No. 2—"Action of Sodium and Magnesium Sulphates on the Constituents of Portland Cement", by G. Shelton — Journal Ind. and Eng. Chem. *17* — 589 (1925).

No. 3—"Action of Sodium and Magnesium Sulphates on Calcium Aluminates", by G. Shelton — Journal Ind. and Eng. Chem. *17* — 1267 (1925).

No. 4—"Review of Paper No. 1 from an Engineering Standpoint", by C. J. Mackenzie—*Engineering Journal* November, 1925.

No. 5—"Differentiation of the Action of Acids, Alkali Waters and Frost on Normal Portland Cement Concrete", by C. J. Mackenzie and T. Thorvaldson — Presented at the Annual Meeting of *The Engineering Institute of Canada*—Toronto, Ont. — Jan. 1926.

The first three of the above papers are of a strictly scientific nature, while the last two are written from an engineering viewpoint for the purpose of indicating some of the practical bearings of the work to date.

It may be of interest to note that requests have been received from the United States, England and Germany for copies of the scientific papers and that over one hundred reprints of each of these papers have already been distributed to interested parties.

In the future we shall follow generally the procedure of the past year with regard to publications, i.e. (1) Publish purely scientific papers in a scientific journal, whenever a definite phase of the problem has been completed; (2) prepare and publish articles and reviews written from the engineering viewpoint to indicate the practical importance of the scientific findings.

FINANCIAL

The following summary of expenditures and receipts as to December 1st, 1925, is submitted: A detailed and itemized statement of expenditures from December 1st, 1924, to December 1st, 1925, is being sent to the financial supporters of the research.

TOTAL EXPENDITURES TO DECEMBER 1ST, 1925.

GENERAL	Committee meetings, travelling expenses	$ 1,836.56	
	Misc. telegrams, office expenses	353.85	
			$ 2,190.41
PHYSICAL TESTS	Travelling allowances and expenses	$ 1,123.66	
	Material and special equipment	1,728.58	
	Freight and cartage	353.09	
			$ 3,205.33
CHEMICAL RESEARCH	Travelling expenses	$ 340.81	
	Salaries	28,967.74	
	Materials	5,457.00	
			$34,765.55
			$40,161.29

TOTAL RECEIPTS TO DECEMBER 1ST, 1925

	1921	*1922*	*1923*	*1924*	*1925*	*Total*
Research Council	5,000	5,000	5,000			$15,000.00
Canada Cement Co.	3,000	3,000	3,000		2,997	11,997.00
Saskatchewan	3,000	3,000	3,000			9,000.00
Alberta	1,000	1,000				2,000.00
C. P. R.	1,000	1,000	1,000			3,000.00
City of Winnipeg	200	200	300			700.00
Interest on bank acc.			139.41	422.14	190.65	752.20
Total receipts						$42,449.20
Total expenditures						$40,161.29
Balance in bank, Nov. 30, 1925						$ 2,287.91

NOTE: — The National Research Council has donated another $5,000., but as this money was received in December, 1925, it does not show in the above statement.

The Greater Winnipeg Water District has written off accounts against this research amounting to $342.78 for work done in connection with our field tests and while this can not appear in our accounts, we wish to formally acknowledge this contribution.

EXPENDITURES IN YEAR DECEMBER 1ST, 1924 TO DECEMBER 1ST, 1925

PHYSICAL TESTS	$ 32.47
CHEMICAL RESEARCH — Salaries	6,990.27
Materials, etc.	396.29
Total	$7,419.03

From the above statement it will be seen that we have received during the past year another grant from the Canada Cement Company of $3,000. and another grant of $5,000. from the National Research Council (which does not show in the statement as to November 30th, 1925). And that accordingly we have on hand at present (January 1st, 1926) about $7,000. As our salary expenditures will be considerably less during the next year, we will probably be able to carry on another year and a half with the moneys now available.

Respectfully submitted,

C. J. MACKENZIE, M.E.I.C., *Chairman.*

Honour Roll and War Trophies Committee

The President and Council,

As a result of the appeal sent out last year for funds for the erection at headquarters of a Memorial to the members of *The Engineering Institute of Canada* who gave their lives in the Great War, and for a Record, in bronze, of those members who served, your committee has now in hand the sum of $3,125.49 out of the $4,000. necessary for the completion of the work.

As $875. still remains to be collected, your committee recommends that the contract should not be let until this amount has been received, and a further appeal is being sent out in order to give members another opportunity of subscribing.

Your committee is confident that as a result the balance required will be forthcoming from the members, and that the work can accordingly be commenced at an early date.

Respectfully submitted,

CHARLES J. ARMSTRONG, M.E.I.C., *Chairman.*

Committee on Biographies

The President and Council,

A considerable number of biographies of deceased members of *The Engineering Institute of Canada* and the Canadian Society of Civil Engineers, in addition to those already completed, have been allocated to writers and are now under preparation. These have been undertaken by men whom the committee considered most competent to undertake their preparation and it is believed the completed work will be entirely creditable.

Owing partly to illness, the chairman, during recent months, has not been able to follow up the work as he desired, and in consequence is not able to report the progress anticipated a year ago.

Respectfully submitted,

PETER GILLESPIE, M.E.I.C., *Chairman.*

Committee on International Co-operation

The President and Council,—

Apart from correspondence and unofficial conversations with officers of other national societies, for the purpose of keeping in touch with them, there have been no activities of the International Co-operation Committee during 1925.

Delegates from many countries are expected to meet in New York in April, 1926, for the scheduled meeting of the International Electrotechnical Commission and preliminary arrangements are now being developed with the view of having Canada join with the United States in welcoming the visitors to North America.

A short trip to Canada may be made by the visitors and, in that event, officials and members of *The Engineering Institute of Canada* will be expected to welcome them heartily. Announcements will be made in due time through *The Engineering Journal.*

The officials of the American National Committee of the International Electrotechnical Commission have been most gracious in inviting Canada to act with the United States as joint-host to the delegates from other countries.

Respectfully submitted,

JOHN MURPHY, M.E.I.C., *Chairman.*

Fuel Committee

The President and Council,—

In January, 1925, the Annual Meeting appointed a Fuel Committee of *The Institute;* and the writer has the honour to submit a report.

During the year the secretary of the committee sent out memos to all members asking them to advise him of any changes in fuel matters that occurred. There are only two changes to which attention need be called:—

1. The imposition of a duty of 50 cents per ton on bituminous slack coal.
2. The steady increase in the use of British anthracite in the eastern portion of the acute fuel area.

The effect of these changes is being discussed, together with other national fuel matters, in a paper to be presented at the Annual Meeting, 1926, by the secretary of the committee, Lesslie R. Thomson, M.E.I.C. The Fuel Committee feels that this paper will act in some measure as a detailed report of the activities of the committee during the year.

In closing, your committee wishes to record again its sense of the great value of the work being done by the Dominion Fuel Board.

On behalf of the committee,

F. A. Combe, M.E.I.C., *Chairman.*

Committee on Engineering Education

The President and Council,

Following the resolution of the 1925 Annual Meeting the following Committee has been appointed and has commenced work with the view of co-operating with the Society for the Promotion of Engineering Education.

Chairman—F. B. Brown, M.E.I.C.
J. D. Craig, M.E.I.C.
T. H. Hogg, M.E.I.C.
C. C. Kirby, M.E.I.C.
H. J. Lamb, M.E.I.C.
S. G. Porter, M.E.I.C.

Frederick B. Brown, M.E.I.C., *Chairman.*

Branch Reports

Border Cities Branch

The President and Council,

The Executive of the Border Cities Branch beg to submit the following annual report for the year ending December 31st, 1925.

This past year has been one of the most successful in the history of the branch. The attendance at the meetings has varied from the minimum of 23 to the maximum of 40, the average being 29. Although the total membership of the branch is 137, of these, only 114 are resident members and many of these 114 are students who are away the university but are classed as resident members due to their homes being in the Border Cities, so in view of these facts the attendance was very good.

Meetings

The meetings held during the year and the speakers or the entertainment are as follows:—

Jan. 9.—Social evening spent in smoking and playing cards.

Feb. 13.—Wm. Gore, M.E.I.C., spoke on "**A Mechanical Explanation of Einstein's Theory of Relativity**".

Mar. 13.—Prof. Peter Gillespie, M.E.I.C., spoke on "**Engineering Achievements in Canada**".

Apr. 17.—Lt.-Col. H. J. Lamb, M.E.I.C., spoke on "**Engineering Works on the Great Lakes**".

May 8.—Social evening.

Aug. 15.—Extra meeting at which the Border Cities Branch entertained members of the London Branch.

Oct. 9.—Prof. C. R. Young, M.E.I.C., spoke on "**Triumphs in Bridge Building**".

Nov. 13.—Chas. McTague, barrister, spoke on "**Some Phases in Company Law**".

Dec. 11.—Annual meeting and election of officers.

During the year the Executive have met on 9 different occasions, transacting all necessary business so that it was not necessary to bring any before the regular dinner meetings.

The Membership Committee were quite active during the year. They have circularized all members of the branch with a view to ascertaining the names of any engineers in the district who would be eligible for membership in *The Institute* but who are not already members. Much valuable information was thus obtained and praise is due the Chairman A. E. West, A.M.E.I.C.

The Papers and Entertainment Committee, as usual, functioned in a most excellent manner. This was evidenced by the excellent papers presented, the entertainment provided for the different meetings and the splendid attendance at the meetings. Up to the May meeting the committee was composed of A. J. Bowman, A.M.E.I.C., and L. M. Allan, A.M.E.I.C. The members for the period beginning Oct. 1925, and ending May 1926, are W. B. Pennock, Jr.E.I.C., and E. G. Ryley, A.M.E.I.C.

A statement of the membership of the branch for the years 1924 and 1925 is as follows:—

	Branch Resident Members		*Branch Non-Resident Members*	
	1924	*1925*	*1924*	*1925*
Members	19	20	2	3
Associate Members	38	47	11	10
Juniors	14	15	7	5
Students	25	31	5	5
Branch Affiliates	1	1	—	—
Total	97	114	25	23

Financial Statement

Receipts

To balance in bank	$235.83	
Rebates from headquarters	175.80	
Branch News	22.25	
Received from dinners at meetings	214.75	
Advertising	9.00	
Miscellaneous	2.00	
Interest at bank	3.01	
Total		$662.64

Disbursements

Printing of Notices	$ 33.38	
Services, entertainments, cigars at meetings	167.18	
Revenue and postage stamps	2.00	
To hotel for dinners at meetings	288.75	
Expenses representative Magrath dinner	32.00	
Gift to officer of *Institute*	25.00	
Express	2.90	
Lantern	45.00	
Stationery	2.40	
Cash in bank	64.03	
Total		$662.64

Respectfully submitted,

J. Clark Keith, A.M.E.I.C., *Chairman.*
F. Jas. Bridges, A.M.E.I.C., *Secretary-Treasurer.*

Calgary Branch

The President and Council,—

On behalf of the Executive Committee we beg to submit the following report of the activities of the Calgary Branch for the year ending December 31st, 1925.

The slate of officers elected on March 8th, 1924, held office untill March 14th, 1925. The following is a list of officers elected on March 14th, 1925, for the branch year 1925-1926:

Chairman	A. L. Ford, M.E.I.C.
Vice-Chairman	W. S. Fetherstonhaugh, M.E.I.C.
Secretary-Treasurer	G. P. F. Boese, A.M.E.I.C.
Committee	R. S. Stockton, M.E.I.C.
	T. Lees, A.M.E.I.C.
	R. M. Dingwall, A.M.E.I.C.
Ex-officio, emeriti	A. S. Dawson, M.E.I.C.
	B. L. Thorne, M.E.I.C.
	R. S. Trowsdale, A.M.E.I.C.
Auditors	H. R. Carscallen, A.M.E.I.C.
	H. J. McLean, A.M.E.I.C.
Branch Editor	W. St. J. Miller, A.M.E.I.C.

Membership

The membership of the branch is as follows:

	Branch Resident	*Branch Non-Resident*	*Total as at Dec. 31, 1925*	*Total as at Dec. 31, 1924*
Members	21	4	25	23
Associate Members	54	20	74	71
Juniors	2	1	3	3
Students	2	2	4	1
Affiliates	1	..	1	1
Branch Affiliates	15	..	15	16
Totals	95	27	122	115

Membership as a whole shows a satisfactory increase.

Meetings

Fifteen executive meetings were held during the year and the business of the branch was kept up to date.

Arrangements for the Western Professional Meeting of *The Engineering Institute of Canada* were carried out by the Calgary Branch. This meeting was held at Banff from July 11th to 16th inclusive, and although the attendance was not as large as anticipated, the meeting was considered a great success and the Calgary Branch had no financial loss.

General meetings, dinners, luncheons, and special affairs were as follows:

Jan. 7.—Annual dinner with entertainment provided by the Brooks Troupe of Entertainers, consisting of members and others of the C.P.R. Irrigation Staff headed by Major F. G. Cross, A.M.E.I.C.

Jan. 28.—**"Main Highway Organizations"**, by C. A. Davidson, commissioner, Alberta provincial highway.

Feb. 9.—**"Ceramics"**, by Prof. W. G. Worcester, M.E.I.C., professor of Ceramics, University of Saskatchewan.

Feb. 23.—**"Hydro-electric Development"**, by A. N. Sanborne, manager, East Kootenay Power Company, Fernie, B.C.

Mar. 6.—**"Steam Power Plant Engineering — Modern Practice"**, by A. J. T. Taylor, M.E.I.C., president, Vickers Combustion Engineering Corporation. This address was divided into two parts: **"Pulverized Fuel"** and **"The Accumulator"**.

Mar. 14.—Annual meeting.

Mar. 30.—**"Hydraulic Mining"**, by W. D. Armstrong, A.M.E.I.C.; **"Aero Engines, General Design and Performance"**, by W. St. J. Miller, A.M.E.I.C. These papers in their order were awarded first and second prizes in the competition for the two best papers open to the branch.

May 18.—General meeting, with regard to holding the Western Professional Meeting at Banff. Discussion on Mr. Henry's paper **"The Motor Vehicle as a Transportation Facility"**.

July 9.—Luncheon in honour of R. J. Durley, M.E.I.C., general secretary.

Aug. 5.—Dinner in honour of R. J. Durley, M.E.I.C., general secretary. Address by Mr. Durley.

Sept. 4.—**"Conditions, Experiences, and Impressions of Great Nations, resulting from two complete Trips around the World"**, by Hiram N. Savage, consulting engineer, Berkeley, Cal.

Oct. 15.—General open meeting and ladies night. Address by Dan McCowan, Naturalist **"From Indian Trails to World Highways"**. This lecture was illustrated by lantern slides, and particularly described Sir James Hector's journey through the Rockies in 1857. Supper was provided.

Nov. 6.—**"Alberta Tar Sands"**, by Dr. S. C. Ells, M.E.I.C.

Nov. 26.—**"Operation and Maintenance of the Lethbridge Northern Irrigation Project"**, by P. M. Sauder, M.E.I.C.

Dec. 8.—Joint meeting of members of the Calgary Branch and the Association of Professional Engineers of Alberta at dinner. Addresses by Dr. R. W. Boyle, M.E.I.C., president of the Association, and Dr. F. A. Wyatt, professor of soils, University of Alberta, on **"Soil Surveys and what they have shown about Alberta Soils"**.

The average attendance at the above meetings was 50.

Financial Statement

Year ending December 31st, 1925

Revenue

Interest on bonds and savings	$ 56.30	
Rebates	255.30	
Branch news	64.23	
Branch Affiliates	33.00	
		$408.83

Expenditure

Expenses meetings and speakers	$210.69	
Stenographic services	19.75	
Printing and miscellaneous expenditure	133.92	
		$364.36
		$ 44.47
Bank balance at Dec. 31, 1925	$124.87	
Remittance and amount owing from headquarters, Jan. 5, 1926	72.01	
	196.88	
Bank balance at Dec. 31, 1924	152.41	
		$ 44.47

Assets

Cash in bank	$ 124.87	
Value of bonds	1,048.66	
Fees collectible from Branch Affiliates	15.00	
Cheque from headquarters, Jan. 5, 1926, rebates and branch news	46.51	
Rebates owing from headquarters, Jan. 5, 1926	25.50	
		$1,260.54
Liabilities........Nil.		
Net value of assets at Dec. 31, 1924		1,236.64
Increase in value of assets		$ 23.90

Audited and found correct, January 5th, 1926.

H. R. Carscallen, A.M.E.I.C., } *Auditors.*
H. J. McLean, A.M.E.I.C.,

Respectfully submitted,

A. L. Ford, M.E.I.C., *Chairman.*
G. P. F. Boese, A.M.E.I.C., *Secretary-Treasurer.*

Cape Breton Branch

The President and Council,

The Executive Committee of the Cape Breton Branch submits the following report of the branch activities during the year ending December 8th, 1925:

The annual meeting for 1924 was held on December 9th, in the branch rooms. At this meeting the following officers were elected:

Chairman	S. C. Mifflen, A.M.E.I.C.
Committee men	W. C. Risley, M.E.I.C.
	W. E. Clarke, M.E.I.C.

On January 13th, George Morrison, A.M.E.I.C., resigned from the Executive as he intended to be away from Cape Breton for some time. At an Executive meeting held on February 12th, W. S. Wilson, A.M.E.I.C., was appointed to take Mr. Morrison's place on the committee and W. C. Risley, M.E.I.C., was appointed vice-chairman.

The number of resident members at the time of the last annual meeting was thirty-eight, with four pending. There are now only thirty-four and three pending.

The holding of a Maritime Professional Meeting in Sydney during the summer of 1926 is now being considered and your advice will later be sought in this connection.

Financial Statement

The financial statement is as follows:

Receipts

On Hand, December 8th, 1924	$192.70	
Rebates from Headquarters for dues and branch news used in *The Journal*	100.64	
Local dues	185.00	
Dinner tickets	60.00	
Total		$538.34

Expenditures

Rent for one year	$180.00	
Printing, stationery and advertising	8.55	
Postage, telegrams, telephone calls, etc.	10.21	
Dinner at Glace Bay, August 29th	77.48	
Donation towards Halifax Professional Meeting	25.25	
Presentations and entertaining	16.45	
Balance on hand	220.40	
Total		$538.34

Meetings

The following meetings were held during the year:—

1924

Dec. 9.—Sydney. Annual Meeting. Paper on **"Radio Reception with the Super Heterodyne"**, by E. L. Ganter, A.M.E.I.C., Cape Breton representative of the Canadian General Electric Company, Limited.

1925

Jan. 13.—Sydney. **"The Use of Electricity in Coal Mining"**, by C. H. Wright, M.E.I.C., Maritime manager for Canadian General Electric Company, Limited. This paper was also read at Glace Bay on the following night by E. L. Ganter, A.M.E.I.C.

Feb. 17.—Sydney. **"The Relation of the Engineer to Railway Operations"**, by D. W. McDonald, superintendent, Sydney and Louisbourg Railway.

Mar. 10.—Sydney. **"Steam Boilers and Furnaces"**, by H. A. Hatfield, Maritime representative of Babcock-Wilcox & Goldie-McCulloch, Limited.

Apr. 14.—Sydney. Discussion on Mr. Henry's paper on **"Motor Transportation"**, led by W. S. Wilson, A.M.E.I.C.

Aug. 29.—Glace Bay. **"No. 1-B Colliery"**, by A. L. Hay, M.E.I.C., This paper was followed by a visit to the colliery and a dinner at the Official Club.

Oct. 2.—Sydney. Smoker for Mr. Durley.

Nov. 3.—Sydney. **"The Marketing of Cape Breton Coal"**, by H. A. Hatfield. This paper was read previously by Mr. Hatfield at the Maritime Professional Meeting at Halifax.

Respectfully submitted,

Sydney C. Mifflen, A.M.E.I.C., *Chairman.*
Donald W. J. Brown, Jr.E.I.C., *Secretary.*

Edmonton Branch

The President and Council,—

We beg to submit, below, our annual report, covering the activities of the Edmonton Branch for the year 1925:—

Lectures have been given or papers read at general meetings as follows:—

Jan. 15.—R. W. Boyle, M.E.I.C., dean of the Faculty of Applied Science, the University of Alberta, spoke on **"A recent Electrical Application"**.

Feb. 26.—C. A. Davidson, R.P.E., commissioner of highways for the province of Alberta addressed the branch and outlined the work being carried out for the improvement of the highways of Alberta.

Mar. 13.—B. A. MacGibbon, professor of political economy at the University of Alberta, explained the methods of **"Marketing Canada's Wheat"**.

Nov. 2.—S. C. Ells, M.E.I.C., field engineer, Mines Branch, Ottawa, gave a résumé of this work in connection with the **"Bituminous Sands of Northern Alberta"**.

The Executive Committee has also met at regular intervals.

The visit to the branch by the general secretary was appreciated by those members in Edmonton at the time.

Membership

The branch membership, in comparison with the same date in 1924 is given:—

	1924 Branch	1924 District	1925 Branch	1925 District
Members	14	2	15	2
Associate Members	47	8	46	8
Juniors	5	1	5	1
Students	7	2	10	0
Affiliates	1	.	2	.
Total	74	13	78	11

Some applications for admission are pending at the present time.

Financial Statement

(*For the calendar year 1925*)

Balance in hand at Jan. 1, 1925	$ 62.85	
Rebates, — Jan., Feb., Mar	71.10	
Rebates, — Apl., May, June, July	13.80	
Rebates, — Aug., Sept., Oct., Nov., Dec	33.90	
Branch news	6.99	
		$188.64
Total disbursements	$109.58	
Balance at Dec. 31, 1925	79.06	
		$188.64

Respectfully submitted,

A. G. S. Stewart, A.M.E.I.C., *Chairman.*
W. R. Mount, A.M.E.I.C., *Secretary-Treasurer.*

Halifax Branch

The President and Council,—

The Executive Committee of the Halifax Branch for the year 1925 respectfully submits this report of the activities of the branch

The Halifax Branch is very appreciative of your kindness in permitting the Maritime General Professional Meeting 1925 to be held in Halifax. The comments which we have heard concerning the meeting itself are such as to make us believe that it was successful in promoting the exchange of engineering knowledge and in promoting still further the *esprit de corps* of our *Institute* in the Maritime Provinces. This meeting was much less of a financial burden to the branch than was expected, as is apparent in the report of the branch treasurer, and no member of the branch subscribed more than $2.00 towards it.

The Halifax Branch wishes you individually and collectively a happy and prosperous New Year.

Meetings

During the year 1925 this branch has held six meetings as follows:—

Jan. 22.—Regular monthly meeting held in the Green Lantern. K. H. Smith, M.E.I.C., chief engineer of the Nova Scotia Power Commission, gave a most interesting and instructive illustrated description of his trip through the Scandinavian countries with delegates to the World Power Conference, London, England. Attendance 38.

Feb. 19.—Regular monthly meeting held in the Green Lantern. Prof. H. W. McKiel, M.E.I.C., professor of engineering at Mount Allison University, Sackville, N.B., gave his address on **"The Mineral Resources of Canada"** which promoted considerable discussion and brought many compliments to the speaker. Present 30.

Mar. 19.—Regular monthly meeting held in the Green Lantern. A. F. Dyer, A.M.E.I.C., read an illustrated paper on **"The Lake Kenogami Storage Dams"**. In a vote of thanks which was passed to Mr. Dyer his paper was called "A clear, lucid, and distinct description of an important and extensive work". Present 35.

Apr. 23.—Regular monthly meeting held in the Green Lantern. This was Water Power night and was arranged by E. M. Archibald, A.M.E.I.C. Short papers ten to fifteen minutes each were given by the following:

K. G. Chisholm, A.M.E.I.C., **"Stream Measurement"**.
H. W. Mahon, A.M.E.I.C., **"Storage and Pondage"**.
K. E. Whitman, A.M.E.I.C., **"Turbines"**.
J. F. Lumsden, A.M.E.I.C., **"Selection of Electrical Equipment"**.
E. M. Archibald, A.M.E.I.C., **"Pipe Lines"**.

With the exception of Mr. Archibald all the engineers on this programme are members of the staff of the Nova Scotia Power Commission. Mr. Archibald is an engineering-contractor. The papers were illustrated with slides and curves. Present 52.

Nov. 19.—Regular monthly meeting held in the Green Lantern. Business meeting for the appointment of 1926 nominating committee and other routine business.

Dec. 17.—Annual meeting and dinner in the St. Julien Room of the Halifax Hotel. Speaker of the evening, Col. E. C. Phinney. Subject, **"Canada's National Problems"**. Attendance 62.

FINANCIAL STATEMENT

Receipts

Rebates	$214.97	
Branch news	20.00	
Regular meetings	62.25	
Maritime General Professional Meeting, 1925	458.10	
Interest on bank deposit	3.17	
Cash on hand at Halifax and Montreal, Jan. 1, 1925	59.36	
		$817.85

Expenditures

Regular meetings	$141.00	
Maritime General Professional Meeting, 1925	461.62	
Postage	14.44	
Telegrams, etc.	1.40	
Addressing and maintaining mailing list	3.50	
Clerical help	60.00	
Miscellaneous	1.55	
Cash on hand at Halifax and Montreal, Jan. 1, 1926	134.34	
		$817.85

F. R. Faulkner, M.EI.C. } auditors
D. Walter Munn, A.M.E.I.C. }

Respectfully submitted,

W. F. McKNIGHT, A.M.E.I.C., *Chairman.*
K. L. DAWSON, A.M.E.I.C., *Secretary-Treasurer.*

Hamilton Branch

The President and Council,

The Executive Committee of the Hamilton Branch submits the following report for the year 1925.

The branch year dates from June. 1st The following compose the executive committees during 1925.

January to June		*June to December*
J. J. MacKay, M.E.I.C.	Chairman	C. J. Nicholson, A.M.E.I.C.
C. H. Marrs, M.E.I.C.	Vice-Chair	F. P. Adams, M.E.I.C.
H. B. Stuart, A.M.E.I.C.	Sec.-Treas	H. B. Stuart, A.M.E.I.C.
F. P. Adams, M.E.I.C. (1 yr.)		W. L. McFaul, M.E.I.C. (1 yr.)
C. J. Nicholson, A.M.E.I.C. (1 yr.)		L. W. Gill, M.E.I.C. (1 yr.)
W. L. McFaul, M.E.I.C. (2 yrs.)		H. A. Lumsden, M.E.I.C. (2 yrs.)
L. W. Gill, M.E.I.C. (2 yrs.)		G. R. Marston, M.E.I.C. (2 yrs.)
R. K. Palmer, M.E.I.C.	*Ex-officio*	W. F. McLaren, M.E.I.C.
J. W. Tyrrell, M.E.I.C.	*Members emeriti*	J. J. MacKay, M.E.I.C.
W. F. McLaren, M.E.I.C.	" "	

MEETINGS

Jan. 21.—Technical School Auditorium — **"Sewage Problems of Hamilton"** — W. L. McFaul, M.E.I.C., city engineer of Hamilton.

Mar. 11.—Charter Dinner, Royal Connaught Hotel, Hamilton. Charter presented by Vice-president J. B. Challies, M.E.I.C., assisted by O. Lefebvre, M.E.I.C. **"Impressions of the World Water Power Conference at Wembley"** — Vice-president Challies. Presentation of Student's Prize to Harold M. Thompson.

Mar. 27.—Grill Room, Royal Connaught Hotel, Hamilton — **"The Why and What of the Geodetic Survey of Canada"** — J. L. Rannie, M.E.I.C., supervisor of triangulation, Geodetic Survey of Canada.

Apr. 17.—Y.M.C.A. rooms, Brantford, — **"Hydro-Electric Power Development in Ontario"** — H. D. Rothwell, district engineer, Hydro-Electric Power Commission of Ontario. **"Landscape and Portrait Photography"** — A. M. Jackson, M.E.I.C.

Apr. 24.—Joint meeting with Toronto Section A.I.E.E., Westinghouse Auditorium, — **"Lightning Phenomena and Protection"** — Dr. J. Slepian.

May 6.—Annual Meeting — Grill Room, Royal Connaught Hotel,— **"The Tribal Spirit amongst Engineers"** — Prof. H. E. T. Haultain, M.E.I.C. Discussion on Professional Engineering Legislation. Incoming executive announced.

Aug. 15.—Inspection of Welland Ship Canal arranged by Niagara Peninsula Branch.

Nov. 27.—Opening Dinner, Grill Room, Royal Connaught Hotel, — Visit from R. J. Durley, M.E.I.C., general secretary of the Institute. Ten minute speeches from five representative local members.

MEMBERSHIP

As at Dec. 31st, 1925.

	Branch Resident	*Branch Non-Res.*	*Total*	*Gain or Loss for Year*
Members	18	7	25	+1
Associate Members	40	22	62	—2
Juniors	10	6	16	+3
Students	27	20	47	+1
Branch Affiliates	34	0	34	+1
	129	55	184	+4

FINANCIAL STATEMENT

Receipts

On hand January 1st, 1925	$477.80	
Rebates	203.70	
Branch news	10.79	
Journal subscriptions	10.00	
Affiliate fees	60.00	
		$762.29

Expenditures

Printing	$115.64	
Stenographer	50.00	
Journal subscriptions	10.00	
Meeting expenses	79.35	
Postage, excise, exchange	14.61	
Telegrams	1.76	
Miscellaneous	13.58	
Library	12.29	
On hand December 31st, 1925	465.06	
		$762.29

Respectfully submitted,

C. J. NICHOLSON, A.M.E.I.C., *Chairman.*
H. B. STUART, A.M.E.I.C., *Secretary-Treasurer.*

Kingston Branch

The President and Council,

On behalf of the Executive Committee of the Kingston Branch, we beg to submit the following report of the activities of our branch, from January 1st, 1925 to December 31st, 1925.

Numerous meetings were held during the first three months of the year, but during October, November and December it was so difficult to choose dates with no conflicts that our meetings during this latter period were considerably fewer than usual. The fact that a very large percentage of the membership of the branch is drawn from the staff and students of Queen's University, makes it very difficult during the busy college term to ward these conflicts and also makes it inadvisable to attempt any meetings during the summer months. The attendance was fairly satisfactory, though somewhat less than the previous year, due to the fact that the Student membership had considerably dropped off with the graduation from the university of a large number of Students of years that were unusually large.

Nine meetings were held during the year, the list of which is as follows:—

Jan. 15—**"The Operation of a Modern Telephone Exchange".** The Kingston staff of the Bell Telephone Co. of Canada.

Mar. 3—**"Electricity in the Paper Industry,"** by Prof. J. W. Bain, A.M.E.I.C., of Queen's University, Kingston.

Mar. 5—**"Pulp and Paper,"** by T. Linsey Crossley, A.M.E.I.C.

Mar. 10—**"Power Plant Design and Operation,"** by Prof. L. M. Arkley, M.E.I.C., of Queen's University, Kingston, assisted by final year students in mechanical engineering at Queen's.

Mar. 17—**"Telephone Engineering,"** by W. K. Detlor, of the staff of the Bell Telephone Co. of Canada.

Mar. 27—**"The Welland Ship Canal,"** by E. G. Cameron, A.M.E.I.C., principal assistant engineer on the Welland canal.

Oct. 28—**"Sculpture and Architecture, Ancient and Modern,"** by J. W. McCallum of the McCallum Granite Co., Kingston.

Nov. 17—Annual business meeting, election of officers and executive for ensuing year.

Nov. 23—Annual dinner, special speakers, R. J. Durley, M.E.I.C., and Gen. Sir Alex. Bertram, M.E.I.C., on **The Institute.**

Membership

The approximate membership of the branch is as follows:—

Honorary Members	1
Members	11
Associate Members	20
Juniors	4
Students	14
Affiliates	1
Total	51

Executive Committee

The Executives holding office during the parts of the two years covered by this report are as follows:—

1924-1925		1925-1926
Major L. F. Grant, A.M.E.I.C.	Chairman	R. J. McClelland, A.M.E.I.C.
R. J. McClelland, A.M.E.I.C.	Vice-Chair	Prof. L. T. Rutledge, M.E.I.C.
G. J. Smith, A.M.E.I.C.	Sec.-Treas.	G. J. Smith, A.M.E.I.C.
G. C. Wright, M.E.I.C.	Executive	Col. D. S. Ellis, A.M.E.I.C.
J. M. Campbell, M.E.I.C.		Prof. D.M. Jemmett, A.M.E.I.C.
Col. W. P. Wilgar, M.E.I.C.		J. M. Campbell, M.E.I.C.
		Major L. F. Grant, A.M.E.I.C.
		Col. W. P. Wilgar, M.E.I.C.

Financial Statement

The following is the financial statement for the year 1925:

Receipts

Jan. 1	By balance brought forward	$ 86.14	
June 5	Rebates on fees	37.80	
June 5	Branch news	11.19	
June 26	Bank interest	.69	
Nov. 2	Rebates on fees	13.20	
Nov. 2	Branch news	20.00	
Dec. 26	Rebates on fees	16.50	
Dec. 26	Branch news	5.79	
Dec. 31	Bank interest	.86	
Dec. 31	Accounts receivable	1.80	
	Total		$193.97

Disbursements

Feb. 3	To expenses, Major L. F. Grant, annual meeting	$ 13.30	
Mar. 19	To cards, printing and postage to date	13.64	
Mar. 19	To expenses, Mr. W. K. Detlor	15.30	
Apr. 24	To expenses (Portion) Mr. T. Linsey Crossley	7.50	
Oct. 29	To secretary's honorarium	50.00	
Oct. 29	To photo frame	3.00	
Oct. 29	To cards, printing and postage to date	3.51	
Dec. 31	To accounts payable, stamps, stationery and telegram to date	2.52	
Dec. 31	To accounts payable, printing to date	3.63	
Dec. 31	Balance carried forward	81.57	
	Total		$193.97

All of which is respectfully submitted,

R. J. McClelland, A.M.E.I.C., *Chairman.*
G. J. Smith, A.M.E.I.C., *Secretary-Treasurer.*

Lakehead Branch

The President and Council,

On behalf of the Executive Committee, I beg to submit the following annual report of the Lakehead Branch.

Membership

On January 1st, 1925, there were 40 corporate members and 14 non-corporate members, and on December 31st, 1925, there are 40 corporate members and 18 non-corporate members, showing an increase during the year of 4 non-corporate members.

Meetings

Meetings of the Lakehead Branch were held as follows:—

Jan. 28.—A dinner was held at the Shuniah Club, Port Arthur, at which J. Antonisen, M.E.I.C., addressed the members.

Mar. 11.—A meeting was held in the City Hall, Fort William, at which G. H. Burbidge, M.E.I.C., addressed the members on **"Plane Table Work in British Columbia, 1909"**.

Mar. 25.—A dinner was held at the Prince Arthur Hotel, Port Arthur, at which Francis Kiefer addressed the members on **"Forestry"**. This was the largest meeting yet held by the branch, fifty members and guests being present.

June 19.—A dinner was held at the Shuniah Club, Port Arthur, at which Lt.-Col. H. J. Lamb, M.E.I.C., of Toronto, addressed the members on **"The Association of Professional Engineers of the Province of Ontario"**, and H. M. Lewis, A.M.E.I.C., addressed the members on **"Aerial Photography"**.

Aug. 12.—A luncheon was tendered R. J. Durley, M.E.I.C., on the occasion of his first visit to the branch as general secretary of the Institute. Mr. Durley addressed the members on subjects of interest to the branch and the Institute as a whole.

Dec. 10.—A dinner was held in the Shuniah Club, Port Arthur, at which H. G. Acres, M.E.I.C., of Niagara Falls, addressed the members on **"Reminiscences of the World Power Conference at London"**, and H. G. O'Leary, A.M.E.I.C., addressed the members on the **"Diversion of the Northern Watershed"**.

No regular meetings were held during the summer months.

Officers

The result of the ballot for officers of the Branch for the ensuing year resulted as follows:—

Chairman	H. M. Lewis, A.M.E.I.C.
Vice-Chairman	D. C. Chisholm, M.E.I.C.
Secretary-Treasurer	Geo. P. Brophy, A.M.E.I.C.
Executive Committee	F. C. Graham, A.M.E.I.C.
	E. W. Robison, A.M.E.I.C.
	C. B. Symes, A.M.E.I.C.
	M. W. Turner, A.M.E.I.C.

The following members were nominated to represent the Lakehead Branch on the Council of *The Institute:*—

G. H. Burbidge, M.E.I.C., Port Arthur.
D. G. Calvert, A.M.E.I.C., Fort William.

Financial Statement

Revenue

Balance in bank, Dec. 31, 1924	$ 97.46	
Rebates on fees	59.70	
Rebates due, Aug. to Dec., (inclusive)	9.00	
Dinner, Jan. 28	15.00	
Dinner, Mar. 25	41.00	
Dinner, June 19	18.00	
Dinner, Aug. 12	9.75	
Dinner, Dec. 10	20.00	
		$269.91

Expenditure

Telegrams	$ 2.19	
Postage	6.00	
Exchange on cheques from headquarters	.30	
Dinner, Jan. 28	18.95	
Dinner, Mar. 25	50.00	
Dinner, June 19	23.20	
Dinner, Aug. 12	9.75	
Dinner, Dec. 10	28.35	
Sundries	12.39	
Balance in bank, Dec. 31, 1925	117.78	
Cash on hand	1.00	
		$269.91

Respectfully submitted,

H. S. Hancock, A.M.E.I.C., *Chairman.*
Geo. P. Brophy, A.M.E.I.C., *Secretary-Treasurer.*

Lethbridge Branch

The President and Council,—

On behalf of the Executive Committee of the Lethbridge Branch we beg to submit the following report for the year ending December 31st, 1925.

At the annual meeting held on March 7th, 1925, the following officers were elected:—

Chairman	Robert Livingstone, M.E.I.C.
Secretary-Treasurer	N. H. Bradley, A.M.E.I.C.
Executive	G. S. Brown, A.M.E.I.C.
	G. N. Houston, M.E.I.C.
	M. Freeman, A.M.E.I.C.
Ex-officio	John Dow, M.E.I.C.
	S. G. Porter, M.E.I.C.
	H. W. Meech, M.E.I.C.

S. G. Porter, M.E.I.C., removed to Calgary in April, 1925, no appointment made in his place.

MEETINGS

The executive held seven meetings during the year with an average attendance of six. Eleven regular general meetings were held during the year and one special meeting on August 3rd, at which R. J. Durley, M.E.I.C., general secretary was present.

Jan. 10.—"**Central Heating**", by W. B. Trotter, A.M.E.I.C.

Jan. 24.—"**The Mining Industry in Canada**", paper prepared by J. B. deHart, A.M.E.I.C., and read by Mr. Quigley, mine manager, Coalhurst.

Feb. 7.—"**Main Highways of Alberta**", by H. P. Keith, A.M.E.I.C., chief construction engineer, province of Alberta, Edmonton.

Feb. 21.—"**Manufacture of Portland Cement**", by W. G. Armstrong, A.M.E.I.C., Exshaw, Alberta.

Mar. 7.—Annual branch meeting. "**Use of Aeroplanes in Forest Patrol**", by Major A. L. Cuffe, squadron leader, High River, Alberta.

Aug. 3.—Special general meeting. "**Institute Affairs**", by R. J. Durley, general secretary, Montreal, Quebec.

Oct. 9.—"**Rambles in the Rockies with a Camera**", by Dan McCowan, naturalist, Banff, Alberta.

Oct. 24.—"**Present Status of Oil and Gas Development in Alberta**", by S. J. Davies, A.M.E.I.C., petroleum engineer, Department of Interior, Calgary, Alberta.

Nov. 7.—"**Hydro-Electric Power for Alberta**", by R. A. Brown, superintendent, Electric Light and Power Department, Calgary.

Nov. 21.—"**The Manufacture of Beet Sugar**", by C. R. Wing, superintendent, Canadian Sugar Refineries Ltd., Raymond, Alberta.

Dec. 5.—"**Banff National Park**", by C. G. Childe, A.M.E.I.C., resident engineer, Banff, Alberta.

Dec. 19.—"**Operation and Maintenance of the Lethbridge Northern Irrigation District**", by P. M. Sauder, M.E.I.C., project manager, L.N.I.D., Lethbridge.

MEMBERSHIP

The membership of the Lethbridge Branch is as follows:—

	Branch Residents	*Branch Non-residents*	*Total*
Members	8	1	9
Associate Members	22	8	30
Juniors	..	1	1
Students	1	3	4
Institute Affiliates	..	1	1
Branch Affiliates	26	..	26
Total	57	14	71

FINANCIAL STATEMENT

End of Branch year — March 7th, 1925

Receipts

Cash in bank, March 15, 1924	$133.88	
Rebates from headquarters and Affiliate dues	196.60	
Branch news	26.34	
Bank interest	3.63	
		$360.45

Expenditures

Journal subscriptions for Affiliates	$ 50.15	
Printing	34.13	
Sundries	156.40	
	240.68	
Cash in bank, March 7, 1925	119.77	
		$360.45

Assets

Fees from Affiliates	$ 69.00	
Rebates of Members	21.00	
Rebates of Associate Members	44.80	
Rebates of Juniors	2.40	
Branch District Associate Members	16.20	
Branch District Juniors	1.00	
Branch District Students	1.20	
Headquarters Affiliates	3.25	
		$158.85

Liabilities

Affiliate *Journals*	$ 50.00

We have examined the vouchers and papers of the Lethbridge Branch, *The Engineering Institute of Canada*, also statement drawn up by G. S. Brown, A.M.E.I.C., Secretary-Treasurer, and find same to be a correct and true account of the standing of the branch.

G. H. DUNNING, C. J. BRODERICK, *Auditors.*

FINANCIAL STATEMENT

December 31st, 1925

Receipts

Cash in bank, March 7, 1925	$119.77	
Rebates from headquarters	81.60	
Rebates from headquarters balance owing	17.40	
Branch Affiliates received	69.15	
Receipt from meeting Oct. 3	93.10	
Receipt from headquarters, branch news	14.89	
Bank interest	2.71	
		$398.62

Disbursements

To headquarters, *Journals* for Branch Affiliates	$ 44.15	
Printing notices	24.65	
Expense of Oct. 3 meeting	123.45	
Sundries, (regular branch meetings)	52.35	
Exchange on headquarter cheques	.50	
	245.10	
Cash in bank, Dec. 31, 1925	88.75	
Cash on hand, Dec. 31, 1925	26.00	
Cheque from headquarters rebates	21.37	
Rebates from headquarters owing	17.40	
		$398.62

Assets

Cash in bank, Dec. 31, 1925	$ 88.75	
Cash on hand, Dec. 31, 1925	26.00	
Cheque from headquarters received Jan. 4	21.37	
Rebates balance owing from headquarters	17.40	
		$153.52

Liabilities

Account payable	$ 6.00	$ 6.00

Respectfully submitted,

ROBT. LIVINGSTONE, M.E.I.C., *Chairman.*

N. H. BRADLEY, A.M.E.I.C., *Secretary-Treasurer.*

London Branch

The President and Council,—

On behalf of the Executive Committee of the London Branch, we beg to submit the following report for the year ending December 31st, 1925.

Seven regular, one special, seven executive meetings and two motor trips were held during the year.

MEMBERSHIP

	1924	*1925*
Members	15	13
Associate Members	33	32
Juniors	6	5
Students	26	35
Total	80	85

FINANCIAL STATEMENT

Receipts

Balance in bank, Jan. 1, 1925	$ 29.59	
Donations	5.50	
Surplus, annual dinner	6.00	
Surplus, Dec. 9, 1925	3.30	
Interest	.20	
Rebates from headquarters (dues and branch news)	133.68	
Rebates due from headquarters	12.45	
		$190.72

Expenditures

Notices, printing and postage	$ 23.30	
Cigars for dinners	9.20	
Pianist for annual dinner	5.00	
Telegrams and long distance	2.90	
Charter dinner (deficit)	3.00	
Refreshment Committee	5.00	
Hydro shop (lamp for stereopticon lantern)	11.88	
Janitor services	5.00	
Entertaining guests	3.00	
Balance in bank, Dec. 31, 1925	109.99	
Rebates due from headquarters	12.45	
		$190.72

We have examined the above statement prepared by the Secretary, and find same to be a correct and true account of the financial standing of the branch.

W. R. SMITH, A.M.E.I.C., } *Auditors.*
FRANK C. BALL, S.E.I.C., }

Respectfully submitted,

W. C. MILLER, A.M.E.I.C., *Chairman.*

E. A. GRAY, A.M.E.I.C., *Secretary-Treasurer.*

Moncton Branch

The President and Council,

On behalf of the Executive Committee, we beg to submit the sixth annual report of Moncton Branch.

The Executive Committee held seven meetings during the year and transacted a considerable amount of business. There were seven meetings of the branch held, three of which were supper-meetings, and two were open to the public. At one of the supper-meetings Moncton Branch had as their guest the newly appointed general secretary of *The Institute*, R. J. Durley, M.E.I.C., who received a hearty welcome from all members present, and his address on *Institute* affairs was most interesting and instructive.

Membership

Our membership at present consists of 85, made up as follows:—

		Resident	*Total*
Members	—	10	
Associate Members	—	25	
Juniors	—	3	
Students	—	25	
Affiliates	—	1	
			64
		Non-Resident	
Members	—	2	
Associate Members	—	10	
Juniors	—	4	
Students	—	5	
			21
Total			85

During the year the branch suffered the loss of one of its most prominent members in the death of Mr. John Edington, formerly city engineer of the city of Moncton. The late Mr. Edington was a Charter Member of Moncton Branch and had been a member of the Executive Committee.

Officers

The annual meeting of the Branch was held on May 28th, and the following officers were elected for 1925-26.

Chairman..........C. S. G. Rogers, A.M.E.I.C.
Vice-Chairman......A. S. Gunn, A.M.E.I.C.
Secretary-Treasurer..M. J. Murphy, A.M.E.I.C.
Executive Committee A. F. Stewart, M.E.I.C.
J. D. McBeath, M.E.I.C.
J. R. Freeman, A.M.E.I.C.

The following members of the Executive hold office for another year.

F. B. Fripp, A.M.E.I.C.
G. C. Torrens, A.M.E.I.C.
G. E. Smith, A.M.E.I.C.
F. O. Condon, M.E.I.C., *ex-officio.*

Financial Statement

The financial statement for the year ending December 31st, 1925, is as follows:—

Revenue		
Balance in bank, January 1st, 1925	$146.67	
Rebates on dues and Branch News	129.36	
Tickets sold for supper-meetings	43.00	
Bank interest	3.36	
	$322.39	
Rebates due from headquarters	13.65	
Total		$336.04
Expenditures		
Postage	$ 6.50	
Expenses of meetings	105.94	
Printing	31.54	
Telegrams and telephones	8.80	
Miscellaneous	66.30	
	$219.08	
Balance in bank	103.31	
	$322.39	
Rebates due from headquarters	13.65	
Total		$336.04

Balance in bank	$103.31	
Cash on hand	2.16	
Rebates due from headquarters	13.65	
	$119.12	
Bills outstanding	7.35	
Balance		$111.77

Respectfully submitted,

C. S. G. Rogers, A.M.E.I.C., *Chairman.*
M. J. Murphy, A.M.E.I.C., *Secretary-Treasurer.*

Montreal Branch

The President and Council,—

We have the honour to make our report to you covering the activities of the Montreal Branch of *The Engineering Institute of Canada* for the year 1925.

The Executive Committee

The personnel of the Executive Committee is given in the following table:

Name	*Office, etc.*
J. L. Busfield, M.E.I.C.	Chairman, 1925.
C. J. Desbaillets, M.E.I.C.	Vice-Chairman, 1925.
W. C. Adams, M.E.I.C.	Elected, 1924-1925.
C. V. Christie, M.E.I.C.	Elected, 1924-1925.
P. S. Gregory, M.E.I.C.	Elected, 1924-1925.
F. C. Laberge, M.E.I.C.	Elected, 1925-1926.
P. L. Pratley, M.E.I.C.	Elected, 1925-1926.
Jas. Robertson, A.M.E.I.C.	Elected, 1925-1926.
C. K. McLeod, A.M.E.I.C.	Secretary, 1925.
E. A. Ryan, A.M.E.I.C.	*Ex-officio*, Past Secretary.
A. Surveyer, M.E.I.C.	*Ex-officio*, President, E.I.C.
J. M. R. Fairbairn, M.E.I.C.	*Ex-officio*, Past President, E.I.C.
R. A. Ross, M.E.I.C.	*Ex-officio*, Past President, E.I.C.
J. B. Challies, M.E.I.C.	*Ex-officio*, Vice-President, E.I.C.
F. P. Shearwood, M.E.I.C.	*Ex-officio*, Vice-President, E.I.C.
K. B. Thornton, M.E.I.C.	*Ex-officio*, Vice-President, E.I.C.
O. O. Lefebvre, M.E.I.C.	*Ex-officio*, Past Chairman and Councillor.
F. B. Brown, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.
J. T. Farmer, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.
J. H. Hunter, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.
Geo. R. MacLeod, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.
C. M. McKergow, M.E.I.C.	*Ex-officio*, Councillor, E.I.C.

There were 17 meetings of the Executive Committee during the year, all of which were well attended, the average attendance being 9 members.

Papers and Meetings Committee

Following out the policy which has been adopted in recent years of appointing a member of the Executive Committee as chairman of the Papers and Meetings Committee, in order to provide proper co-relation in the work of the two bodies, J. L. Busfield, M.E.I.C., chairman of the branch, was appointed chairman of the Papers and Meetings Committee, and W. Walker, A.M.E.I.C., was appointed vice-chairman, and C. K. McLeod, A.M.E.I.C., secretary of the branch, *ex-officio.*

The branch by-laws provide that this committee consist of a chairman and vice-chairman, and also of the chairman and vice-chairmen of the various sections of the branch, who were appointed as follows:—

Civil Section	A. Duperron, A.M.E.I.C.	Chairman
	C. L. Cate, A.M.E.I.C.	Vice-Chairman
Electrical Section	R. H. Mather, A.M.E.I.C.	Chairman
	G. A. Wallace, A.M.E.I.C.	Vice-Chairman
Mechanical Section	J. A. McCrory, A.M.E.I.C.	Chairman
	J. W. McCammon, A.M.E.I.C.	Vice-Chairman
Industrial Section	K. G. Cameron, A.M.E.I.C.	Chairman
	R. E. MacAfee, A.M.E.I.C.	Vice-Chairman
Municipal Section	G. R. MacLeod, M.E.I.C.	Chairman
	J. A. Lalonde, A.M.E.I.C.	Vice-Chairman
Railway Section	A. R. Ketterson, A.M.E.I.C.	Chairman
	V. I. Smart, M.E.I.C.	Vice-Chairman
Student Section	F. E. Winter, S.E.I.C.	Chairman
	G. Gingras, S.E.I.C.	Vice-Chairman

While this committee commenced its work early in 1925, its function was the preparation of the programme for the 1925-1926 season, which is reported on elsewhere.

Membership Committee

Considerable attention has been paid during the year to the question of increasing our membership. Early in the year, a special committee consisting of J. H. Hunter, M.E.I.C., chairman, and J. L. Busfield, M.E.I.C., C. J. Desbaillets, M.E.I.C., T. J. Lafrenière, M.E.I.C., and K. B. Thornton, M.E.I.C., was appointed for the express purpose of obtaining new members and also following up the question of existing members transferring to a higher grade.

Reception Committee

A Reception Committee, under the chairmanship of H. Massue, A.M.E.I.C., together with F. B. Heward, A.M.E.I.C., H. G. Thompson, Jr.E.I.C., L. G. Boisseau, A.M.E.I.C., E. Prévost, Jr.E.I.C., W. H. Abbott, A.M.E.I.C., S. A. Neilson, A.M.E.I.C., E. Roy, Jr.E.I.C., and L. O'Sullivan, A.M.E.I.C., was appointed early in the season.

Publicity Committee

A committee consisting of S. A. Neilson, A.M.E.I.C., chairman, and E. Prévost, Jr.E.I.C., was appointed for the purpose of arranging publicity matters for the branch in the public press.

The Secretary-Treasurer

Early in the year the resignation was regretfully accepted from E. A. Ryan, A.M.E.I.C., who has been secretary-treasurer of the branch since 1922. This action was taken on Mr. Ryan's part on account of the pressure of his own affairs and of the demands made on his time by the affairs of the branch. After due consideration, C. K. McLeod, A.M.E.I.C., was appointed to the office in February 1925, since which date he has continuously fulfilled his duties to the complete satisfaction of the Executive Committee and the branch has undoubtedly benefitted by his whole-hearted service.

Membership

The membership of the branch is given in the following table. It will be noted that there is practically no change in the numerical position of the branch except for a falling off in the number of Branch Affiliates, which is largely due to the dropping from the roll of a number of Affiliates who had failed to pay their dues.

Statement of Membership, 1924-1925

		Dec. 31st, 1924	*Dec. 31st, 1925*
Honorary Members	Resident	1	1
Members	Resident	205	212
	Non-Resident	16	15
Associate Members	Resident	410	406
	Non-Resident	46	48
Juniors	Resident	70	65
	Non-Resident	13	12
Students	Resident	285	280
	Non-Resident	30	35
Affiliates	*Institute*	10	11
	Branch	28	20
Total		1114	1105

Sincere regret was felt by the branch at the loss by the death of Professor H. A. Lamb who had been of valuable assistance to the branch in connection with the various committees for a number of years. A. R. Henry was another well-known member of the engineering fraternity of Montreal who passed away during the year.

Papers and Meetings

The meetings of the first half of the season were arranged by the Papers and Meetings Committee under the chairmanship of W. C. Adams, M.E.I.C., who made their report at the last annual meeting. The meetings of the latter half, i.e., since October, have been arranged by the Papers and Meetings Committee, under the chairmanship of J. L. Busfield, M.E.I.C. The complete list of meetings as held throughout the year is given in table below.

The general attendance at the meetings has shown a slight decrease and leaves very much to be desired. The members of *The Institute* must bear in mind that if the policy of inviting men of standing to give addresses before a branch is to be maintained, that the meetings of the branch must be well supported. It is only natural that if we have a reputation of poorly attended meetings it is going to be impossible to obtain the best authors or speakers. From another point of view it is only reasonable that the members of the branch should be asked to give their hearty support not only to the committee which devotes a great deal of time to the preparation of a programme for the edification of the members, but also to those members who go to the trouble of time and expense in the preparation of papers. Apart from the benefit to the member of such technical or other information, as may be disseminated, the benefit of social intercourse between the members must not be overlooked.

A large number of members of *The Institute* are absolutely throwing away the opportunity of benefit to themselves through non-attendance at the meetings. The excuse which is so frequently made, that the member is not interested in the particular subject is a very poor one and indicates a mental attitude which, from the point of view of the profession at large, is regrettable, to say the least. Even in the case of the member who is not directly connected with the subject under discussion, there are five excellent reasons why he should attend the meetings:

1. For the value to himself of broadening his own general knowledge of some branch of engineering other than his own.
2. For the value to himself of the social intercourse with his fellow-members.
3. For the value to himself of the possibility of outstanding speakers being invited to meetings, provided a good attendance is regularly assured.
4. For the value to himself of building up the prestige of the branch and the general interest of the members therein.
5. For the courteous expression of appreciation of the work of his fellow-members.

It is appreciated that the foregoing remarks will in all probability only come to the attention of those members to whom they do not apply, but they are inserted in this report, in the hope that those members to whose attention they do come, will use their best efforts towards passing on the word to their fellow-members at every possible opportunity.

Meetings — 1925

Jan. 8.—**"The Kenogami Dam,"** by O. O. Lefebvre, M.E.I.C. Attendance 128.

Jan. 15.—**"Some of the Economic Phases entering into Adjustment of Motor Vehicles to Railway Requirements,,'** by R. A. C. Henry, M.E.I.C. Attendance 61.

Jan. 22.—**"Automatic Electric Stations,"** by D. V. Canning, Jr.E.I.C. Attendance 90.

Feb. 5.—**"Recent Developments in the Design of Long Span Bridges,"** by Dr. G. F. Porter, M.E.I.C. Attendance 147.

Feb. 12.—**"Some English Paper Mills,"** by J. N. Stevenson. Attendance 51.

Feb. 19.—**"Maintenance of Way of the Lehigh Valley Railroad,"** by C. R. Moore. Attendance 125.

Feb. 26.—**"Export of Power."** Discussion. Attendance 195.

Mar. 5.—**"Invisible Radiations,"** by Dr. L. E. Pariseau. Attendance 135.

Mar. 12.—**"Improvements in Design and Appearance of Highway Bridges,"** by C. J. Desbaillets, M.E.I.C. Attendance 140.

Mar. 19.—**"Steam Storage and Steam Accumulators,"** by G. E. Lofgren. Attendance 80.

Mar. 26.—**"Reconditioning Frogs and Rails by Oxy-Acetylene under Traffic,"** by Major G. P. MacLaren, M.E.I.C. Attendance 56.

Apr. 2.—**"Municipal Underground Conduit System, of Montreal,"** by G. E. Templeman, A.M.E.I.C. Attendance 106

Apr. 9.—**"Vancouver Harbour,"** by A. D. Swan, M.E.I.C. Attendance 71.

Apr. 16.—**"Consideration of Rainfall and Run-off in connection with Sewer Design,"** by J. G. Caron, A.M.E.I.C. Attendance 108.

Apr. 23.—**"Transformers,"** by C. E. Sisson, M.E.I.C. Attendance 109.

Apr. 30.—**"Preservation of Forest Products,"** by Dr. Hermann von Schrenk. Attendance 88.

June 6.—Visit to Shawinigan Falls. Attendance 46.

Oct. 1.—**"Evolution,"** by Dr. L. E. Pariseau. Attendance 160.

Oct. 8.—**"Hydraulic Regulating Gates,"** by F. Newell, M.E.I.C. Attendance 143.

Oct. 15.—No meeting, (A.S.C.E. ball).

Oct. 22.—**"High Voltage Phenomena,"** by F. W. Peck, Jr. Attendance 135.

Oct. 28.—**"Steel Construction,"** by Lee H. Miller. Attendance 110.

Nov. 5.—**"Rate Making—Public Carriers,"** by Dr. S. J. McLean. Attendance 102.

Nov. 12.—**"Rock Ballasting on Eastern Lines, C.P.R.,"** by A. C. MacKenzie, M.E.I.C. Attendance 80.

Nov. 19.—**"Stress Analyses by Means of the Photo-Elastic Method,"** by Dr. P. A. Heymans. Attendance 133.

Nov. 26.—**"Aviation and Modern Engineering Practice,"** by Wing-Commander E. W. Steedman, O.B.E. Attendance 120.

Dec. 3.—**"Automatic Control for Railway Sub-Stations,"** by E. Gray-Donald, S.E.I.C.; and **"Scientific Principles Applied to Dwelling House Construction"**, by H. A. Gauvin, S.E.I.C. Attendance 52.

Dec. 10.—**"Transmission Line Towers,"** by C. M. Goodrich, M.E.I.C. Attendance 85.

Dec. 17.—Annual meeting.
Average attendance: 109.

Financial Statement

Ordinary Revenue:			
Branch news		$ 64.12	
Branch Affiliate dues		160.00	
Rebates — Nov. and Dec., 1924	$122.20		
Jan. to March, 1925	800.40		
Apr. to July, 1925	355.70		
Aug. to Oct., 1925	206.00		
		1,484.30	
Interest on savings account		23.10	
			$1,731.52
Extraordinary Revenue:			
Surplus from Annual and Professional Meeting		668.45	
Surplus from Sir E. Rutherford luncheon		5.65	
Sale of tickets, A.S.C.E. smoker		261.00	
Cash on hand, January 1st, 1925		933.64	
			1,868.74
Total revenue			$3,600.26
Ordinary Expenditures:			
Weekly post cards and notices		$ 618.29	
Miscellaneous printing		165.18	
Stationery and stamps		42.49	
Secretary's honorarium		300.00	
Clerical assistance		120.00	
Telephone and telegrams		59.71	
Moving pictures, rentals, slides, etc.		52.50	
Subscription to *Journal* for Affiliates		60.00	
Refreshments at meetings		109.12	
Miscellaneous, gratuities, entertaining speakers, travelling expenses, etc.		253.15	
			$1,780.44
Extraordinary Expenditures:			
Smoker to A.S.C.E.			711.25
Total expenditures			$2,491.69
Balance on hand: savings a/c		$ 768.16	
current a/c		340.41	
			1,108.57
			$3,600.26

General

In addition to the routine affairs described in the foregoing part of this report, the branch has been active in other ways with the object of enhancing its usefulness to the members and to the public.

Resolution to Provincial Government

Following an address by R. A. C. Henry, M.E.I.C., director of the Bureau of Economics of the Canadian National Railways, given before the branch on January 15th, 1925, dealing with the use of public highways by trucking and bus companies, the Executive Committee held a number of meetings for the express purpose of discussing this subject.

A resolution was sent to the provincial government, the Canadian Good Roads Association, Royal Automobile Club of Canada, Chambre de Commerce and the Board of Trade. The branch was gratified at receiving the commendation of Council and advice that the subject had been referred for discussion to the other branches of *The Institute*.

During the convention of the Canadian Good Roads Association in Quebec, on September 23rd, the chairman of the branch attended the convention and outlined the action of the Montreal Branch of *The Engineering Institute of Canada*. While no definite action appears to have been taken nevertheless we have been given to understand that the government is giving serious consideration to the proposal.

Export of Power

During the early part of the year, a subject in which there was great public interest was that of the export of power. It was felt that the atmosphere of uncertainty might be somewhat cleared if a discussion was held under the auspices of the Montreal Branch. With that idea in mind, a number of speakers took part in the meeting which was arranged for February 26th. The addresses and discussions were fully reported in *The Engineering Journal* for April 1925, so no further reference is necessary in this report.

Visit to Shawinigan Falls

An event of unusual interest took place on June 6th, 1925, when the members of the Montreal Branch visited Shawinigan Falls. Through the courtesy of the Shawinigan Water and Power Company, a very enjoyable and instructive time was had by 46 members of the branch. A full account of the visit appeared in *The Engineering Journal* for July, 1925.

Branch Sections

One of the subjects which was left over from last year for action by the 1925 executive was that of the organization of the sections of the branch. It will be remembered that suggestions had been made that each section should have its own organization and also that members of other societies, resident in Montreal, should become complimentary affiliates of the section in which they were directly interested. Considerable study was given to this matter and we also had a number of communications with headquarters regarding the second suggestion, the last advice being to the effect that the matter had been referred to the Committee on International Co-operation.

With regard to the first suggestion, it was felt that the proposed action was somewhat premature but an innovation was introduced this year by the chairman of each section of the branch calling a meeting of engineers, both members of *The Institute* and otherwise, representative of his section. While there were no new or drastic recommendations made at any of these meetings, they nevertheless fulfilled an important function and gave an opportunity for views to be expressed by all parties. We would recommend that an effort be made to have these meetings held every year and would lay stress on the advisability of inviting engineers who are not members of *The Institute* take to part in the discussions.

Students Section

What may possibly be looked upon as an outstanding action during the year was the formation of a Students Section of the branch. It was felt by the Executive Committee that there had not been sufficient means in the past for co-operation between the branch and its Student members.

After considerable discussion of the subject, the formation of a Students Section of the branch was decided upon. This section is on the same footing as the other sections with a chairman and vice-chairman who, *ex-officio*, become members of the Papers and Meetings Committee.

The chairman of the Students Section, F. E. Winter, S.E.I.C., and the vice-chairman, G. Gingras, S.E.I.C., have not only co-operated regarding the obtaining of papers but have also been of value to the organization in many ways. It is hoped that now that the Students Section has been inaugurated care will be taken to built it up as an integral part of the branch.

At the meeting of the branch, held on December 3rd, under the auspices of the Students Section, it may well be noted that the quality of the papers, the delivery of the speakers, the conduct of the meeting by the Student chairman, were all of very high order, and compared favourably with the very best meetings arranged by any section of the branch.

While dealing with the subject of Students, it is a matter for gratification that three of the four prizes awarded to Students in 1924 were won by members of the Montreal Branch.

A. S. C. E. Fall Convention

During the week of October 12th, Montreal was honoured by the presence of the members of the American Society of Civil Engineers holding their Fall Convention. It was felt that the occasion was of such importance as to warrant the Montreal Branch doing something in the way of entertainment to the visiting engineers, and, after due discussion and co-operation with headquarters, it was decided that the branch should act as hosts at a smoking concert which was held on October 14th. This function was successfully carried out and was thoroughly enjoyed by the visitors. President Ridgway, Past-President Grunsky and Secretary Seabury of the American Society of Civil Engineers were singled out as recipients of gifts in the shape of walking canes.

The American Society of Civil Engineers were glad to accept the offer of the secretary of the Montreal Branch, C. K. McLeod, to take charge of the registration of the meeting.

Annual and Professional Meeting

An important event in the work of the branch during the year was the holding of the Annual and Professional Meeting on January 27th, 28th and 29th. The request of the Montreal Branch to conduct a Professional Meeting in conjunction with the Annual Meeting of *The Institute* was duly granted and towards the end of 1924, a special committee was appointed to co-operate with a committee of Council for the arrangement of all the functions. The details of the meeting have already been fully reported in *The Engineering Journal* for February, 1925.

Entertainment of Visitors

On the occasion of outstanding speakers visiting Montreal for the express purpose of addressing the branch, it has been the policy of the Executive to entertain them at a small dinner prior to the meeting. Among others who have been invited were Dr. Hermann von Schrenk of St. Louis, Mo.; Dr. S. J. McLean of Ottawa; Dr. Paul Heymans of Cambridge, Mass.

On May 21st, 1925, Mr. F. Gill, past-president of the Institution of Electrical Engineers of Great Britain, accepted an invitation to a luncheon. This meeting was fully reported in *The Engineering Journal* of June, 1925.

The whole respectfully submitted, on behalf of the Montreal Branch,

J. L. BUSFIELD, M.E.I.C., *Chairman.*

C. K. MCLEOD, A.M.E.I.C., *Secretary-Treasurer.*

NOTE:—The original of the above report contained additional details regarding the various activities of the branch mentioned.

Niagara Peninsula Branch

The President and Council,

On behalf of the Executive Committee we beg to submit the annual report of the Niagara Peninsula Branch.

The Executive met as the necessity arose. These meetings were well attended.

There were nine general meetings of the branch, at which the attendance averaged 44. In addition, the annual dance was a very successful function.

The annual picnic, held at Niagara-on-the-Lake, was not as well patronized as usual. Threatening rain kept many away. The following functions have been reported at length in *The Journal.*

Jan. 9—Business meeting at Thorold. **"The Yukon, '97 and To-day,"** by W. R. Bramley. Attendance 50.

Mar. 19—General meeting at St. Catharines. **"The New Filtration Plant,"** by Alex. Milne, A.M.E.I.C., superintendent St. Catharines Water Works, — attendance 25.

Mar. 24—Dinner meeting at Niagara Falls. **"Contracts,"** by Lt.-Col. W. R. Robertson, — attendance 25.

April 25—Trip to Hamilton. Visit to Hamilton By-Products Coke Co., followed by dinner-meeting, — attendance 75.

May 19—Annual meeting at Welland. **"The Life and Works of Sir Sanford Fleming"**. Prof. Peter Gillespie, M.E.I.C., — attendance 50.

June 27—Picnic at Niagara-on-the-Lake, — attendance 42.

July 8—Trip to Buffalo. Visit to Pierce Arrow plant, — attendance 75.

Aug. 15—Visit of Hamilton Branch. Trip over Welland ship canal, — attendance 38.

Oct. 29—Trip over Flight locks Thorold. Dinner-meeting at Welland. **"Harbor Development,"** by J. A. Grant, A.M.E.I.C., — attendance 40.

Nov. 26—Dinner-meeting at St. Catharines. **"Achievements in Bridge Building,"** by Prof. C. R. Young, M.E.I.C., — attendance 40.

MEMBERSHIP

The membership shows a slight loss from last year.

	1924	*1925*	*Loss*	*Gain*
Members	18	18	–	–
Associate Members	92	89	3	–
Juniors	20	14	6	
Students	33	34	–	1
Branch Affiliates	11	15	–	4
	174	170	9	5
Net loss during year			4	

FINANCIAL STATEMENT

As at December 31st, 1925

Receipts

Balance on hand Jan. 1st, 1925	$152.70	
Rebates, Branch News and commissions	249.79	
Affiliate fees	44.50	
Proceeds of meetings	214.75	
Total		$661.74

Expenditures

Printing, stationery and notices	$ 89.00	
Expenses, meetings	336.15	
Postage, telephone, express and telegrams	29.19	
Presentation	15.00	
Condolences	15.00	
Secretary's honorarium	100.00	
Balance on hand, Dec. 31st, 1925	57.65	
Rebates, Branch News, commissions not yet received	19.75	
Total		$661.74

All of which is respectfully submitted,

H. L. BUCKE, M.E.I.C., *Chairman.*

R. W. DOWNIE, A.M.E.I.C., *Secretary-Treasurer.*

Ottawa Branch

The President and Council,

On behalf of the Managing Committee of the Ottawa Branch, we beg to submit the following report for the calendar year 1925.

The branch has completed another very successful year in every respect.

During the year the Managing Committee held ten meetings. In addition the branch held eight evening meetings and eight luncheons. The annual smoker took the form of a joint smoker with the Professional Institute of the Civil Service of Canada and the evening meeting on December 8th, was a joint meeting with the Ottawa Valley Graduates Society of McGill University.

One of our members, C. A. Magrath, M.E.I.C., was appointed chairman of the Ontario Hydro-Electric Power Commission to succeed the late Sir Adam Beck. While the selection reflected great honour on not only Mr. Magrath in particular, but upon the engineering profession in general, it also indicated a development of uncommon sense in political minds and a better appreciation of engineering training for executive work in public utilities. The publicity gained through our meetings is now beginning to make itself felt so that, in the formation of committees on questions of municipal or provincial affairs, a place is now generally reserved for a representative from the engineers. It is certainly gratifying to know that we are getting away rapidly from that position known as the lone voice in the wilderness.

The Ottawa Centenary to be celebrated in 1926 has an engineer on the general committee and an engineering committee to advise on construction details.

It is with profound regret that we report the loss through death of four of our members, namely, two Members, J. J. McArthur and W. J. Stewart and two Associate Members, L. F. Brinkman and J. A. Symes.

The annual ball was held at the Chateau Laurier on January 22nd and well upheld the reputation established in previous years. It is one of the few affairs that bring us together socially whereby we may become known to one another.

During the year the Managing Committee lost one of its valuable members, R. J. Durley, M.E.I.C., who was appointed general secretary of *The Institute.*

The balance sheet shows that we had a successful financial year. Although considerable expense was incurred our assets have been decreased by only $7.38, leaving a working capital of $1,603.45.

Regardless of deaths and removals from the city, our membership shows a net increase of 20 for the past year.

PROCEEDINGS AND PUBLICITY

During the year eight luncheons and eight evening meetings of the branch were held, as follows:—

Jan. 8—**"A Visit to Wembley,"** by Fraser S. Keith, M.E.I.C.; general secretary, "Engineering Institute of Canada," Montreal; luncheon meeting at the Chateau Laurier.

Jan. 8—Annual meeting — Daffodil Tea Rooms.

Feb. 10—**"The Expedition of 1924 to the Arctic Islands of Canada,"** by F. D. Henderson, D.L.S., senior officer in charge of the expedition, Ottawa; evening meeting at the Victoria Memorial Museum.

Feb. 19—**"Wagner Motor Film,"** by John Murphy, M.E.I.C., Ottawa; evening meeting at the Victoria Memorial Museum.

Mar. 3—**"Technical Education,"** by Prof. L. W. Gill, M.E.I.C., principal of the Hamilton Technical Institute, Hamilton; luncheon meeting at the Chateau Laurier.

Mar. 19—**"The Motion Picture Industry of Today,"** by B. E. Norrish, A.M.E.I.C., manager, Associated Screen News of Canada, Ltd., Montreal; luncheon meeting at the Chateau Laurier.

Mar. 26—**"The Practical Man versus the Theorist,"** by H. M. Tory, D.SC., LL.D., chairman of the Honorary Advisory Council for Scientific and Industrial Research of Canada, and president of the University of Alberta, Edmonton; luncheon meeting at the Chateau Laurier.

April 24—Joint smoker with the Professional Institute of the Civil Service of Canada at the Chaudiere Golf Club.

April 30—**"Structural Steel,"** by Lee H. Miller, chief engineer of the American Institute of Steel Construction, New York; evening meeting at the University Club.

May 16—**"Field Control of Concrete,"** by Colonel H. C. Boyden, chief engineer, Portland Cement Association, Chicago; evening meeting at the University Club.

Oct. 6—"**The Work of the Royal Canadian Air Force in Canada,**" by Captain J. Stanley Scott, M.C., A.F.C., A.D.C., director of the Royal Canadian Air Force, Ottawa; luncheon meeting at the Chateau Laurier.

Nov. 13—Complimentary luncheon at the Chateau Laurier in honour of C. A. Magrath, M.E.I.C., chairman, Ontario Hydro-Electric Power Commission.

Nov. 19—"**Highway Bridges,**" by C. J. Desbaillets, M.E.I.C., chief engineer, Montreal Water Board, Montreal; evening lecture at the University Club.

Nov. 26—"**The Newly Developed Oil-Electric Car,**" by C. E. Brooks, chief of motive power, Canadian National Rys., Montreal, and A. E. L. Chorlton, representing Wm. Beardmore's Works, London, England; luncheon meeting at the Chateau Laurier.

Dec. 8—"**The Ascent of Mount Logan,**" by H. F. Lambart, D.L.S., co-leader of the Mount Logan expedition, Ottawa; joint evening meeting with the Ottawa Valley Graduates Society of McGill University at the Victoria Memorial Museum.

Dec. 15—"**Some Economic Phases entering into the Adjustment of Vehicular Traffic to Steam Railways,**" by R. A. C. Henry, M.E.I.C., director of the Bureau of Economics, Canadian National Rys., Montreal; luncheon meeting at the Chateau Laurier.

The attendance at the luncheon meetings has averaged about 110, the largest attendance being at the complimentary luncheon to Mr. Magrath when 180 were present. During the year the Committee carried out the established policy of inviting prominent speakers to address the luncheon meetings. While the addresses, as a rule, had a general engineering trend, they were not in many cases strictly technical but it is the opinion that this policy works out to the best interests of all concerned.

The evening lectures were also well attended as many as 400 having been present at some of them. At the annual meeting on January 8th, the Charter was presented to the local branch by General Secretary, Fraser S. Keith.

Membership

During the year the total membership increased from 452 to 472, and the corporate membership from 344 to 357.

The following table shows in detail the comparative figures of the branch membership for the years 1923, 1924 and 1925:—

	1923	*1924*	*1925*
Honorary Members	2	1	1
Members	113	112	113
Associate Members	207	232	244
Affiliates of *Institute*	6	6	8
Juniors	30	35	35
Students	18	31	34
Branch Affiliates	32	35	37
Total	408	452	471

Rooms and Library

The branch library is situated on the third floor of the Stephen building where it is open for consultation by members under the same conditions that have previously prevailed.

Accessions to the library consisted of government reports, the Proceedings of the American Society of Civil Engineers, presented by F. H. Peters, M.E.I.C., and the Proceedings of the Institution of Civil Engineers, provided by the librarian.

Advertising in The Journal

Commissions for advertising secured in *The Journal* during 1925 amount to $107.19, which is equivalent to the rebates received from 53 Associate Members.

Finances

The financial position of the branch continues to be very satisfactory as may be seen from the attached statements of assets and liabilities and of receipts and expenditures. Although these statements show a somewhat smaller bank balance our assets show a decrease of only $7.38.

The branch closed the year with a balance of $560.36 in the bank, $4.50 cash on hand and $700.00 in Victory Bonds. In addition to this balance the branch has assets of $55.40 in rebates due from headquarters $107.19 due for advertising in *The Journal* and $176.00 in furniture, equipment, etc., making a total of $1,603.45.

The income for the last two years was, for 1924 — $1,209.93 and for 1925 — $712.59; the expenditure for 1924 — $1,548.90 and for 1925 — $833.66. The annual income of the branch from Victory Bonds is $36.25.

Financial Statement

Statement of Receipts and Expenditures
for the year ending December 31st, 1925.

Receipts

Balance in bank, Jan. 1st, 1925	$679.68	
Cash on hand, Jan. 1st, 1925	6.25	
Interest on Victory Bonds	36.25	
Rebates from headquarters:—		
Nov., and Dec., 1924	48.90	
Jan., Feb. and Mar., 1925	255.40	
April to July, 1925	173.60	
Aug. to Oct. and Branch News for Nov. and Dec., 1925, (less exchange .15)	88.69	
Branch News, Jan. to April 1925	16.07	
Branch News, May and June 1925	6.97	
Refund from McGill Graduates' Society	2.50	
Refund from Smoker Committee	6.83	
Branch Affiliate fees	66.00	
Proceeds from sale of luncheon tickets	329.30	
Bank interest	13.88	
Total		$1,730.32

Expenditures

Chateau Laurier — for luncheons	$598.75	
Daffodil Tea-room — annual meeting	47.50	
University Club, evening meetings	72.85	
Printing, stationery, etc	46.51	
Advertising	67.80	
Insurance	2.00	
Scrim's, for flowers	30.00	
Balance on Annual Ball expenses	86.00	
Subscriptions to *Engineering Journal* and Engineering News Record	11.00	
Sundries, lantern operator, gratuities, etc	51.39	
Petty cash, postage, etc	151.66	
Balance in bank, Dec. 12th, 1925	560.36	
Balance cash on hand	4.50	
Total		$1,730.32

Statement of Assets and Liabilities
For year ending December 31st, 1925.

Assets

Furniture, (cost $200.00)	$ 80.00	
Library:—Book cases (cost $72.50) Nominal	50.00	
Bound magazines "	1.00	
Books "	25.00	
Rebates due from headquarters on 1925 fees	55.40	
Rebates due from headquarters *Journal* advertising 1925	107.19	
Stationery and equipment	20.00	
Victory bonds, due November 1st, 1934	500.00	
Victory bonds, due October 15th, 1934	200.00	
Cash in bank	560.36	
Cash on hand	4.50	
Total		$1,603.45

Liabilities

Surplus	$1,603.45	
		$1,603.45

Audited and found correct: Noel Ogilvie, M.E.I.C.

Officers for 1925

The annual meeting of the Branch will be held in Ottawa on January 14th, when the officers and members of the Managing Committee will be elected for the year 1926.

Respectfully submitted,

A. F. Macallum, M.E.I.C., *Chairman.*

F. C. C. Lynch, A.M.E.I.C., *Secretary-Treasurer.*

Peterborough Branch

The President and Council,—

The year 1925 is the sixth in the history of this branch. The annual meeting was held on May 14th, which resulted in the election of the following executive.

Past-chairman	E. R. Shirley, M.E.I.C.
Chairman	A. L. Killaly, A.M.E.I.C.
Vice-chairman	B. L. Barns, A.M.E.I.C.
Treasurer	A. B. Gates, A.M.E.I.C.
Secretary	P. Manning, A.M.E.I.C.
Executive	W. M. Cruthers, A.M.E.I.C.
	R. C. Flitton, A.M.E.I.C.
	J. H. MacIntosh, A.M.E.I.C.
	D. L. MacLaren, A.M.E.I.C.
	A. H. Munro, A.M.E.I.C.
	W. E. Ross, A.M.E.I.C.

During the summer, however, D. L. MacLaren, A.M.E.I.C., was transferred to Toronto, and is now in the Toronto Branch. The executive unanimously agreed that this vacancy be filled by B. Ottewell, A.M.E.I.C.

The executive, feeling that the interests of this outspread branch will be better served, have during the year, elected representatives in each of the outlying centres, as follows:—

Lindsay — E. L. Miles, M.E.I.C.
Port Hope — A. A. Outram, Jr.E.I.C.
Belleville — O. R. Thomson, M.E.I.C.
Campbellford — A. E. Caddy, M.E.I.C.

Mr. Caddy having been transferred to Peterborough, his position as representative in Campbellford has been filled by A. L. Malcolm, M.E.I.C.

It is realized that these representatives cannot possibly attend the executive meetings, so that to keep them in touch with executive activities, copies of the minutes of each meeting will be mailed to them as in the the case of other members of the executive.

Meetings

Twelve regular meetings were held throughout the year. The papers varied as usual in the subjects taken, and the average attendance turned out to be the same as last year, the good figure of 48. The very pleasing feature has developed throughout the meetings in the eagerness for discussion; it displays the interest the members are taking in the papers presented.

The social activities covered our annual outing held during the summer and the annual banquet held in November. Both these events were very well supported and thoroughly enjoyed. The venue of the former being Campbellford and district, where the automatic generating stations in actual service were visited. The latter event, though, not having any special attraction as in previous years was quite a success.

The complete list of meetings being as follows:—

Jan. 8.—**"Radio for Emergency Communication"**, F. K. Dalton, assistant laboratory engineer, Hydro-Electric Power Commission, Toronto.

Jan. 22.—**"Impressions and Views of Wembley"**, Frederick B. Brown, M.E.I.C., and Fraser S. Keith, M.E.I.C.

Feb. 12.—**"Factory Management"**, W. R. McGie, A.M.E.I.C., chief engineer of Ford Motor Company of Canada, Ford, Ont.

Feb. 26.—**"Modern High Voltage Insulation"**, W. R. Goddard, president, Canadian Porcelain Company, Hamilton.

Mar. 12.—**"Modern Paper Making"**, A. D. Ross, Canadian General Electric Company, Toronto.

Mar. 25.—**"Electrical Wiring Devices, Past and Present"**, C. S Mallett, manager of Ward St. Works of Canadian General Electric Company, Toronto.

Apr. 23.—**"Radio — Frequency Amplification"**, W. B. Cartmel, M.E.I.C.

May 14.—**"Field Control of Concrete"**, Col. H. C. Boyden, Portland Cement Association.

Sept. 22.—**"Some Economic Results of Use of Electric Power"**, C. M. Ripley, publicity Department of General Electric Company, Schenectady, N.Y.

Oct. 8.—Central Ontario System of Hydro-Electric Power Commission.

Oct. 22.—**"Rail Steel for Concrete Reinforcement"**, J. B. Carswell, A.M.E.I.C., president, Carswell Construction Company, Toronto.

Nov. 23.—Annual banquet.

Dec. 10.—**"Reclamation of Lands in Western Canada"**, E. L. Miles, M.E.I.C., Lindsay, Ontario.

Membership

The total membership remains at the same total as in the previous year, the grades of members and associate members increasing by a total of three, but the three remaining grades each decreasing by one offset it.

	1924	*1925*
Members	24	25
Associate Members	41	43
Juniors	11	10
Students	32	31
Affiliates and Branch Affiliates	31	30
	139	139

Financial Statement

Receipts

Balance in bank, Jan. 1, 1925	$ 15.40	
Rebates on fees	148.95	
Branch news	26.99	
Affiliate fees and *Journal* subscription	47.33	
Receipts — annual dinner	146.00	
Bank interest	.89	
		$385.56

Expenditures

Rent	$ 50.00	
Journal subscriptions	23.66	
Speaker and meeting expense	25.53	
Printing	78.16	
Secretarial expense	13.86	
Annual dinner expense	138.81	
Postage, etc	1.09	
Balance in bank, Dec. 31, 1925	54.45	
		$385.56

On behalf of the executive, respectfully submitted,

A. L. Killaly, A.M.E.I.C., *Chairman.*
P. Manning, A.M.E.I.C., *Secretary.*

Quebec Branch

The President and Council,—

The Executive of the Quebec Branch begs to present the following annual report on the work of said branch during the year 1925:—

Membership

	Resident	*Non-Resident*	*Total*
Honorary Members	1	..	1
Members	17	1	18
Associate Members	61	15	76
Juniors	9	3	12
Students	17	5	22
Affiliates	1	..	1
Total membership			130

Annual Meeting

The annual meeting of the Quebec Branch was held on June 29th, 1925, under the presidency of A. R. Décary, M.E.I.C. The following officers were elected for the year 1925-1926:

Honorary President (for life)	A. R. Décary, M.E.I.C.
President	A. B. Normandin, A.M.E.I.C.
Vice-President	S. L. deCarteret, A.M.E.I.C.
Secretary-Treasurer	Louis Beaudry, S.E.I.C.
Executive Committee	T. E. Rousseau, A.M.E.I.C.
	Hector Cimon, A.M.E.I.C.
	L. C. Dupuis, A.M.E.I.C.
	Alex. Larivière, A.M.E.I.C.

Meetings

The executive of the Quebec Branch has held its meetings regularly during the year 1925.

The monthly luncheons and evening meetings of the branch were held regularly at the Chateau Frontenac and at the City Hall from the month of December, 1924, to the month of July, 1925.

It has been our pleasure to have frequent opportunities of welcoming outside members of our *Institute*, and also prominent men in public life at our different luncheons and evening meetings. At all our meetings, practically the full membership of the branch attended, and very good publicity of the activities of the branch was given through the press.

All questions submitted by the Council of *The Institute* have been studied, discussed and transacted.

Our branch has followed with interest *The Institute* deliberations and has devoted its full energy to all matters aiming to the protection and promotion of the interest of *The Institute* and its members.

Our special committee has followed closely, studied seriously and made as complete report as possible on all applications for membership which have been referred to this branch, and the necessary recommendations have been made to the Council of *The Institute* who has kindly taken them into consideration.

ADDRESSES

The following addresses were made at our different luncheons and evening meetings:—

"Exploitation of Forests." by G. C. Piché, A.M.E.I.C., chief of the Provincial Forestry Service of Quebec.

"The Difference Between a Land Surveyor and a Civil Engineer," by David W. Mill, Q.L.S., A.M.E.I.C., F.S.I., director of surveys of the province of Quebec.

"The Engineer and the Industry," by J. H. Fortier, president of the Manufacturers Association of Canada, general-manager of the P. T. Légaré Co.

"Some Duties Common both at this Time to the Engineer and to the Lawyer," by Louis S. St-Laurent, K.C.

"Aerial Photography applied to Engineering," by Ellwood Wilson, M.E.I.C., manager of the Forestry Division, Laurentide Co. Ltd.

"Mining Deposits of the North-West of Quebec," by A. O. Dufresne, M.Sc., mining engineer.

"Earthquake," by Rev. Alex. Vachon, honorary member of the Quebec Branch of the E.I.C., professor at Laval University.

"Field Control of Concrete," by Col. H. C. Boyden, Chicago.

FINANCIAL STATEMENT

For the year 1925

Revenue

Cash in bank, Jan. 1, 1925	$ 96.49	
Bank interest	1.16	
Rebates from headquarters:—fees	188.50	
branch news	14.97	
		$301.12

Expenditures

Printing, stamps, etc	$ 56.25	
Expenses of meetings	60.00	
Miscellaneous	106.00	
		$222.25
Balance on hand, Jan. 1, 1926		$ 78.87

Respectfully submitted,

A. B. NORMANDIN, A.M.E.I.C., *Chairman.*

LOUIS BEAUDRY, S.E.I.C., *Secretary-Treasurer.*

Au Président et au Conseil,—

Le Conseil de la Section de Québec a l'honneur de vous soumettre son rapport annuel pour l'année 1925 comme suit:—

RÔLE DES MEMBRES

	Résidents	*Non résidents*	*Total*
Membres honoraires	1	..	1
Membres	17	1	18
Membres associés	61	15	76
Membres juniors	9	3	12
Membres étudiants	17	5	22
Membres affiliés	1	..	1
Total des membres			130

ASSEMBLÉE ANNUELLE

L'assemblée annuelle de la Section de Québec a été tenue le 29 juin 1925, sous la présidence de A. R. Décary, M.E.I.C. Les officiers dont les noms suivent ont été élus pour l'année 1925-1926:

Président Honoraire (à vie)	A. R. Décary, M.E.I.C.
Président	A. B. Normandin, A.M.E.I.C.
Vice-Président	S. L. deCarteret, A.M.E.I.C.
Secrétaire-Trésorier	Louis Beaudry, S.E.I.C.
Conseillers	T. E. Rousseau, A.M.E.I.C.
	Hector Cimon, A.M.E.I.C.
	L. C. Dupuis, A.M.E.I.C.
	Alex. Larivière, A.M.E.I.C.

ASSEMBLÉES

Le Conseil de la Section de Québec a tenu ses assemblées régulièrement durant l'année 1925.

Les déjeuners et assemblées du soir de chaque mois ont été tenus régulièrement au Château Frontenac et à l'Hôtel de Ville de Québec, à partir du mois de décembre 1924 jusqu'au mois de juillet 1925.

A nos différents déjeuners et assemblées du soir, nous avons eu fréquemment l'occasion de compter parmi nous des membres de l'*Institut*, étrangers à notre branche, ainsi que des personnages de marque dans la vie publique. Toutes nos réunions ont assemblé la presque totalité des membres de notre branche, et la presse a toujours eu l'amabilité de donner de très bons comptes rendus de nos travaux.

Toutes les questions soumises par le Conseil Général à la Section de Québec ont été étudiées, discutées et transigées.

Notre section a suivi avec intérêt les travaux de l'*Institut*, et a prêté son plein concours à toutes les questions ayant pour but de protéger et de promouvoir les intérêts de l'*Institut* et de ses membres.

Notre Comité Spécial s'est occupé de surveiller, de faire une étude sérieuse et de faire un rapport aussi complet que possible sur toutes les demandes d'admission qui ont été référées à notre branche, et les recommendations nécessaires ont été faites au Conseil Général de l'*Institut* qui a bien voulu en tenir compte.

CAUSERIES

Les causeries suivantes ont été faites à nos différentes assemblées du soir et des déjeuners:

"Exploitation des Forêts," par M. G. C. Piché, A.M.E.I.C., chef du Service Forestier de la province de Québec.

"L'Arpenteur et l'Ingénieur," par M. David W. Mill, A.M.E.I.C., surintendant des Arpenteurs de la province de Québec.

"L'Ingénieur et l'Industrie," par M. J. H. Fortier, président de l'Association des Manufacturiers du Canada, gérant général de la Cie "P. T. Légaré Co.".

"Quelques devoirs communs actuellement à l'Ingénieur et à l'Avocat," par M. Louis S. St-Laurent, C.R.

"La Photographie Aérienne appliquée au Génie," par M. Ellwood Wilson, M.E.I.C., gérant du département des Forêts de la Laurentide Company Limited.

"Les Gites Miniers du Nord-Ouest de Québec," par M. A. O. Dufresne, M.Sc., ingénieur des mines.

"Les Tremblements de terre," par M. l'abbé Alex. Vachon, membre honoraire de la Section de Québec, professeur à l'Université Laval.

"Le contrôle du béton sur le chantier," par le Colonel H. C. Boyden, de la Portland Cement Association.

ÉTAT FINANCIER

Recettes

Caisse au 1er janvier 1925	$ 96.49	
Intérêt sur compte de banque	1.16	
Remises du bureau chef: — Cotisations des membres	188.50	
Nouvelles pour *Journal*	14.97	
		$301.12

Dépenses

Impressions, timbres, etc	$ 56.25	
Dépenses pour assemblées	60.00	
Divers	106.00	
		$222.25
Solde au 1er janvier 1926		$ 78.87

Respectueusement soumis,

A. B. NORMANDIN, A.M.E.I.C., *Président.*

LOUIS BEAUDRY, S.E.I.C., *Secrétaire-Trésorier.*

Saint John Branch

The President and Council,—

On behalf of the executive the eighth annual report of the Saint John Branch for the year 1925 is herewith submitted.

Twelve meetings of the executive and nine meetings of the branch have been held during the year. Nine papers on varied engineering subjects have been presented before the branch.

The members of the branch have taken an active interest in the affairs of *The Institute.* Eleven members attended the Annual and General Professional Meeting at Montreal in January last, and fifteen members visited Halifax in October for the Maritime General Professional Meeting.

Engineers have participated in the public life of the province. During the year a member of this branch held cabinet rank in the government, four members of the engineering profession were candidates for election, a member of this branch is at present a member of the provincial legislature.

The aid of the engineer has been sought in civic affairs. Members of this branch served acceptably as members of a committee during the construction of a war memorial, erected this year, in Saint John. The committee revising the by-laws of the city of Saint John includes members of this branch on its personnel.

This branch has been addressed by members of other branches during the year and has welcomed as guests transient members of sister branches. The public is invited to attend all branch meetings and those of a popular nature have been advertised in the press.

The interests of the members not residing in Saint John have been attended to as far as possible by holding a meeting at Fredericton jointly with the Engineering Society of the University of New Brunswick. By this means the work of *The Institute* is brought to the attention of the engineering students.

The members of this branch learned with regret of the resignation of Fraser S. Keith, M.E.I.C., as general secretary, during the year, and by a resolution forwarded to Mr. Keith expressed its appreciation of his work for *The Institute.* The members have been pleased to welcome R. J. Durley, M.E.I.C., as successor to Mr. Keith.

MEMBERSHIP

A statement of membership as on December 3rd, 1925, follows:—

	Branch Residents	*Branch Non-Residents*	*Total*
Members	17	11	28
Associate Members	26	10	36
Juniors	8	5	13
Students	5	3	8
Affiliates	2	..	2
Branch Affiliates	3	..	3
Total	61	29	90

Total at end of 1925: 90; total at end of 1924: 96; loss: 6. Applications for admission pending: 1.

FINANCIAL STATEMENT

(*Year ending December 31st, 1925*)

Receipts

Balance in bank Dec. 31, 1924	$ 82.10	
Rebates of members' fees	140.70	
Branch news	31.59	
Branch Affiliates, dues and *Journal* subscriptions	12.00	
		$266.39

Expenses

Hall and meeting	$ 25.15	
Advertising	10.00	
Printing and stationery	18.46	
Branch Affiliates, *Journal* subscriptions	6.15	
Outstanding disbursements, May 1, 1924, Dec. 8, 1925	105.20	
Grant to Maritime Professional Meeting, 1925	50.00	
Stenography, incurred in 1924	5.00	
	$219.96	
Balance in bank, Dec. 31, 1925	46.43	
		$266.39

Assets

Balance in bank, Dec. 31, 1925	$ 46.43	
Rebates of members fees outstanding	30.60	
		$ 77.03

Liabilities

Outstanding accounts	$ 22.64	
Surplus on Dec. 31, 1925	54.39	
		$ 77.03

Respectfully submitted,

W. R. PEARCE, M.E.I.C., *Chairman.*

W. J. JOHNSTON, A.M.E.I.C., *Secretary-Treasurer.*

Saguenay Branch

The President and Council,—

On behalf of the Executive Committee we take pleasure in submitting the following report of the activities of the Saguenay Branch for the year 1925.

EXCURSIONS

Following the policy adopted at the annual meeting in 1924, no winter meetings were held owing to the difficulty of transportation during these months, but during the summer three very interesting excursions were held, namely:—

July 20th, — The complete power developments of the Chicoutimi river were visited. These comprise three electric generating stations and two pulp mills. The annual meeting was also held during this outing at Chute Garneau power house, where the members had been guests at luncheon of la Compagnie Électrique de Chicoutimi, Limitée.

August 21st. — The second excursion was held to the new town and mill at Riverbend, Que., both the property of Price Brothers. The afternoon was devoted to a visit to Isle Maligne where the immense progress made since last year was very much in evidence.

September 19th. — The final excursion of the year was held, the trip being on the north shore of the Saguenay and comprising a visit to the power developments and logging flumes of Price Brothers in that region.

OFFICERS

The general elections gave the following results:—

Chairman	C. N. Shanly, M.E.I.C.
Vice-Chairman	Georges LaMothe, A.M.E.I.C.
Secretary-Treasurer	Burroughs Pelletier, A.M.E.I.C.
Executive Committee	Edouard Lavoie, M.E.I.C. (1 year).
	J. E. A. McConville, A.M.E.I.C. (1 year).
	J. L. Delisle, A.M.E.I.C. (2 years).
	A. A. MacDiarmid, A.M.E.I.C. (2 years).
	W. G. Mitchell, M.E.I.C. (*ex-officio*).

(Georges LaMothe, A.M.E.I.C., is also, *ex-officio*, a member of the Executive.)

MEMBERSHIP

The membership of the branch is as follows:—

Members	4
Associate Members	24
Juniors	9
Students	13
Total	50

FINANCIAL STATEMENT

(*As at January 1st, 1925*)

Receipts

Balance on hand Dec. 31, 1924	$ 53.35	
Remittances from headquarters (May)	40.65	
Remittances from headquarters (Oct.)	19.56	
Remittances from headquarters (Dec.)	4.20	
Rebates from headquarters (Dec. 31st)	10.65	
Total receipts		$128.41

Disbursements

Expenses re annual elections	$ 12.85	
Expenses re annual meeting and outing	40.67	
Printing	14.16	
Postage, stationery, exchange and telegrams	3.39	
Total disbursements	71.07	
Balance on hand	57.34	
		$128.41

Respectfully submitted,

C. N. SHANLY, M.E.I.C., *Chairman.*

BURROUGHS PELLETIER, A.M.E.I.C., *Secretary-Treasurer.*

Sault Ste. Marie Branch

The President and Council,—

The attendance at the meetings for the year averaged fifteen, and the meetings were all preceded by a dinner at the Y.W.C.A. rooms.

The low attendance may be partly explained by the continued commercial depression in the Sault.

On account of the extended area covered by our district, it was impossible to have any of our Branch District Members present although they were individually notified of all meetings.

The papers and publicity committee and the entertainment committee provided good material in the way of papers and inspection trips, all of which were of great interest to the members.

The entertainment of R. J. Durley, M.E.I.C., the general secretary of *The Engineering Institute of Canada*, at a luncheon on August 14th, was exceptionally well attended and all present enjoyed and derived much benefit from the "round table talk" after the luncheon.

MEETINGS

The regular meetings were held on the last Friday of each month except June, July, August and November, and the papers given and the inspection trips made were as follows:—

Jan. 30.—**"The Modern Blast Furnace"**, by F. Smallwood, M.E.I.C., chief engineer of the Algoma Steel Corporation.

Feb. 27.—**"Safety First as Practised at the Coke Ovens of The Algoma Steel Corporation"**, by Mr. E. A. Davis, assistant superintendent of the Coke Plant, Algoma Steel Corporation.

Mar. 27.—"**Paper**", by H. A. Morey, A.M.E.I.C., resident engineer, Lake Superior Paper Company.

Apr. 24.—"**Economic Aspects of the Dye Industry**", by G. Durgin, superintendent of operation, Research Department, of the Spanish River Pulp and Paper Mills Limited.

May 29.—"**The Equipment of the Modern Blast Furnace**", by F. Smallwood, M.E.I.C., chief engineer of the Algoma Steel Corporation.

June 17.—A special meeting was held to meet Lt.-Col. Lamb, M.E.I.C., representing the Association of Professional Engineers of Ontario.

Aug. 14.—A special luncheon-meeting was held to welcome R. J. Durley, M.E.I.C., the general secretary of The Engineering Institute of Canada. In the evening in co-operation with the local Board of Trade, the members of the Michigan Mining Institute were entertained at a dinner at the Pavilion.

Sept. 25.—An inspection trip was made through the local plant of the Bell Telephone Company.

Oct. 30.—An inspection trip was made through the power plant of the Great Lakes Power Company.

Dec. 18.—Annual meeting — reports of committees and address of retiring Chairman Wm. Seymour, M.E.I.C. Election of officers. Address by L. R. Brown, A.M.E.I.C., city engineer, on "**Municipal Affairs**". Subjects of general interest.

MEMBERSHIP

The present membership of the branch is:—

	Branch Residents	Branch District	Total
Members	10	12	22
Associate Members	14	37	51
Juniors	7	4	11
Students	6	19	25
Affiliates	1	—	1
Branch Affiliates	11	—	11
Total			121

This is a decrease of nine members as shown by the 1924 report. This is caused by the continued depression throughout the North Country. There are three applications for admission pending.

FINANCIAL STATEMENT

Receipts

Balance from 1924	$227.32	
Income from headquarters rebates	149.40	
Income from branch news	36.09	
Affiliate fees	28.00	
Dinners	96.75	
Interest on savings account	2.00	
Balance due from headquarters, rebates	16.20	
advertising	48.00	
		$603.76

Expenditures

Postage and post cards	$ 24.50	
Printing	77.00	
Stenographer	20.00	
Office equipment	42.50	
Gratuities and donations	55.75	
Dinners and entertainment	147.40	
Telegrams	3.64	
Journal subscriptions	12.00	
Sundries	1.87	
Balance current account	52.90	
Balance savings account	102.00	
Balance due from headquarters	64.20	
		$603.76

Assets

Outstanding fees	$ 32.00

Respectfully submitted,

A. H. RUSSELL, A.M.E.I.C., *Secretary-Treasurer.*

Saskatchewan Branch

The President and Council,—

On behalf of the branch executive we beg to submit the following report concerning the activities of the Saskatchewan Branch during 1925. This report is supplemental to the report which will be issued in March, covering the branch year.

Early in the year an attempt was made to secure engineering legislation similar to that obtained in other provinces. A bill was introduced but was defeated in committee. However it has been a matter of satisfaction to the branch that the Provincial Public Health Act has been amended so that a civil engineer is included in the Council of Public Health.

Other matters occupying the attention of the branch have been attendance at meetings and the requirements for admission to corporate membership in *The Institute.* With regard to the latter the branch has gone on record as desiring a tightening up and stricter adherence to the rules concerning admission. Motives prompting this action are a desire to enhance the standing given by membership in *The Institute* and to remove the chance of discrimination when considering applications.

The branch was glad to welcome our new general secretary, R. J. Durley, M.E.I.C., at a special meeting this summer, and it is hoped there may be frequent opportunities for improving acquaintanceship.

During the fall a Saskatchewan Section of the American Institute of Electrical Engineers has been formed with headquarters in Regina. Cordial relations have been established between the new organization and the local branch of *The Institute.*

The executive wishes to record its thanks and appreciation for the efforts of the committees which have arranged and put into effect the various functions and activities.

MEETINGS

During the year there have been held seven executive meetings, six regular meetings, one special meeting and one social evening.

Meetings and papers were as follows:—

Jan. 8.—Business meeting, consideration of qualifications for admission to Institute and classification of membership. Branch goes on record as desiring a tightening up and stricter adherence to regulations.

Feb. 12.—"**Military Engineering**", Capt. G. R. Chetwynd, M.C., D.C.M., A.M.E.I.C.

Mar. 13.—Eighth annual meeting, reports of committees, election of officers, address by retiring chairman, Prof. C. J. Mackenzie, M.E.I.C., dinner and social evening.

Apr. 17.—"**Transmission of Speech over Long Distances**", S. R. Muirhead, Jr.E.I.C.
Discussion of matters relating to improvement of attendance at meetings, reading and discussion of paper submitted from headquarters by R. A. C. Henry, M.E.I.C., "**The Motor Vehicle as a Transportation Facility**".

Aug. 10.—Special meeting for R. J. Durley, M.E.I.C., general secretary. "**Institute Affairs**".

Oct. 14.—"**Duties of a Municipal Engineer**", R. W. Allen, A.M.E.I.C.
"**Features of Supply in Light and Power Business**", E. W. Bull.
"**Retail Business of a Waterworks Department**", J. W. D. Farrell, A.M.E.I.C.

Nov. 12.—"**Outline of the Work of Some Branches of the Department of the Interior, Ottawa**", Lt.-Col. A. C. Garner, D.S.O., M.E.I.C.
"**History of Town Planning**", Stewart Young, A.M.E.I.C.
"**Parks and Boulevards**", J. M. Craig, Parks Supt., Regina.
"**Some Court Decisions bearing on Surveying**", R. W. E. Loucks, A.M.E.I.C.

Dec. 15.—Social evening in collaboration with the A.I.E.E. Cards and dancing.

FINANCIAL STATEMENT

Revenue

Bank balance, Mar. 1925	$ 51.88	
Cash on hand, Mar., 1925	17.00	
Headquarters rebates	191.10	
Branch dues	59.00	
Sundries	41.66	
		$360.64

Expenditure

Meetings	$ 31.70	
Stationery, notices, etc	73.48	
Sundries	66.80	
Scholarship	50.15	
Cash in bank	80.79	
Cash on hand	57.72	
		$360.64

Respectfully submitted,

R. N. BLACKBURN, M.E.I.C., *Chairman.*

J. W. D. FARRELL, A.M.E.I.C., *Secretary-Treasurer.*

Toronto Branch

The President and Council,

The Executive Committee of the Toronto Branch respectfully submits the following report for the calendar year 1925.

During this period, the present executive was elected in March at the branch annual meeting.

EXECUTIVE COMMITTEE

January to March, 1925.		*March to December, 1925.*
J. M. Oxley, M.E.I.C.	Chair.	T. R. Loudon, M.E.I.C.
N. D. Wilson, M.E.I.C.	V.-Ch.	J. G. R. Wainwright, A.M.E.I.C.
J. H. Curzon, A.M.E.I.C.	Sec.-T.	C. B. Ferris, A.M.E.I.C.
R. W. Angus, M.E.I.C.	Exec.	R. W. Angus, M.E.I.C.
H. K. Wicksteed, M.E.I.C.		E. T. J. Brandon, A.M.E.I.C.
E. T. J. Brandon, A.M.E.I.C.		R. B. Young, M.E.I.C.
J. G. R. Wainwright, A.M.E.I.C.		J. A. Knight, A.M.E.I.C.
T. R. Loudon, M.E.I.C.		A. C. Oxley, A.M.E.I.C.
Peter Gillespie, M.E.I.C.		L. W. Wynne-Roberts, A.M.E.I.C.
G. T. Clark, A.M.E.I.C.	*Ex-O.*	H. K. Wicksteed, M.E.I.C.
C. R. Young, M.E.I.C.		G. T. Clark, A.M.E.I.C.
E. G. Hewson, M.E.I.C.		E. G. Hewson, M.E.I.C.
J. A. Knight, A.M.E.I.C.		J. M. Oxley, M.E.I.C.
R. O. Wynne-Roberts, M.E.I.C.		J. H. Curzon, A.M.E.I.C.

COMMITTEES

The standing committees and chairmen are:—

Programme..................T. R. Loudon, M.E.I.C.
Finance.....................J. G. R. Wainwright, A.M.E.I.C.
Publicity....................S. G. Talman, A.M.E.I.C.
" ....J. W. Falkner, A.M.E.I.C.
Library......................A. C. Oxley, A.M.E.I.C.
Attendance.................L. W. Wynne-Roberts, A.M.E.I.C.
Student Relations.............W. L. Thompson, S.E.I.C.

The Toronto Branch representative on the Nominating Committee of *The Institute* is J. G. R. Wainwright, A.M.E.I.C., who has been re-elected by the executive for this office during 1926.

ANNUAL MEETING COMMITTEE

In anticipation of the Annual Meeting of *The Institute* in Toronto on January 27th, 28th, and 29th, 1926, an Annual Meeting Committee was appointed which consists of the executive and the following members who have been making preparations under the direction of Professor C. R. Young, M.E.I.C., who was unanimously selected chairman of this committee.

Chairman....................C. R. Young, M.E.I.C.
Vice-Chairman and Papers.....W. P. Dobson, M.E.I.C.
Secretary......................L. W. Wynne-Roberts, A.M.E.I.C.
Finance.......................W. E. Douglas, A.M.E.I.C.
Dinner........................Col. H. J. Lamb, M.E.I.C.
Entertainment................B. N. Simpson, jr.E.I.C.
Service........................H. W. Tate, A.M.E.I.C.
Accommodation...............J. B. Carswell, A.M.E.I.C.
Publicity......................C. A. Meadows, A.M.E.I.C.
Reception.....................R. O. Wynne-Roberts, M.E.I.C.
Convener of Ladies Committee. Mrs. C. H. Mitchell.

MEETINGS

The executive held fourteen meetings for the transaction of branch affairs. There were nineteen general meetings. Of these, three were luncheon-meetings which are now held down town at 12.30 noon on the first Thursday of each month and are well attended.

The October, November and December luncheon meetings were addressed respectively by C. A. Magrath, M.E.I.C., N. D. Wilson, M.E.I.C., on "Mexico City" and Sir Robert Falconer on "Geneva".

For the general meetings, held on Thursday evening of each week, the endeavor has been to have subjects which conform to the aims and technical requirements of *The Institute*, interspersed with those of popular interest. The average attendance is under one hundred. An indication of the present trend was the attendance of over two hundred to the open meeting on "Matter, Energy and Radiation".

The advisability of social meetings was indicated at the smoker in Hart House on December 17th. J. A. Knight, A.M.E.I.C., led the discussion which followed the report of R. B. Young, M.E.I.C., A. C. Oxley and J. A. Knight, A.M.E.I.C., as a committee on the subject of "Membership Standards" which had been brought forward by the Saskatchewan Branch. The branch were greatly pleased to have Mr. Durley, the general secretary, present and thoroughly appreciated his visit.

The programme for the year was the following:—

Jan. 22.—"**Canadian Woods and Their Uses**", W. Kynock, superintendent, Forest Products Laboratories.
Jan. 29.—"**Developments in Structural Steel Design**", L. H. Miller.
Feb. 5.—"**The Coal Problem**", Dr. E. S. Moore.
Feb. 12.—"**The Rubber Industry**", D. E. Beynon.
Feb. 19.—"**The Design and Construction of the new Niagara Arch**", H. Ibsen.
Feb. 26.—Joint meeting with A.S.M.E.
Mar. 5.—"**Recent Developments of the Hydro-Electric Power Commission of Ontario**", T. H. Hogg, M.E.I.C.
Mar. 12.—"**The Relation of Mining to our Industrial Life**", G. C. Bateman.
Mar. 19.—Branch annual meeting and elections.
Oct. 15.—Luncheon in honour of C. A. Magrath, M.E.I.C.
Oct. 22.—"**Speculations on the Mechanisms Along the Lines of Relativity**", W. Gore, M.E.I.C.
Oct. 29.—"**The Winds of the Globe**", Sir F. Stupart.
Nov. 5.—Luncheon — "**Mexico City**", N. D. Wilson, M.E.I.C.
Nov. 12.—"**Nipigon Region Development**", O. Holden, A.M.E.I.C.
Nov. 19.—"**Mining Developments of Ontario**", The Hon. C. McRae.
Nov. 26.—"**Modern Views on Matter, Energy and Radiation**", Dr. J. G. McLennan.
Dec. 3.—Luncheon — "**Geneva**", Sir Fobert Falconer.
Dec. 10.—"**Brazil**", F. J. Mulqueen.
Dec. 17.—Smoker — Hart House — Report by Committee on "Membership Standards" and discussion led by J. A. Knight, A.M.E.I.C.

MEMBERSHIP

The membership of the branch has continued with the usual fluctuations due to transfers, etc.

The total at Dec. 31st, 1925, was:—

	Branch Residents	*Branch Non-residents*	*Total*
Members	146	5	151
Associate Members	265	14	279
Juniors	50	1	51
Students	104	9	113
Affiliates	5	—	5
Total	570	29	599

FINANCIAL STATEMENT

Revenue

Balance as at January 1st, 1925	$677.23	
Rebates and branch news	690.66	
Bank interest to December 31st, 1925	8.10	
		$1,375.99

Expenditure

Advertising and printing	$355.20	
Rent of room	105.00	
Rent of Engineers' Club, Committee Room	250.00	
Secretary's honorarium	100.00	
Library Committee	41.00	
Stenography and postage	44.68	
Insurance	13.93	
Lecturers' expenses	41.69	
Convention expenses	72.05	
Entertainment	21.00	
Balance as at December 31st, 1925	331.44	
Total		$1,375.99

Respectfully submitted,

T. R. LOUDON, M.E.I.C., *Chairman.*
C. B. FERRIS, A.M.E.I.C., *Secretary-Treasurer.*

Vancouver Branch

The President and Council,—

I have the honour to report on the affairs of the Vancouver Branch, for the year 1925, as follows:—

GENERAL MEETINGS

During this year the policy in regard to general meetings of the branch has been to invite by personal notices, the members of sister organizations, such as the Association of Professional Engineers of B.C., the Vancouver Section, American Institute of Electrical Engineers and the Vancouver Section, Canadian Institute of Mining and Metallurgy. The attendance at our meetings, including visitors, has averaged about 65, as compared with 95 during 1924.

In addition to five general meetings, the branch participated in a convention with the B.C. Division, Canadian Institute of Mining and Metallurgy during February, and a joint meeting with the Vancouver Branch, Town Planning Institute of Canada in November.

The result of this broadened policy has been to stimulate to a marked degree the cordial relations existing between ourselves and sister organizations and to generally increase the usefulness and influence of *The Engineering Institute of Canada* in British Columbia.

The seven meetings occurred as follows:

Feb. 18, 19 and 20.—Convention: B. C. Division, C.I.M.M.
The whole of the second day was devoted to a joint survey and discussion of the **"Pacific Great Eastern Railway Problem"**. The Vancouver Branch contributed two papers: **"The P.G.E. Railway Problem"**, by W. G. Swan, M.E.I.C., chairman, Vancouver Branch; and **"Hydro-Electric Power Possibilities Along the Route of the P.G.E. Railway"**, by Ernest A. Cleveland, M.E.I.C., comptroller of water rights, province of British Columbia.
At the luncheon on Feb. 20th, an address was given on: **"The History of Highway Construction in British Columbia"**, by Patrick Philip, M.E.I.C., chief engineer, Dept. Public Works, province of British Columbia; and at the dinner on the same day an address was given on: **"Professional Engineering Relations"**, by E. A. Wheatley, A.M.E.I.C., registrar, Association of Professional Engrs. of British Columbia.

Mar. 26.—Lantern lecture: **"Highway Bridges in British Columbia"** by A. L. Carruthers, M.E.I.C., bridge engineer, Dept. of Public Works, province of British Columbia. At this meeting the Branch Charter was presented by Major Geo. A. Walkem, M.E.I.C., on behalf of the Council and received by H. J. Cambie, M.E.I.C., on behalf of the branch.

Apr. 2.—Lecture: **"A Standard Specification for Structural Steel"** by Lee H. Miller, New York, U.S.A.

May 21.—Lantern lecture: **"Dominion Dry Dock, Esquimalt, B.C."** by J. P. Forde, M.E.I.C., district engineer, Dept. of Public Works, Victoria, B.C.

Oct. 23.—Lantern lecture: **"The Mount Logan Expedition"** by Lieut.-Col. W. W. Foster, D.S.O., past-president, Alpine Club of Canada and member of expedition.

Nov. 18.—Lantern lecture: **"Town Planning in Practice"**, by W. Brand Young, A.M.E.I.C., assistant city engineer, Vancouver, B.C.
This was a joint meeting with the Vancouver Branch, Town Planning Institute of Canada.

Dec. 17.—Annual general meeting: Annual business and election. Lecture: **"A Talk on the Meteorological Service and Weather Forecasting"** by E. B. Sherman, weather observer, Vancouver, B.C.

Executive Committee

The executive committee held five meetings during 1925, the average attendance being seven. All branch business was transacted by the executive, with the single exception of the annual general meeting.

General Review of 1925 Business

Institute Nominating Committee

On December 16th, A. K. Robertson, M.E.I.C., was appointed to represent the Vancouver Branch on *The Institute* Nominating Committee during 1926.

Branch Elections

Sixty-two marked ballots were returned out of a total of 157 mailed to the membership of the branch for the 1926 election. Last year 52 were returned out of 154.

Library

L. F. Merrylees, A.M.E.I.C., was appointed to act with E. A. Wheatley, A.M.E.I.C., registrar, Professional Engrs. of British Columbia, in negotiations with the University Club of Vancouver relating to the removal of the Joint Library from 931 Birks building to the visitors' room in the new quarters of the Club. Arrangements have been completed, whereby the Club will house the library in the visitors room at a rental of $100. per annum, and will grant free access to the library to all members of the two engineering organizations.

The former room at 931 Birks building was vacated on November 30, 1925, and the library stored until the new library quarters in the University Club are ready for occupation, which is expected in the near future.

Negotiations with headquarters are being conducted by the executive with a view to a loan of $300. to finance new book cases and the binding of certain periodicals. It is confidently expected that a real library will eventually be available for the use of our members in place of the collection of dusty books heretofore.

Branch Office

The branch will retain its headquarters at 930 Birks building at a greatly reduced rental. This question is practically settled but official confirmation has not been given to the details of the arrangement as yet. It is expected that the net result of the changes made in the present joint quarters will be an annual saving to the branch, in rent, of about $115.

Presentation of Branch Charter

This ceremony occurred at the general meeting of March 26th, held in the auditorium of the Vancouver Board of Trade. The presentation address was made by Major Geo. A. Walkem, M.E.I.C., M.L.A., and H. J. Cambie, M.E.I.C., senior life member of *The Institute*, a charter member of the Vancouver Branch, received the charter on behalf of the branch.

Professional Engineering Relations

As a result of the special attention given to this matter by the executive, a distinct step forward has been made, in improved relations with sister engineering organizations. A free discussion of the question was held at a luncheon in February, attended by representatives of the various bodies interested, at which W. G. Swan, M.E.I.C., chairman, Vancouver Branch, presided.

The ultimate objective is the formation of a voluntary body whose membership will consist of all members of professional associations throughout the Dominion. W. G. Swan has been active in promoting this idea but the time is not ripe for its consummation.

During the July visit of R. J. Durley, M.E.I.C., general secretary of *The Institute*, he was the guest at an informal dinner given by the executive, following which the feasibility of such a scheme was discussed with him at considerable length.

Further important developments are looked for during the coming year.

Joint Committee on P. G. E. Matters

W. G. Swan, M.E.I.C., and Wm. Anderson, M.E.I.C., were appointed as representatives of the branch on a joint committee organized by the B. C. Division C.I.M.M., to examine and report on the Pacific Great Eastern Railway Problem. This committee undertook an exhaustive study of the problem and submitted a report to the provincial government in October. W. G. Swan, M.E.I.C., acted as chairman of the committee.

Western Professional Meeting at Banff

Geo. A. Walkem, M.E.I.C., M.L.A., was a delegate from the Vancouver Branch at this meeting, at which he read a paper on "The Vancouver Harbour", prepared by W. G. Swan, M.E.I.C., consulting engineer for the Vancouver Harbour Commissioners.

Students' Prizes

The Walter Moberly Memorial Prize

The initial award of this prize was made to Bruce M. Callander, 1925 graduate of the University of British Columbia in the Faculty of Applied Science, for a summer essay on "The Construction of the Connaught Tunnel". The prize consisted of $25.00 in books.

The A. D. Swan Special Book Prize

This prize was divided equally between two winners in Class 1926, Faculty of Applied Science, University of British Columbia, namely, Harry V. Warren, for a summer essay on "A Reconnaissance in the Whitesail District", and Alexander M. Richmond, for a summer essay on "The History and Development of Copper Mountain, B.C." Each winner received books to the value of $12.50.

We have pleasure in noting the recent announcement that Harry V. Warren has been awarded a Rhodes Scholarship.

H. H. Broughton Prize

This prize, $50.00 cash, was awarded to A. M. Anderson, S.E.I.C., as winner in an essay competition on "Handling of Bulk Cargo". The second prize, $25.00 offered by Mark R. Colby, was not awarded.

Membership

Grade	*Branch Residents* Dec. 17th, 1925	Dec. 18th, 1924	*Branch Non-Residents* Dec. 17th, 1925	Dec. 18th, 1924
Members	60	61	20	19
Associate Members	90	87	59	55
Juniors	7	6	12	10
Students	42	40	9	9
Affiliates	0	0	1	1
Total	199	194	101	94

We regret to record the death of H. M. Burwell, M.E.I.C., on July 30th, 1925, and that of Thos. H. Tracy, M.E.I.C., on October 30th, 1925.

FINANCIAL STATEMENT

Receipts

Balance on hand at Dec. 18th, 1924	$175.51		
A. D. Swan Prize, donation	25.00		
		$200.51	
Rebates on fees, Nov., 1924, to July, 1925		247.05	
Branch news to Dec., 1925		28.30	
H. H. Broughton, donation for Students' Prize		50.00	
Refund of expenses on Cambie, White and Kennedy Group, photograph enlargement		45.45	
			$571.31

Expenditures

Rent — 930 Birks building to Nov. 30, 1925		$220.00	
Rent — Board of Trade auditorium		25.00	
Printing and typing		44.00	
Postage and revenue tax		10.82	
Telegrams		5.84	
Stationery		1.20	
Addressograph		2.36	
Bank exchange		1.20	
Honorarium to secretary		50.00	
Library		3.15	
Entertaining, etc.		8.85	
A. D. Swan prize	$ 25.00		
H. H. Broughton prize	50.00		
		75.00	
Balance paid on Cambie, White, Kennedy Group photograph		32.20	
Line cuts for book plates—Swan and Moberly prizes		7.09	
Engrossing 12 book plates—Swan and Moberly prizes		3.00	
Wreath for late T. H. Tracy, M.E.I.C.		6.00	
Contribution to expenses of Joint Committee on P.G.E.		15.00	
Balance on hand Dec. 17, 1925		60.60	
			$571.31

There are no outstanding accounts to be paid, excepting rent of office space at 930 Birks building for the month of December. The amount will not be fixed until the tentative agreement with the Association of Professional Engineers has been approved. In any case the amount owing will not exceed $10.00.

The balance, $60.60, on hand at the date of this report, shows a shrinkage of $114.91 since the beginning of the year: but it should be noted that the rebates on fees cover a period of only nine months as compared with fourteen months shown in last year's report.

The average monthly rebates on fees for nine months of this year were about $27.50. Assuming this average for a period of twelve months, our receipts from this source would increase our balance to about $145.00, as compared with an adjusted balance of about $130.00 in last year's report.

If the large amount of arrears of fees could be collected our position would be still better.

The ordinary expenses of operating the branch during 1925 were approximately $375.00 as compared with $370.00 for the two previous years.

Our financial position will be greatly strengthened in future through the large reduction in rent which will result from the removal of the library to the University Club. The estimated annual saving in this respect will be $115.00.

One cheque for $25.00 was drawn on the Moberly Memorial Fund this year to cover the prize awarded to Bruce M. Callander. The balance in the fund at the date of this report is $39.04.

Respectfully submitted,

W. G. SWAN, M.E.I.C., *Chairman.*
P. H. BUCHAN, A.M.E.I.C., *Secretary-Treasurer.*

Victoria Branch

The President and Council,—

On behalf of the Executive Committee of the Victoria Branch, we beg to submit the following report of branch activities for the year ending November 30th, 1925.

The membership was increased by the addition of nine names:— Messrs. Barltrop, Bourne, Finlay, Hodgson, Livingstone, Porritt, White, Whitman, Wood; but the following left the jurisdiction of the branch during the same period, namely: — Messrs. Cummings, Faulkner, Graham, Grant, Kingham, McRae and Orton, so we can only claim an increase of two.

The standing of the branch membership is as follows:—

	Resident	*Non-Resident*	*Total*
Members	31	4	35
Associate Members	40	5	45
Juniors	1	1	2
Students	4	1	5
Affiliates	2	..	2
Total	78	11	89

The branch officers for the year were as follows:—

Chairman	G. B. Mitchell, M.E.I.C.
Vice-Chairman	J. N. Anderson, A.M.E.I.C.
Secretary-Treasurer	E. P. Girdwood, M.E.I.C.
Executive	E. E. Brydone-Jack, M.E.I.C.
	P. Philip, M.E.I.C.
	F. C. Green, M.E.I.C.
	M. P. Blair, M.E.I.C.
	R. A. Bainbridge, M.E.I.C.

Conveners of committees:—

Papers	F. L. Macpherson, M.E.I.C.
Social	F. G. Aldous, A.M.E.I.C.
Library	E. P. Girdwood, M.E.I.C.
Town Planning	E. A. Cleveland, M.E.I.C.
Publicity	C. A. Faulkner, A.M.E.I.C.

MEETINGS

A very successful series of meetings were held during the year.

Jan. 15.—E. A. Cleveland, M.E.I.C., gave an outline of the work of the World Power Conference of 1924, and a description of the power plants visited during the subsequent Scandinavian tour, with many references to matters of general interest.

Jan. 28.—A talk was given on **"Radio Communication"** by H. C. Vickers, M.E., M.Sc., Ph.D., a recognized authority on this subject.

Feb. 11.—After a paper by A. L. Carruthers, M.E.I.C., bridge engineer of the Provincial Department of Public Works, a number of members joined in the discussion, with particular reference to foundation work.

Feb. 14.—The members and their friends paid a visit to the works of the British America Paint Co., an industry known to all visitors to Victoria.

Feb. 19.—Two members of the Provincial Forestry Branch, Messrs. E. C. Manning and Geo. Wilkinson, spoke on the **"Depletion of our Timber Resources"** and **"Forest Protection"**, the mechanical superintendent of the same branch, J. H. Blake, A.M.E.I.C., following with a paper on **"Some Economics of Steam Plants"**.

Mar. 11.—Major G. G. Aitken, chief geographer of the province, gave an illustrated address on **"Comparative Geography"**, drawing many very interesting comparisons between the climate, natural resources, and productive capabilities of British Columbia and those of other places and countries on the continents of Europe and America.

Mar. 14.—The branch paid a visit to the plant of the Sidney Roofing and Paper Co.

Mar. 25.—A brief outline of **"Some of the Problems that are met with in Town Planning"** was given by E. G. Marriott, A.M.E.I.C., and was followed by one of the most vigourous discussions the branch has had, everyone present taking part under the capable management of the chairman.

Mar. 26.—The new gasometer of the Victoria Gas Co. was inspected. This is of the latest type with spiral guides, and was of particular interest to the structural members of the branch.

Apr. 8.—At the invitation of F. Napier Denison, director of the Meteorological Observatory, Gonzales Hill, another outing was enjoyed by members and friends; Mr. Denison being a specialist on seismic observations.

Apr. 18.—J. P. Forde, M.E.I.C., district engineer for the Dominion Public Works, gave an address on the **"Construction of the New Dominion Drydock at Lang's Cove, Esquimalt"**. This paper, which was of outstanding interest, has been published in The Journal for the benefit of the members of The Institute at large.

May 8.—A visit of a lighter nature was taken advantage of by a good number, when they learned something of the commercial production of a variety of biscuits and candy at the factory of Ormonds Limited.

July 24.—As many as possible of the members in town at such a time of year enjoyed the opportunity of making the acquaintance of R. J. Durley, M.E.I.C., our now well-known general secretary.

Nov. 11.—A joint lunch was held with the members of the Provincial Association of Professional Engineers, at which E. A. Wheatley, M.E.I.C., the registrar, spoke on the "**Business Organization of Engineering Societies and Branches**", showing very effectively the opportunities for progress.

Nov. 14.—The last and best attended of the branch meetings was held, the speaker being Col. W. W. Foster, A.D.C., D.S.O., and his subject "**The Mount Logan Expedition**". After giving an outline of the difficulties that had to be faced, and the methods by which they were overcome, Col. Foster showed a set of magnificent views. The public had been cordially invited to this meeting, and some three hundred people were present.

The financial statement of the branch is attached and shows a small increase in the balance on hand.

FINANCIAL STATEMENT

Balance sheet — Dec. 1, 1924 to Dec. 1, 1925

Balance in bank Dec. 1, 1924	$ 10.11		
Cash in hand	19.93		
			$ 30.04
Receipts			
Fees from Dec. 1, 1924 to Dec. 30, 1925	$131.02		
Rebates from headquarters	135.30		
Branch news	32.77		
Sundries profit	.15		
		$299.24	
Disbursements			
Rent of room, Nov. 1, 1924, to Nov. 30, 1925	$120.00		
Printing	31.00		
Typing	8.00		
Exchange and commission on cheques	1.31		
Light and socket	3.83		
Insurance	4.10		
Stationery	11.17		
Postage	28.09		
Lectures, visits and hall rent	8.00		
Magazines	13.90		
Janitor	3.25		
Photos	8.00		
Telegrams	7.17		
Telephone	.80		
Entertainment of guests	11.00		
Express on parcels	1.41		
Two signs on office door	5.00		
		$266.03	
Excess receipts over disbursements			$ 33.21
Balance in hand			$ 63.25
Bank balance	$ 14.62		
Cash	48.63		
	$ 63.25		

The books, vouchers and balance sheet have been audited and found correct.

M. P. BLAIR, M.E.I.C., *auditor.*
E. G. MARRIOTT, A.M.E.I.C., *auditor.*

In conclusion the executive wish to record their appreciation of the assistance given by many members of the branch, through whose co-operation 1925 may be classed as a very satisfactory year in the history of the branch.

Respectfully submitted,

J. N. ANDERSON, A.M.E.I.C., *Chairman.*
E. G. MARRIOTT, A.M.E.I.C., *Secretary-Treasurer.*

Winnipeg Branch

The President and Council,—

On behalf of the Winnipeg Branch, the following report is submitted:—

MEMBERSHIP

The membership of the branch as at December 31st, 1925, is as follows:—

	Resident	*Non-Resident*	*Total*
Members	44	4	48
Associate Members	137	17	154
Juniors	18	4	22
Students	47	4	51
Affiliates	5	..	5
	151	29	280

MEETINGS

Fifteen regular meetings were held during the year 1925. There was an average attendance at the meetings of 42. Two special meetings might well be mentioned, namely that addressed by Mr. Lee H. Miller at which there was an attendance of 101; and that held during the convention in Winnipeg, during August, 1925, held with the Minnesota Federation of Architectural and Engineering Societies, at which there was an attendance of 223.

The following is a detailed list of the regular meetings:—

Jan. 8.—"**Prospecting**," Prof. DeLury. Attendance 51.

Jan. 23.—"**Manufacture and Use of Industrial Alcohol**," C. D. Lill. Attendance 42.

Feb. 5.—"**Railway Water Supply**," C. H. Fox, M.E.I.C. Attendance 29.

Feb. 19.—"**Heat Treatment and Metallography of Steel**," J. Gilchrist and C. H. Turtle. Attendance 30.

Mar. 4.—"**Steam Storage**," A. J. T. Taylor, M.E.I.C. Attendance 65.

Mar. 18.—"**A Koppers Gas Plant**," Hugh McNair. Attendance 39.

Apr. 2.—"**Central Steam Heating Project of City of Winnipeg**," N. W. Calvert. Attendance 80.

Apr. 16.—"**Use of Compressed Air in Engineering**," A. A. Paoli, A.M.E.I.C. Attendance 42.

May 7.—Annual Meeting of Winnipeg Branch. Attendance 18.

Oct. 1.—"**Reinforcement of Weir at Pointe du Bois**," W. G. Chace, M.E.I.C. Attendance 45.

Oct. 15.—"**Some Problems in Railway Transportation**," H. J. Symington. Attendance 43.

Nov. 5.—"**Long Distance and High Voltage Transmission**," E. P. Fetherstonhaugh, M.E.I.C. Attendance 53.

Nov. 19.—"**Island Falls Development**," Martin O'Day, S.E.I.C.; and "**Spokie Valley Extension of the North Shore Line**," C. V. Antenbring, S.E.I.C. Attendance 33.

Dec. 3.—"**Primary Triangulation**," A. Bain; and "**Precise Levelling**," H. E. Treble, S.E.I.C. Attendance 26.

Dec. 17.—"**Patents and Inventions**," G. S. Roxburgh, A.M.E.I.C. Attendance 25.

GENERAL

The visit of R. J. Durley, M.E.I.C., general secretary, was an outstanding event of the year. He was present as a guest at a meeting of the branch executive on July 7th, and, on his trip returning from visiting the branches further west, he entertained some members of the branch to luncheon. Matters of interest to *The Institute* were discussed and considered on both occasions.

A. L. Ford, M.E.I.C., chairman of the Calgary Branch, attended a meeting of Winnipeg Branch executive as a guest, on September 10th.

The convention held in Winnipeg during August, with the Minnesota Federation of Architectural and Engineering Societies was pleasant and profitable. It lasted officially for two days. During that time an afternoon was devoted to the exchange of technical papers at a formal meeting. The entertainment of the visitors included a visit to the City of Winnipeg Hydro Electric System's plant at Pointe du Bois, as the guests of the city. Some 260 people enjoyed this trip.

It is to be noted that the papers of the regular meetings of November 19th, and December 3rd, were prize winning theses by students in the electrical and civil engineering sections of the University of Manitoba.

At the meeting of October 15th, on the motion of H. A. Bowman, A.M.E.I.C., and C. A. Millican, A.M.E.I.C., both charter members, Winnipeg Branch, there was recorded a vote of condolence to the members of the family of the late Brig.-General H. N. Ruttan, M.E.I.C., who died during the week of October 10th.

FINANCIAL STATEMENT

Following is the financial statement of the branch as from the date of the annual meeting of the branch on May 7th, 1925, to December 31st, 1925.

Receipts and Expenditures			
Cash in bank May 7, adjusted		$ 998.11	
Receipts: Local dues	$280.00		
Interest	18.73		
Rebates	227.00		
Branch news	21.33		
		547.06	
			$1,545.17
Expenditures		$ 684.98	
Bank balance December 31, 1925		874.69	
Cash balance December 31, 1925		1.63	
		1,571.30	
Over deposit, (deduct)		26.13	
			$1,545.17
Assets			
Cash balance		$ 815.19	
Rebates, branch news and advertising		119.41	
Interest		13.75	
Local dues in arrears less 50 per cent written off		807.00	
Office furniture and library, less 5 per cent depreciation		292.09	
War bonds		500.00	
			$2,582.44
Liabilities			
Accounts payable		$ 21.04	21.04
Surplus			$2,561.40

Respectfully submitted,

C. H. ATTWOOD, M.E.I.C., *Chairman.*
JAMES QUAIL, A.M.E.I.C., *Secretary.*

Discussion on the Trend of Steam Power Plant Development

Discussion of paper presented by A. G. Christie, Professor of Mechanical Engineering, The Johns Hopkins University, School of Engineering, Baltimore, Maryland, before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

Brig.-Gen. C. H. Mitchell, D.S.O., M.E.I.C.

General Mitchell remarked that there were two features which Professor Christie brought out in his paper to which he wished specially to draw attention. The first of these was the statement that low cost stand-by steam stations will soon fill an economic need in Canada.

The employment of steam power supplementary to hydro-generated power, migth seem superfluous in this country so full of water powers, but the employment of such supplementary steam plants had been or was being dictated, either by geographic conditions, of which New York state powers were an example, or by a scarcity of hydro sources with a shortage of supply visibly in sight, of which Ontario at present was an example. In the case of Ontario, it was obvious, notwithstanding the many hydro sources tributary to its industrial region, that some temporary measure, at least, must be taken, by which peaks could be taken care of until the development of St. Lawrence powers, necessarily requiring a long period of time, could be effected, or unless more power could quickly be made available by additional water at Niagara Falls or otherwise, Such a plant or plants would come under the head of low load-factor plants referred to by Professor Christie.

The other feature to which he wished to draw attention was the relation of fixed charges to the other costs of steam power developments.

Fixed charges had remained high, especially during the post war years. This doubtless meant high initial and other capital costs of construction as reflected in interest charges, which also had been high since the war.

Another interesting factor in costs of operation of the modern steam plant was to be observed in the uniformity of the annual costs of operation and maintenance throughout the whole ten years.

All these features were very clearly exhibited by the author in the curve of figure No. 1.

Important economical deductions could be made from these facts and curves, and the speaker desired particularly to impress upon the members of *The Institute* the desirability, as expressed by the author, of "the reduction of initial investment in the plant so that the trend of the curves for fixed charges and for total cost may be downward".

The responsibility would fall on designing and constructing engineers to secure economically — not cheaply, — built plants in the first instance, not unduly over powered, and free from unnecessary adjuncts and experimental features. This economic practice should apply most particularly in low load-factor plants, secondary plants or plants used in conjunction with water powers, particularly in this part of Canada, a caution which was specially voiced by the author in the fourth paragraph of his valuable paper.

Mr. E. W. Bull

Mr. Bull remarked that in discussion of this paper, he wished to concur in the desirability of working the steam through the greatest possible temperature range, the conservation of heat units by the use of closed circuit air coolers for the electric generator, using condensate as a cooling medium, preheated air to furnaces, and the reduction of banking losses by the use of powdered coal furnaces.

He particularly referred to the question of load-factor and use-factor of equipment. The daily load-factor on plant falling below unity, was usually accounted for by a general slump in demand after midnight, and extending to six or seven a.m., and was often a relief to the operating force, as it allowed of shutting down parts of plant equipment for minor repairs, that might extend the periods between general overhauls considerably, and might allow of this overhaul taking place in a period favourably influenced by amount of load or demand on plant. This feature influenced the amount of reserve equipment necessary and thereby reduced the fixed charges.

In connection with the author's reference to base load plants and to their doubtful life as base load plants, Mr. Bull said that this condition could be parallelled by a condition of a base load machine in a plant, which naturally with its complement of boilers formed a unit; due to the economy feature, the unit was kept in service at all times, and was only helped out or relieved from service by other machines and boilers not capable of the same economy.

This base load feature brought up the consideration of what use-factor could be expected of the base load equipment. This could be best decided by operating records as to the availability of equipment, and the speaker submitted the following on a steam turbine, and boilers equipped with underfeed stokers.

A highspeed turbine was installed and commenced operation on November 10th, 1920. It was the most efficient machine in the plant and was capable of carrying most of the load. It was kept continuously at work whenever possible until November 10th, 1925, an elapsed time of 43,934 hours, of which the turbine operated 42,227 hours or 96 per cent of the time; at which time a more efficient turbine was installed and took up the base load work.

A group of boilers was also installed and commenced operation January 1st, 1922, and were capable of supplying this turbine. One boiler, No. 6, was fitted with a larger superheater, furnished higher temperature steam, and consequently was operated at all times possible. All boilers were fed by condensate and distilled makeup.

On December 31st, 1925, after an elapsed time of 35,064 hours, No. 6 boiler had operated 27,487 hours or 81.24 per cent of the time, the rating varying from 100 per cent to 300 per cent with an average of 170 per cent.

An analysis of the causes of this equipment being out of service would no doubt assist in the design of power plants. The turbine with its auxiliaries was laid idle once each year for a thorough examination and overhaul which was carried forward with all dispatch and 916 hours of the total of 1,707 hours of off-service was required for this work. This period was not likely to be lowered and could be considered as a necessary outage for this very necessary work in the operation of turbines.

The balance, of 891 hours, of outage was caused by the auxiliaries of turbine requiring attention and was largely due to many stops to clear weeds, grass and trash from the condenser tube plates. This was not due to fault in the condenser, but was caused by the fact that screens, no matter how well made and fitted, will allow of small quantities of weeds and blades of grass to pass through screen wire endwise and later block some of the tubes at tube plate of condenser. The remedy for this feature in the design of plant was to have the condenser arranged in two independent sections to allow of one section being cleaned while the other is in operation, or to have circulating water piping and valves arranged so that a back flow through tubes can be brought about for a short period and wash any accumulated weeds and trash away to discharge lines.

In the latest installation both of these features had been incorporated in one condenser, with the additional features of being able to change from a two- to a four-pass condenser, during cold circulating water and light load periods, to conserve auxiliary power, as the circulating water pumps were driven by constant speed motors. It was expected that this arrangement of condenser would reduce the period of outage of a turbine by nearly 50 per cent.

No. 6 boiler likewise had an annual period of inspection and overhaul, and 1,584 hours of the total outage of 7,577 hours was consumed in this necessary procedure. This left a balance of 5,993 hours that the boiler was out of service due to a variety of causes, the furnace and stoker predominating in the causes for withdrawal from service.

The boiler proper had surprisingly few occasions for withdrawal from service and from a study of all conditions it appeared that any design that will eliminate the carrying of many tons of fuel bed in furnace at one time and the elimination of metal supports for this fuel bed, cannot be a development in the wrong direction.

In considering the use of powdered fuel system of burning, the fact that the mechanical parts are outside of furnace and any minor repairs can be made without waiting for boiler furnace to cool, had not been given the prominence that it deserves.

Professor L. McK. Arkley, M.E.I.C.

Professor Arkley remarked that in the first paragraph of Professor Christie's paper, the statement regarding the present efficiency of the modern steam central station was rather conservative and the prediction that further reduction in heat consumption per kilowatt hour was likely to be delayed on account of increasing fixed charges, etc., was to say the least, rather pessimistic.

In a paper by Sir Chas. Parsons, the father of the reaction steam turbine as it is known to-day, read before the World Power Conference in 1924, he made the statement that his company was at that time building a 50,000 kw., turbo-generator for the Commonwealth Edison Company of Chicago, to be placed in their Crawford Avenue station and to operate at 550 pounds pressure and a temperature of 750° F. at the throttle, for which a heat consumption from steam to electricity, of 10,265 B.t.u. was anticipated. This would represent an overall heat consumption of about 12,300 B.t.u. per kilowatt hour. In this paper, the author estimates that with a pressure of 1,500 pounds per square inch, and a temperature of 750° at the throttle, an overall heat consumption of about 11,000 B.t.u., would result. The 1,200 pounds boiler and throttle temperature of 750° F. were already with us. It therefore seemed probable that a substantial reduction from the 15,000 B.t.u., heat consumption quoted might be looked for in the near future.

With the author's statement a little farther on, that it is quite probable that low cost stand-by steam plants, hooked up with hydro-electric systems, will soon fill an economic need in Canada, the speaker heartily agreed, and said he was glad that an authority of Professor Christie's standing had made this statement, for it was surprising how many engineers believe that in harnessing a water power you get something for nothing and that all steam generated power must be very costly.

The author just mentioned that local conditions may favour the addition of a central heating load to a stand-by steam station. In this, the speaker believed, may be found the real solution of our economical steam power plant. After all the refinements which the author described in his paper had been made; after the questions of high pressures and high superheats had been exhausted, and all this at a very high cost, it was found that there was an overall thermal efficiency of from 25 to 30 per cent. The chief reason for this was that the exhaust steam is condensed from the turbines and in this way its latent heat is lost.

A simple computation would show that if all the exhaust steam from a power plant can be used for heating purposes, for which live steam would have to be supplied if we did not have the exhaust, the steam plant would operate at over 60 per cent. efficiency. The central heating plants in connection with the universities and hospitals were doing this now.

Mr. J. O. Twinberrow, A.M.E.I.C.

Mr. Twinberrow remarked that he regretted that so much of Prof. Christie's paper dealt with considerations peculiar to problems incident to large central station designs. He thought that it was questionable whether conditions in Canada, generally speaking, are suitable as yet for installations of large plants, and one might estimate that 98 per cent of the plants to be installed in this country during the next few years would be of the smaller industrial plant class.

The connecting together of a number of small plants had not been given the attention it should on this continent. In this respect attention should be drawn to the results achieved in England by the Newcastle-on-Tyne Electric Supply Company, Limited, and its associated companies, who in 1924 had some 600,000 h.p., connected to their system over an area of some 1,400 square miles. In addition to the three large power stations — Carville, Dunstan, and North Tees, there were twenty-five small stations utilizing waste heat from gas and coke ovens and other processes which were connected to the common system of cables. Of these twenty-five small stations fourteen were operated entirely by the company. These small plants produced 14 per cent. of the total kilowatts sold.

In dealing with the history of the rise in steam pressures and temperatures, credit should be given for what has been done in Europe. For instance: in 1913 a pressure of 275 pounds and 700° total temperature was being used in a central power plant in England., while in 1917 the North Tees plant was designed to work at a pressure of 475 pounds and gave an output of one kilowatt for 16,271 B.t.u.

Professor R. W. Angus, M.E.I.C.

Professor Angus said that in the curves shown on figure No. 1, in Professor Christie's paper, some information was given as to the magnitude of the different factors entering into the cost of power production, and that it was interesting to note that the operating and maintenance costs had remained constant during the last thirteen years at about one-half mill. each per kilowatt hour, even though the wages paid to the employees had very materially increased.

The curve of fuel cost per kilowatt hour showed that from 1913 there was a rise from two mills. per kilowatt hour to five mills. in 1922, and since that year a very marked decrease had taken place, giving a final value of about 2.3 mills. in 1925. While the downward slope was no doubt due to a certain extent to the decreased cost of fuel per ton, it also indicated a marked gain in efficiency of the steam plants, and as the curve had a distinct downward trend at the present time, it would suggest that further improvements are probable.

It was worthy of note that the modern cycle tends to approach the theoretical conditions described by Carnot one hundred years ago, when he stated that maximum efficiency would be obtained by a reversible cycle of operations. In the modern plant the process of bleeding the turbine at various stages for feed water heating was one which caused the actual cycle to approach the theoretical cycle. If the number of stages of reheating by the bleeding process were sufficiently increased the cycle became fully reversible, and therefore one of maximum efficiency.

In this connection the author gave the illustration (figure No. 8) of the Gould St. station of the Consolidated Gas, Electric Light and Power Company of Baltimore, in which he showed that 21 per cent. of the steam was withdrawn from the turbine for feed heating purposes, the turbine being supplied with steam at a pressure of 405 pounds absolute, and the feed heating steam being drawn off at absolute pressures of approximately 183 pounds, 94 pounds, 28 pounds and 9 pounds, respectively. There was considerable expense involved, as a closed heater must be used for each stage from which steam is drawn.

In his paper, Prof. Christie referred to the steam pressures and temperatures being raised, and the speaker urged that there is a great field of advancement in this direction, the tendency at the present time being to increase the pressures rather than the temperatures, one reason being that the properties of metals at high temperatures are not sufficiently well established.

The author had calculated some efficiencies, using the Rankine cycle, to compare the results obtained by using high pressure saturated steam to produce a given temperature, rather than using lower pressure superheated steam to produce the same result, in all cases the back pressure being taken at one inch of mercury. The results showed that saturated steam produces a higher efficiency in the Rankine cycle than superheated steam at the same temperature; thus, if the supply steam temperature were to be 500° F., and this were produced at 200 lbs. pressure, the cycle showed 32.6 per cent, while if the same temperature was produced by raising the pressure to 679 lbs., at which the steam was saturated, the efficiency rises to 37.4 per cent.

In any event, he said, a certain amount of superheating was essential to the life of the turbine, as it prevented condensation in the earlier stages, and for that reason it was true that, as the author stated, there was considerable gain from the higher superheats, and probably both pressures and degrees of superheat would continue to be raised in the future.

The speaker was of the opinion that there was a great future for the use of several working fluids in power plants, and had followed with very much interest the work of Mr. Emmet on the mercury vapour turbine. Should it be found practicable to use some such fluids as mercury for the upper temperature range, steam for the intermediate temperature range, and such a fluid as ammonia for the low temperature range, it would be possible to utilize a much greater range of temperatures than was now possible, and still keep the pressures within ordinary working limits, and one naturally looked forward to advancement along this line.

The author's statement about the operation of boilers at capacities of 300 per cent of their nominal output, the speaker thought, called for a criticism of the present method of rating boilers, as it seemed absurd to classify a boiler so that its continuous output would be 300 per cent of its rating. Engineers should establish some new rating for boilers which would make the continuous maximum output more nearly agree with the rated capacity.

The author laid considerable stress on the use of powdered coal, and this, the speaker said, had also been a distinct advance in recent years, enabling exceedingly high efficiencies to be obtained during regular operation, and very much reducing the standby losses when the plant was shut down. It was, therefore, a method which offered very great promise where high efficiency was desired, and also where the steam plant was used as a standby on any system, because powdered fuel, being practically as flexible in its use as oil, enabled the full power to be thrown on the plant within 15 or 20 minutes from stationary condition.

The author had spoken of the large size of turbines now being installed and this would seem to account, at least partly, for the horizontal operating cost curves in figure No. 1. The cooling water required for condensing the steam for such units, amounting to about two gallons per kilowatt per minute, offered a very serious problem, and practically compelled the placing of any large station close to the water front, which indeed would be a desirable location on account of the convenience for taking in coal. A 50,000-k.w. turbine would require about 100,000 gallons of cooling water per minute, which is 144 million gallons per day, or about 50 per cent. more than the amount used by the city of Toronto.

The speaker wished to emphasize the importance of securing the coldest cooling water for the condenser, as had already been mentioned by the author, for which purpose not only must the intake be placed as far below the surface as possible, but its design must be thought out with the greatest care, otherwise it would draw in surface water, even though it might be 15 feet or 20 feet down. The design of this intake tunnel also affected the power required to operate the circulating pumps, the entry losses to such an intake tunnel being a fairly large proportion of the total head; too little attention had been paid to this important feature of power station design.

Mr. R. E. MacAfee, A.M.E.I.C.

Mr. MacAfee remarked that the author had suggested that stand-by plants could be used for central heating plants during the winter months. This would probably work out very well in a peak load plant where the boiler capacity at maximum rating is based on the expected requirements. But where a steam plant was installed as a stand-by to an hydro-electric development it would not seem good practice to use the plant as a central heating plant during the winter, as it was very possible that the stand-by service would be needed much more during the winter months than during the summer. This would, of course, depend on local climatic conditions. Records over a period of years would be a guide as to whether it would be possible to use a stand-by plant as a central station heating plant with safety. If the plant were built with the idea of being a stand-by, nothing should be permitted to creep into the development to interfere with the plant's actual stand-by capacity.

Boilers for use in purely stand-by plants could be arranged to operate at very high ratings to keep down the capital cost. It was interesting to note that in some cases boilers are being installed to operate at ratings of 500 per cent and over. In deciding on the ratings at which boilers are to be operated for stand-by purposes, the speaker said, it was necessary to take into consideration the character of service to be rendered, for instance, whether the interruption of the hydro plant was likely to be due to breaks in transmission lines or trouble at wheels due to ice conditions, which would require a comparatively short period to put the plant back in operation, or whether the interruption would be due to low water, which might last for considerable periods of time In the former case all the boilers could be operated at maximum rating, while in the latter it would evidently be better to be more conservative in the matter of ratings.

With reference to the method of driving the auxiliary equipment on which the operation of the plant depends, Mr. MacAfee said that it would seem wise to decide this on continuity of operation rather than maximum efficiency. In any power station ample reserve should be arranged for such items as boiler feed pumps, forced and induced draft fans, stoker drive, condenser auxiliaries and exciters. The necessary reserve might be supplied by electric drive fed from sources other than that supplying the main drive, or where this was not available steam driven units as stand-bys should be provided.

Pulverized fuel was undoubtedly coming rapidly to the front as a method of burning coal and should be given consideration in any new power plant designs. Pulverized fuel could be arranged on the central system where a certain amount of coal in the pulverized state was carried in storage, or with the unit system where the coal was pulverized and fed directly to the burner.

The question of whether one system or another should be used was an exceedingly interesting one, and Mr. MacAfee thought that the author could probably give a general idea as to what size of boiler and what size of plant could best be handled with one or the other system. He agreed that unit mills were not too reliable, and raised the question as to what has been found to be the trouble in these mills and what is the general trend of development to overcome this trouble.

Mr. J. G. Worker

Mr. Worker remarked that the Richmond station of the Philadelphia Electric Company, with an ultimate capacity of 600,000 kilowatts, had recently gone into operation, and was generating electric energy at less than the figures mentioned by Professor Christie. This plant was interesting on account of the use of highly preheated air with underfeed stokers. At this company's Chester station, very close to 90 per cent. boiler efficiency was being obtained by the use of air preheated to 500 degrees.

The Philo station of the Ohio Power Company had been in operation since the fall of 1924, and over long periods of time had shown an expenditure of about 14,000 B.t.u. per kilowatt-hour of net station send-out. This station was designed for a steam pressure of 550 pounds per square inch gauge and a temperature of 725° F. and reheating steam which later was sent back to the turbine. Chain grate stokers were used with preheated air, burning a low grade coal of about 10,000 B.t.u. per pound.

The author had make the following statement: "Powdered coal requires more auxiliary power than stokers. On the other hand, it gives a higher efficiency over a wider range of boiler rating and is more independent of the grade of coal than the best stokers." This statement, the speaker said, was of interest, because there was agreement among engineers with respect to the first part of the statement, but some recent developments in stoker fired plants might be taken to indicate opposite conclusions relative to efficiency and burning of a variety of coals.

The author's statement that powdered coal more nearly approached test efficiency in daily operation and had lower stand-by losses and lower maintenance cost than stokers was the issue on which the two factions split; namely, those who favoured pulverized coal firing and those who favoured stoker firing. Perhaps the truth of the matter was that there was as yet insufficient information to justify any definite statement in this connection.

Professor E. A. Allcutt, M.E.I.C.

Professor Allcut remarked that the author's paper was an interesting résumé of the development of the steam power plant generally, the influence of the various components on its efficiency and economy, and the probable directions in which future improvements may be expected. The present tendency towards the use of higher pressures and temperatures had been outlined, and up to the present, as the author had pointed out, the maximum steam temperature available was about 750° F. All materials weakened at high temperatures, — this might be allowed for, — but the experiments of Dickenson* and others also showed that steels which purport to stand a given load at a certain temperature under ordinary test conditions, would fail at lower loads if time be allowed. A steel which broke at 19,000 pounds per square inch, at 1,500° F. in 6 seconds, failed under the same load in 28 hours, with a temperature of 1,150° F., and at lower temperatures in longer periods. Thus, with the tendency of cast iron to grow and of steels to flow at high temperatures, the limiting temperature of steam production was comparatively low, particularly when high pressures were used to obtain the maximum thermal efficiency.

Mellanby and Kerr** put the economic limit of temperature at about 900° F., and of pressures at about 1,250 pounds per square inch.

*Proc. Iron and Steel Institute — Sept. 6th, 1922.

**North East Inst. Coast of Engineers and Shipbuilders, Feb. 27th, 1925.

This temperature, however, was far less than the combustion temperature, and even though the boiler gives an efficiency of 90 per cent. the result was to transform the heat to a form of lower thermodynamic value. In fact a large quantity of heat was transferred to the condenser cooling water, where, owing to its low temperature, it could not be utilized effectively.

The question therefore arose as to whether the problem of heat conservation was being tackled along the right lines. The internal combustion engine could and did handle heat at the temperature of combustion, and enormous strides had been made recently in its practical application for the production of large powers. Only a few weeks ago the liner "Asturias" was launched, containing two 10,000-h.p. internal combustion engines, having eight cylinders each. This power was small as compared with the steam turbines described in the paper, but when it was considered that this century had seen the power per cylinder of the internal combustion engine raised from 300 to 1,250 h.p., it was at least conceivable that this type would develop further and would (as it did now) produce fuel economies unapproached by any steam plant. Further, the exhaust loss of the internal combustion engine was at a considerably higher temperature than that of the steam plant, and therefore offered greater potentialities for development. In fact, the internal combustion engine left off where the steam plant commenced.

Mr. J. W. Sanger, A.M.E.I.C.

Mr. J. W. Sanger remarked that in his opinion for many years to come, in the field of steam power production, Canada would not be at all interested in thermal efficiency except in a few isolated cases. The intensive hydro-electric development which now existed and the far greater expansion which had yet to come, would restrict the steam power plant to the minor function of carrying peak loads, and this condition would exist until the total power demands of the country far exceed the available water power resources.

The design of steam plants for extremely low annual load-factors was the problem to be faced. There did not seem to be any cure for this poor load-factor condition, except that used in Winnipeg, where a steam standby plant, a central steam heating system, and a battery of large electric boilers had been combined with a hydro-electric system, in an effort to get relief from the expense of carrying a steam standby plant for the hydro-electric system. In such a combination, if the central steam heating system could be made to carry itself, there should be attractive profits from the sale of off-peak hydro-electric power to the electric boilers, and from the saving of operating labour in the boiler house of a joint central heating and standby plant.

A steam standby plant of any appreciable size was too great a burden for a hydro-electric system to carry, as the annual cost would be at least $16.00 per kilowatt of installed capacity. Moreover, the interconnection of a number of hydro plants and their transmission lines would make the likelihood of a lengthy interruption to service extremely remote.

He considered that the most important opportunity for the use of steam power plants in Canada would be the period between the loading up of one large hydro plant and the development of another. To cite an example, we might consider the development of a power site on the Nelson river for the Winnipeg market. The initial expenditure on a 150,000-h.p. site and 350 miles of transmission line would be not less than $15,000,000, representing annual cost of approximately $1,500,000. If the first block of power supplied were 20,000 h.p. it would cost delivered $75.00 per horse-power-year, or about three times the annual cost of a 20,000-h.p. steam station located in Winnipeg and operating over the peak loads of the system. Hence, provided that the annual increase of load of a system is small compared with the initial annual cost of a new hydro-electric development, the intermediate steam plant would function economically.

Annual load factors as low as five per cent must therefore be considered, which immediately eliminated from the problem of design the cost of coal, thermal efficiency, cost of water and those maintenance costs which depend on the output of the plant. Capital expenditure would then become the sole item of importance, and surveying the trend of steam power plant development one would be inclined to suggest that boilers of medium pressure and extremely high rating, unit pulverizer fuel systems, high speed turbo-generators, small condensers and a minimum quantity of auxiliary apparatus would be the ultimate selection to give the best financial results.

Mr. Christie's Reply

The author, in reply, observed that a study of the load-duration curve of almost any power system would disclose the fact that the upper 25 per cent of the maximum demand existed for only about 800 hours per year, while the upper 10 per cent might last even less than 200 hours per year. Only the cheapest possible station could carry economically a load that lasts for only 200 hours per year. Hydro plants paid best on base loads, and it would be apparent that a steam station should carry this portion of a system's load if it could be built at a lower cost than an equivalent hydro station, as fixed charges were the most important element in the cost of such power.

Many people believed that large sums of money would be spent on coal for such a steam station. This was not the case. If a gross rate of 2 lbs. of coal per kilowatt hour were assumed for a 50,000 K.W. plant to carry the upper 10 per cent of a system's peak, then at $5. per ton, the coal cost would be about $1.75 per kilowatt year. This would probably be about one-eighth of the yearly fixed charges on such a plant. It was therefore evident that economic pressure would force the construction of a low cost steam plant to get the cheapest service.

Mr. Bull had contributed valuable data on the performance of his own plant. The Regina station had long been regarded as one of the best operated steam stations in America and these figures confirmed this reputation.

Professor Arkley had presented some figures indicating very low B.t.u. per Kw.H. on some of the newer stations in the United States. Plants that would operate on 12,000 B.t.u. per Kw.H. could not be built cheaply. The real criterion was the total cost of power, which considers the fixed charges on first cost plus operating costs including fuel. Executive officials did not ask how efficient a plant one could design, but how cheaply could one produce the power. These officials now scrutinized first cost very closely, and limited investments might make the highest efficiency unobtainable. A high efficiency plant could readily be designed if fuel costs warrant it. Low coal consumption could never be justified in a peak load plant, on account of high first cost.

He considered that the addition of a heating system to a steam station was an economic problem, and in many cases this combination would yield large financial savings.

Mr. Spotton had felt that the large plant had received overemphasis. The paper had dealt principally with the large plant, as past records show that the small plant follows the practice of the large plant.

The connection of small plants to a power system had been suggested. This scheme had many advantages and deserved careful study on the part of the power supply organizations.

While the mercury vapour system had been demonstrated in an experimental way, no cost figures were yet available to indicate that it could produce power more cheaply than by our present steam systems.

Regarding Professor Angus' discussion of the steam cycles, it should be noted that if total steam temperatures could be raised to 1,000° F., the plant efficiency at all pressures would be increased several per cent. This was the next direction to look for improvements in plant economy, as the advantages and utility of higher pressures are now recognized.

In connection with Mr. MacAfee's discussion it might be well to point out that ratings are a factor of furnace design rather than of boilers.

Attention had been called to underfeed stokers, on the ground that these might provide a more economical station than pulverized fuel. This was a timely discussion, for it indicated that engineers may not agree on the present trend of development.

Discussion on the Principles of Combustion and Heat Transfer as Applied to Steam Generation

Discussion of paper presented by John Blizard, Research Engineer, Power Specialty Company, New York, before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 29th, 1926.

Mr. V. Z. Caracristi

Mr. Caracristi remarked that it was difficult to determine what constitutes a combustion space which is "too small". In stationary practice as at present commercialized, approximately one and one-half pounds of coal were burned per hour for each cubic foot of combustion space, and by "combustion space" was meant all the space available for combustion below the heat-absorbing elements, without regard to the manner in which localized combustion takes place.

There were installations in service, burning pulverized coal, in which the amount of coal burned ran as high as eighteen pounds to the cubic foot of combustion space, using the same definition for "combustion space", with a fuel loss well within the commercial limitations of results obtained under similar operating conditions where less coal was burned per cubic foot of combustion space. He considered that the amount of coal burned per cubic foot was dependent on design, and that the limitations the author had imposed as to capacity were within reasonable commercial limits, non-existent.

It was difficult, also, to conceive the authority for the implied additional cost of installing and operating equipment for burning pulverized coal, as compared with an installation for burning solid coal on grates or stokers. The cost of an installation was not measured by the number of boilers or units installed, or the heat-absorbing surface available, but only by the ability of the installation to deliver steam, under the required pressure and superheat conditions. He believed that when measured on this basis, the difference, if any, would be in favour of powdered coal.

The limit of heat-transfer rate stated by the author was approximately correct, but this rate of heat transfer could not be obtained if the heat-absorbing surface of the tubes were shielded in any way from the direct action of the radiant heat. Were this not true, there would be no material available suitable for heat insulation purposes.

In his discussion of the relative values of economizers and air heaters, the author had not brought out the value of the admission of heated air to the combustion chamber.

Mr. J. G. Worker

Mr. Worker remarked that in order to attain high efficiency in the combustion of pulverized coal provision must be made for the maintenance of the highest possible temperature in all parts of the combustion space, and the possibility of loss of unburnt coal carried through the furnace must be carefully watched.

Professor John Stephens, M.E.I.C.

Prof. Stephens remarked that with regard to burning coal on grates, it was a matter of general experience, with eastern Canadian coals of about 30 per cent volatile content, that there is some minimum draft difference between the furnace and ashpit, necessary for efficiency, with any practical thickness of fire.

In the tests on a domestic boiler referred to by the author, 50 per cent was given as a low efficiency with bituminous coal. He had found it difficult in such boilers, using coal from either the Sydney or Minto fields, to attain an efficiency of 50 per cent, 40 per cent being a more usual value. He would ask what were the volatile content of the coal, the draft conditions, and the depth of the layers of coal put on at each firing, in the tests where an efficiency of 50 per cent had been attained or exceeded. In his experience, efficiency increased with the frequency of firing in proportionately thin layers, if the volatile content of the fuel was high.

He desired to point out, as arising out of the ideas suggested by the paper, that a fuel of increasing industrial importance in some parts of Canada, namely wood, required no air to be admitted above the grate.

Mr. A. R. Mumford

Mr. Mumford remarked that a study of combustion by means of gas samples withdrawn from the furnace through water-cooled samplers had recently been completed in one of the stations of the New York Steam Corporation and was progressing in another.

It had been found that some means of mixing the several streams of gases rising from the fuel bed of a chain grate stoker was necessary in order to reduce the

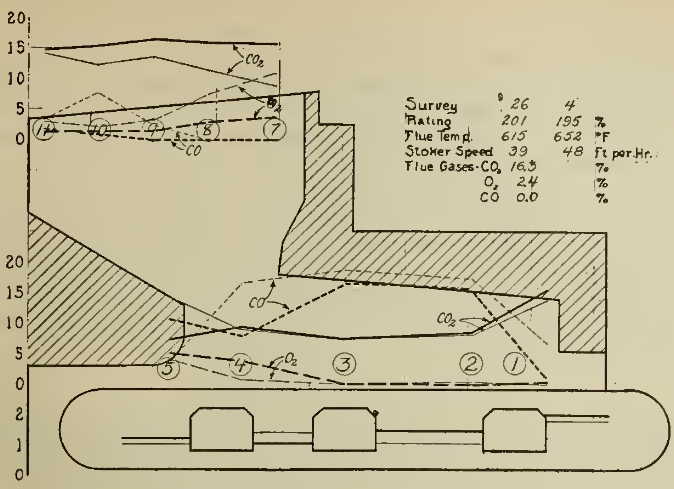

Figure No. 1.—Actual Effect of a Rear Arch.

losses due to incomplete combustion. In this particular case an arch extending forward above the stoker from the bridgewall had been found to be the solution. Figure No. 1 gave a comparison of the combustion conditions before and after the installation of the arch at the rear of the furnace. The heavy lines showed the gas composition after the arch was installed, and the light lines that before the arch was installed. Over the fuel bed the gas composition was different in the two cases, although this was obviously not due wholly to the rear arch. The air pressure in the last air chamber was maintained considerably higher with the rear arch in service, and the refuse passing over the end of the stoker appeared well burnt out.

In the first pass the gas composition showed that the CO_2 was higher at all points and that the CO was lower. The arithmetical averages of the gas composition showed that without the rear arch about one-fifth of the CO formed in the furnace entered the boiler, and that with the rear arch in service only one twentieth of the CO formed entered the boiler.

Here evidently the enforced mixing of the streams of gases from the sections of the stoker had resulted in an improved gas composition. The shape and size of such an arch must be adapted to the furnace available, and it is not always necessary to make the mixing action so vigourous as in this case.

In the second plant in which a study of furnace conditions was now progressing a different shape of furnace had been found, as shown in figure No. 2. The height to which the gases may rise in this furnace was much greater than in the other and the effect of this longer path was evident in the absence of combustible gases entering the boiler. The conditions immediately above the fire were identical with those found in Plant No. 1, as would be expected. The stratification of the gas streams was also identical in character, (namely, the air from the rear of the stoker rose vertically and entered the boiler in the region of point II while the rich gases from the front of the stoker passed vertically up to point 7 after emerging from under the combustion arch). Evidently diffusion was rapid enough to permit the combustion of the unburned gases in this length of travel, and the function of an arch would only be the elimination of the severe stratification that existed.

He considered it evident from these two series of experiments that gaseous combustion could be completed in a small furnace, if the several gas streams were forced to mix, and that although there might not be combustible

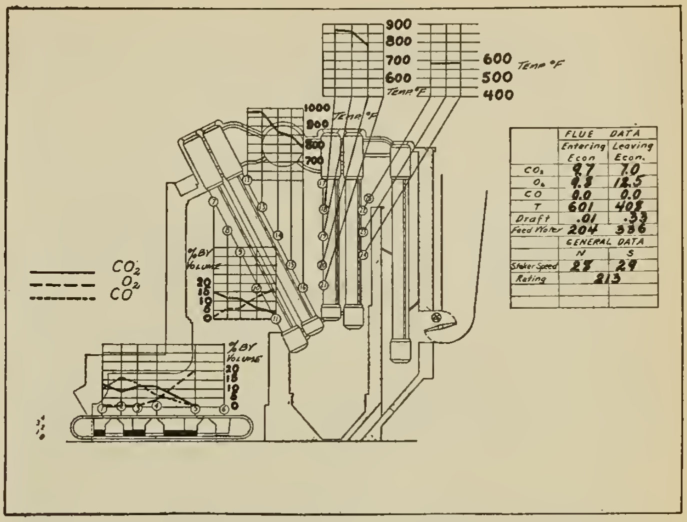

Figure No. 2.—Survey of Furnace Boiler No. 3 Station J, N.Y. Steam Corporation.

gases entering the boiler from a large furnace, stratification existed which might be eliminated to advantage by the introduction of enforced mixing combined with changed operating methods.

Unfortunately all of the fuel fed to the stokers did not remain on the grates. Varying quantities of solid particles were lifted from the fuel bed and carried through the boilers by the gas stream. Unlike pulverized fuel these were comparatively large and required considerably more time to burn than did the gases. The installation

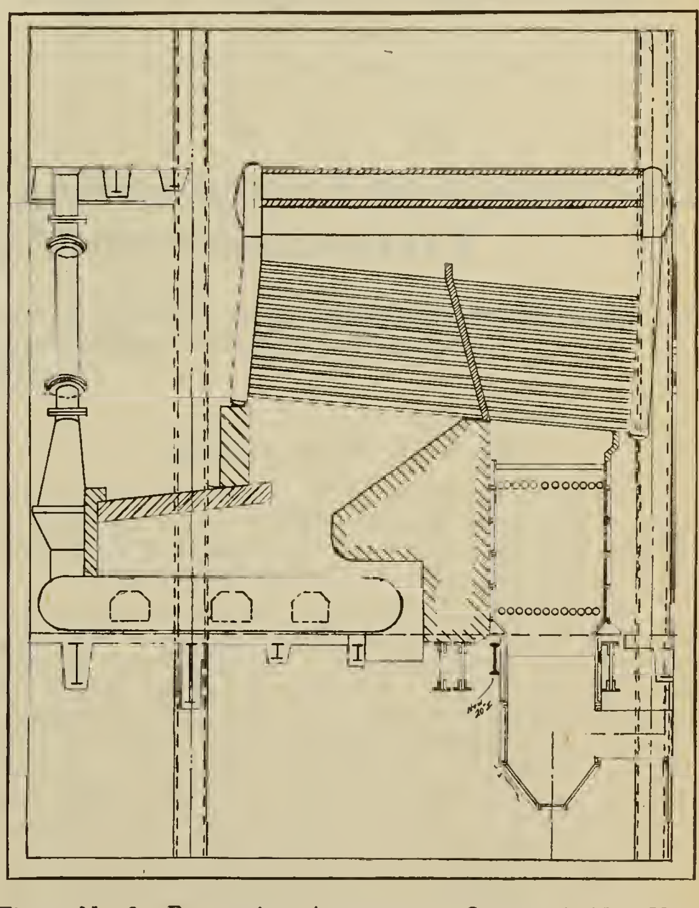

Figure No. 3.—Economizer Arrangement Station A, New York Steam Corporation.

of enforced mixing had no noticeable effect on these particles, and here the only solution seemed to be increased volume, or increased length of travel, which might result from increased volume, under high temperature conditions.

In reference to the second section of the paper he wished to point out that any increase in the rate of gas flow caused by increasing the number of baffles would result in increased cost of baffle maintenance, which was very likely to materially affect the estimated saving. As a rule baffles were continually in need of some repair, and any leak that developed would immediately reduce the estimated improvement. He believed, therefore, that any design eliminating baffles would result in a closer approach to test efficiencies under operating conditions. His attitude toward baffles was one of the factors which had led to the change of design in plant No. 1, where the boiler had been rebaffled so that the original three passes were replaced by two, and one baffle eliminated. An economizer had been installed under the second pass, as shown in figure No. 3. The results of this change were best expressed in terms of gas temperatures at several rates of steam flow, as follows:—

Relation of Steam Flow to Temperature of Exit Gases in 3-Pass Boiler and 2-Pass Boiler with Economizer.

Steam flow M Lb. per hr.	Temperature of gases. Deg. Fahr.		
	Leaving 3rd pass (3-pass boiler)	Leaving 2nd pass (2-pass boiler)	Leaving economizer (2-pass boiler)
50	580	570	219
75	662	642	254
100	765	705	286
115	?	727	293

The change from 3-pass to 2-pass had accompanied by baffle replacement and he believed that this change accounted for the existing gas temperature reduction where an increase was expected.

The reduction in gas temperature by the economizer was, in this case, the same as would have resulted if the economizer had been installed on the original 3-pass boiler. The savings arising from the 2-pass arrangement occurred through the reduction of draft loss, baffle maintenance, and space occupied. The compactness of the new arrangement was clearly shown in the sketch, and was of great importance because of structural features and land values.

Mr. H. A. Tuttle

Mr. Tuttle remarked that in the case of domestic boilers it seemed doubtful whether the actual efficiencies obtained in practice exceeded 40 per cent. He believed that an improvement in this respect would effect a substantial saving on our total annual fuel bill, and would reduce the necessity for the purchase of imported coal. He considered that domestic furnaces should be designed so as to run more efficiently with less attention, and that provision should be made for their operation with high volatile bituminous coal by arranging for the admission of preheated air over the fire.

Mr. Blizard's Reply

The author, in reply, pointed out that the use of powdered fuel would not replace mechanical stokers, as each filled a separate need. Stokers needed more attention, but ash loss was more readily detected.

He drew attention to the valuable information contained in Mr. Mumford's contribution to the discussion, and would remind Mr. Tuttle that the efficiencies quoted in the paper were obtained in laboratory tests, and should be compared only with results obtained in similar tests.

Discussion on European Engineering Practice in Production, Transmission and Use of Electrical Energy

Discussion of paper presented by A. E. Davison, Transmission Engineer, Hydro-Electric Power Commission of Ontario, before the Annual General Professional Meeting, Toronto, Ont., January 28th, 1926.

Mr. K. H. Smith, M.E.I.C.

Mr. K. H. Smith had read the advance proof of the paper with special interest because of the fact that in 1924 he had covered some of the same territory as that which formed the basis for the author's paper.

With reference to Northern France, the author had remarked that "the towns of the war zone are being restored very slowly indeed". His impression in 1924 was quite the reverse. He had spent three days in the Canadian section of the war zone, and had been impressed with the great progress which had been made in the rebuilding of villages, particularly during the time elapsed since the war. It was true that little or nothing had been done to many non essential or public buildings such as the Cloth Hall in Ypres and the Cathedral in Albert. He agreed with the author that there had been a large amount of temporary overhead construction of a very flimsy character. The same applied to Norway and Sweden where there appeared to be much distribution construction intended as permanent but actually very flimsy according to our standards.

The author had referred to rural distribution and rates in Sweden. The *Electrical World* of July 25th, 1925, contained an interesting and informative article on this subject as to previous costs and new rates. Cost at the so-called tertiary sub-stations at 3,000 volts was shown to be about 3.6 cents per k.w. hr. while the charges to the consumer were 6.7 to 8.75 cents per k.w. hr. in densely populated areas and 12.1 to 13.5 cents in moderately populated districts. New rates consisted of a demand charge based on the area of land served and an energy rate of 1.8 cent per unit. He had been informed that 40 per cent of all the agricultural sections of Sweden were now provided with electrical service. This might, of course, not be inconsistent with the author's statement that 70 per cent of the possible rural customers had been served with distribution lines.

Reference had been made to the need of standardization of frequencies in Europe. Such was undoubtedly the case, particularly in England. This immediately raised the question, why the large Queenston development at Niagara perpetuated a 25 cycle system in the face of the almost universal use of 60 cycles in this country. Possibly the author could without impropriety give us some useful information in this connection.

In two different parts of the paper, the author had referred to reactances, relays and protective devices of one kind or another, with the comment that the tendency is to minimize their use, and he was in agreement with the author's view. In Sweden particularly, he had been constantly impressed with the lack of elaborate protective devices.

He expressed surprise at the statement that aluminum paint was used on galvanized material after it had been in contact with salt-laden atmosphere for five or six years. Having recently carefully examined galvanized structures near Halifax which had been exposed to salt atmosphere for over five years, he had found not the slightest evidence of deterioration. Moreover, similar structures in railway yards at Halifax and subject to smoke as well as salt-laden atmosphere for a somewhat less period, also showed no deterioration. He desired to point out, however, that in this country an excellent job of galvanizing on transmission line material is usually obtained.

The references to the economics of the distribution of electricity raised a question of the greatest importance. He believed that a proper rate structure was one of the most important factors in stimulating electricity consumption as well as in adequately meeting the various requirements of all classes of customers under modern conditions with satisfaction to everyone concerned.

He had seen the Lila Edet development in its thin state of construction in 1924 and the Kaplan water-wheel unit for this development in the shop at Kristinehamn. This was undoubtedly one of the most interesting hydro-electric developments now existing or under construction anywhere. It would have one Kaplan runner with moveable buckets, and two Lawaczech runners, their capacity being somewhat larger than the author had stated, viz.: 11,200 h.p. instead of 10,000 h.p. with a head of 21.25 feet and a speed of 62.5 r.p.m., giving units of tremendous proportions.

On the whole, he would have liked to see the author, with his particular qualifications along this line, discuss the subject at somewhat more length, and, if possible, draw conclusion as to the approved practice in Europe for various types of construction and the conditions governing the selection of these. There were for example, the important questions of overhead and underground distribution, secondary distribution voltage, transmission line supports, insulators, and spacing.

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Retiring President's Address

Delivered by Dr. Arthur Surveyer, M.E.I.C., before the Fortieth Annual General Meeting of The Engineering Institute of Canada, Toronto, Ont., January 27th, 1926.

Members of The Engineering Institute of Canada,
Gentlemen:—

This is the time of the year when bank presidents review the economic conditions which have obtained in Canada during the past year, attempt to predict what we may expect and generally conclude by expressing an optimistic opinion on the future of Canada. I may possibly be pardoned, therefore, if I attempt, in a more modest way, to predict what is in store for the engineers in Canada.

You have all heard of the construction boom which has taken place in the United States during the last few years. In 1919 the construction programme, measured by the value of the contracts let, called for an expenditure of about $3,142,000,000. Last year this figure reached a total of $6,500,000,000. or an expenditure for construction purposes only at the rate of over $54.00 per capita. In the meantime the volume of construction in Canada had risen from about $190,000,000. in 1919, to about $280,000,000. last year, or at the rate of about $33.00 per capita.

In going over the figures published by the Dominion Bureau of Statistics, I was surprised to note that the yearly post-war volume of construction, including residential, business, industrial and engineering, had never reached, even in 1922, the figures of the three pre-war years of 1911, 1912, and 1913, and this, notwithstanding an increase of about 60 per cent in the cost of construction, and notwithstanding the fact that we have had, during the last few years, a number of very large industrial developments which have contributed very materially to the raising of our total figure.

The average yearly volume of construction during the three pre-war years just noted was about $400,000,000. compared with an average yearly expenditure of about $290,000,000. during the last three years. If we reduce this last figure to the pre-war cost of construction we are forced to the conclusion that the volume of construction in the last three years has been less than half of the pre-war figures.

Judging by the fact that our railroad expansion is about completed, that our population has practically stopped increasing, and that necessity will compel us to curtail our public works, it would seem that it will be some years before our construction activities will again reach our actual pre-war figures.

Luckily, the education received by engineers does not, in any way, limit their usefulness to the design or construction of engineering works. Engineers have recently discovered that they are also competent to operate mines and manufactures, to manage cities and public utilities, and, in other words, to fill numerous positions which have hitherto been filled by business men.

Two years ago the National Industrial Conference Board of the United States reported the astonishing finding that there were 750,000 major technical and supervisory positions in the manufacturing and mechanical industries of the United States, and that in 1930 American industry might need 400,000 more, and this without taking into account the necessary replacements.

These figures, of course, cannot be applied bodily to Canadian conditions, but there is no doubt that even in this country there is a rapidly growing need for administrative and technical ability in practically all lines of human activity, especially in the manufacturing industries and in the field of public utilities. It has been observed that the engineering courses have, in the past, succeeded in developing, in a certain measure, these two talents in the best graduates. The training of the engineer, besides, gives him the ability to analyze causes and effects, as well as the faculty of working out in his own mind original solutions of the business or technical problems which he has to solve. Engineers could also be employed more frequently, not only by investment bankers, but even by the banks themselves on question of industrial loans.

In France, where the field of the banks is broader than in Canada, each important bank has its own technical staff, and for an engineer to be in charge of such a department is considered as the crowning of his career.

I remember seeing, some years ago, a report analyzing the occupations of the engineering graduates of Rensselaer, Pennsylvania, Harvard, Lehigh and Stevens Institute. This report showed that 15 years after leaving college, from 35 to 60 per cent of the engineers had risen from purely engineering positions to executive work, and that 25 years after graduation, these percentages had increased to 45 and 72 per cent. It is needless to tell you that the larger salaries are certainly drawn by the engineers who have become administrators, and we are being forced to the somewhat paradoxical conclusion that the crowning of an engineer's career is out of the pure engineering into the executive field.

And why should it not be so? These functions are all implied in our name "engineer", which according to some British authorities does not come from the word "engine", but rather from the Latin verb "ingenere" and from the corresponding French verb "s'ingénier". The import of this word has nothing whatever to do with engines or machines, but is purely psychological and is defined by Littré as follows:

"S'ingénier: Chercher dans son génie, dans son esprit, quelque moyen pour réussir"; or in other words, an engineer is one who sets his mental power in action in order to discover or devise some means of succeeding in a difficult task he may have to perform.

The engineer who wishes, however, to graduate from the designing and supervising field into an executive position must be well informed on all financial matters, and he must remember at all times that all engineering problems are dominated by the financial aspect of the question, and that to forget this truth is to condemn himself to remain for ever what an ex-president of this *Institute*, Mr. R. A. Ross, once called a "glorified slide rule", and with no great chance for advancement. This fact is beginning to be realized by the men in charge of engineering education, and that is why you will note in the various curricula a larger portion of the time being devoted to the teaching of financial subjects, such as economics, accounting, business administration, etc.

Ten or twelve of the leading American engineering schools have gone so far as to create courses in business administration and engineering, which are known as courses in administrative engineering. It is now a recognized truth that all engineering activities are dominated by economical and financial requirements. It is therefore advisable for all engineers who, during their stay at college, did not have the benefit of modern engineering teaching, to devote as much time as possible to the study of financial questions. There is such a thing as obsolescence of knowledge, and the engineer who does not improve continually is very rapidly left behind by his colleagues.

In closing this address, gentlemen, I wish to express my sincere thanks to F. P. Shearwood, M.E.I.C., our Minister of Finance, to Sir Alexander Bertram, M.E.I.C., our honorary treasurer, Fraser S. Keith, M.E.I.C., our ex-secretary, and to R. J. Durley, M.E.I.C., our present secretary, and to all the members of Council, for the quiet and effective way in which they have carried out the work of *The Institute* during my tenure of office as president of *The Engineering Institute of Canada.*

The Fortieth Annual General and General Professional Meeting

Convened at Headquarters, Montreal, January 26th, and adjourned to Toronto, January 27th, 28th and 29th, 1926.

The fortieth annual general meeting of *The Institute* was held at headquarters, on Tuesday, January twenty-sixth, nineteen twenty-six. President Arthur Surveyer, D.Eng., M.E.I.C., took the chair at ten twenty a.m.

Reading of Minutes

The minutes of the thirty-ninth annual general meeting were submitted, and on the motion of J. T. Farmer, M.E.I.C., seconded by O. O. Lefebvre, M.E.I.C., were taken as read, and confirmed.

Appointment of Scrutineers

On the motion of E. A. Ryan, A.M.E.I.C., seconded by J. M. Robertson, M.E.I.C., Messrs. H. Massue, A.M.E.I.C., and J. L. T. Martin, A.M.E.I.C., were appointed scrutineers to report the result of the ballot.

Appointment of Auditors

On the motion of Fraser S. Keith, M.E.I.C., seconded by W. Hamilton Munro, M.E.I.C., Messrs. Riddell, Stead, Graham and Hutchison were appointed auditors for the ensuing year.

Proposal Regarding Date and Time of Annual Meeting

J. L. Busfield, M.E.I.C., drew attention to the inconvenience due to holding the first session of the annual general meeting in the morning, and he suggested that since in accordance with the by-laws this meeting has to be held in Montreal, for the transaction of formal business, and can take place in any date in January selected by Council, it would be advisable to make this date coincide with that of one of the January meetings of the Montreal Branch, and hold an evening meeting, just before or after the Montreal Branch meeting, so that there would be no difficulty in obtaining a quorum.

The president concurred, and thought also that in future it would be well to arrange for the adjourned annual general meeting to be held on some date in February, as the customary time at the end of January had been found to conflict with the annual meetings of a number of other organizations in which our members desire to take part. He thought this matter should be considered when selecting the time for the annual meeting in 1927.

The opinion of the members present appeared to be that the suggested changes in the hour of the first session and in the date of the adjourned meeting, were very desirable, and that the question should be favourably considered by Council.

There being no other formal business, it was resolved, on the motion of G. K. McDougall, M.E.I.C., seconded by F. A. Combe, M.E.I.C., that the meeting should adjourn, to reconvene on Wednesday, January twenty-seventh, at ten a.m., at the King Edward Hotel, Toronto.

The meeting adjourned at ten forty a.m.

Toronto Sessions

The meeting was called to order by President Arthur Surveyer, M.E.I.C., at 10.10 a.m., January 27th, 1926, in the Banquet Hall of the King Edward hotel, Toronto.

Reports of Council and Committees

The report of Council for 1925 was presented and, on the motion of C. H. Rust, M.E.I.C., seconded by F. P. Shearwood, M.E.I.C., the report was approved.

The report of the Library and House Committee was read by O. O. Lefebvre, M.E.I.C., and on the motion of O. O. Lefebvre, M.E.I.C., seconded by W. H. Baltzell, M.E.I.C., the report was approved.

The report of the Finance Committee was read and explained by F. P. Shearwood, M.E.I.C., and, after the auditors' certificate had been read by the president, the report was approved on the motion of F. P. Shearwood, M.E.I.C., seconded by H. A. Lumsden, M.E.I.C.

Amendments to By-laws

During discussion on the report of the Legislation and By-laws Committee, Mr. Doane presented a letter from the Halifax Branch in which attention was drawn to the fact that under section 52 of the by-laws, the secretary-treasurer of the branch is elected, whereas the branch is of opinion that he should be appointed in all cases by the executive committee, and this was, in fact, now required by the Halifax Branch by-laws.

Mr. Busfield agreed that in this respect some of the existing branch by-laws do conflict with the by-laws of *The Institute*, and the procedure of the Ottawa Branch was explained by J. L. Rannie, M.E.I.C., the branch secretary in that case being elected in accordance with *The Institute's* by-law, but only one name being placed upon the ballot paper, this arrangement being, therefore, practically equivalent to nomination by the executive committee of the branch.

A resolution from the Niagara Peninsula Branch was presented recording the objection of that branch to the proposed amended version of section 32 of the by-laws, because it does not specifically require Council to make known the identity of the complainant to the respondent, does not specifically require the complainant to attend an enquiry, and does not state that twenty members may force Council to hold an enquiry.

After further discussion it was resolved on the motion of Duncan MacPherson, M.E.I.C., seconded by C. H. Rust, M.E.I.C., that the report of the Legislation and By-laws Committee be approved, and that the consideration of the question raised regarding the amendment to section 32 of the by-laws be left in the hands of Council, and that in accordance with section 76 of the by-laws, Council send out with the letter ballot for the proposed amendments, a statement of the reasons pro and con.

On the motion of J. L. Busfield, M.E.I.C., seconded by C. K. MacLeod, A.M.E.I.C., it was resolved that Council be requested to appoint a special committee to co-ordinate the existing branch by-laws with those of *The Institute.*

On the motion of R. W. Downie, A.M.E.I.C., seconded by J. L. Busfield, M.E.I.C., the reports of the Engineering Sections Committee, Papers Committee, Nominating Committee, and Committee on Code of Ethics, were approved.

The president read the reports of the Gzowski Medal Committee, Students' Prizes Committee, Leonard Medal Committee, and Plummer Medal Committee. Attention was drawn to the small number of papers for Students' prizes submitted from points other than Montreal, and Major Walkem suggested that more publicity should be given to these prizes, and that a statement of the conditions governing the Students' Prizes should be forwarded in good time to the Deans of the engineering schools of the various universities. This was approved, and on the motion of Major Geo. A. Walkem, M.E.I.C., seconded by G. G. Murdoch, M.E.I.C., the above named four reports were approved.

P. Burke-Gaffney, A.M.E.I.C., said that he had been delegated by the Winnipeg Branch to urge upon the meeting the desirability of publishing transactions in addition to *The Journal.* He enquired whether a circular letter could be sent out to all members to ascertain how many of them would be willing to pay an additional subscription of from $1.00 to $3.00 to cover the expense of publishing transactions.

After discussion it was moved by Prof. C. R. Young, M.E.I.C., seconded by P. Burke-Gaffney, A.M.E.I.C., and unanimously resolved that Council be urged to take such measures as will enable the publication of transactions to be resumed.

The reports of the Canadian Engineering Standards Committee, the Committee on Deterioration of Concrete in Alkali Soils, the Committee on Biographies, and the Committee on International Co-operation were read and approved.

In connection with the report of the Honour Roll and War Trophies Committee, the President drew attention to the appeal which is being sent out to the membership for the necessary contributions to complete the work. The report of this committee was approved.

The reports of the four following committees were approved, on the motion of J. A. Bernier, A.M.E.I.C., seconded by W. H. Baltzell, M.E.I.C.:—

Fuel Committee;

Committee on Engineering Education;

Canadian National Committee of the International Electrotechnical Committee;

Board of Examiners and Education Committee.

Branch Reports

The reports of the following branches were unanimously approved, the movers and seconders of the resolutions being as follows:

Branch	*Moved by*	*Seconded by*
Border Cities	J. Clark Keith, A.M.E.I.C.	W. H. Baltzell, M.E.I.C.
Calgary	B. L. Thorne, M.E.I.C.	P. Turner Bone, M.E.I.C.
Cape Breton	H. W. L. Doane, M.E.I.C.	O. O. Lefebvre, M.E.I.C.
Edmonton	J. M. Oxley, M.E.I.C.	B. L. Thorne, M.E.I.C.
Halifax	H. W. L. Doane, M.E.I.C.	O. O. Lefebvre, M.E.I.C.
Hamilton	C. Harvey, A.M.E.I.C.	H. A. Lumsden, M.E.I.C.
Kingston	R. J. McClelland, A.M.E.I.C.	L. M. Arkley, M.E.I.C.
Lakehead	H. J. Lamb, M.E.I.C.	O. O. Lefebvre, M.E.I.C.
Lethbridge	B. L. Thorne, M.E.I.C.	P. Turner Bone, M.E.I.C.
London	H D. Lumsden, M.E.I.C.	J. Clark Keith, A.M.E.I.C.
Moncton	John Stephens, M.E.I.C.	J. A. Bernier, A.M.E.I.C.
Montreal	J. L. Busfield, M.E.I.C.	C. K. McLeod, A.M.E.I.C.
Niagara Peninsula	R. W. Downie, A.M.E.I.C.	W. J. Johnston, A.M.E.I.C.
Ottawa	J. L. Rannie, M.E.I.C.	J. A. Knight, A.M.E.I.C.
Peterborough	A. L. Killaly, A.M.E.I.C.	Geo. Coutts, A.M.E.I.C.
Quebec	O. O. Lefebvre, M.E.I.C.	C. R. Young, M.E.I.C.
St. John	G. G. Murdock, M.E.I.C.	John Stephens, M.E.I.C.
Saguenay	O. O. Lefebvre, M.E.I.C.	C. R. Young, M.E.I.C.
Sault Ste. Marie	A. E. Pickering, M.E.I.C.	F. P. Shearwood, M.E.I.C.
Saskatchewan	L. W. Gill, M.E.I.C.	L. W. Wynne-Roberts, A.M.E.I.C.
Toronto	T. R. Loudon, M.E.I.C.	C. R. Young, M.E.I.C.
Vancouver	Geo. A. Walkem, M.E.I.C.	C. H. Rust, M.E.I.C.
Victoria	Geo. A. Walkem, M.E.I.C.	C. H. Rust, M.E.I.C.
Winnipeg	J. W. Sanger, A.M.E.I.C.	P. Burke-Gaffney, A.M.E.I.C.

J. W. Sanger, A.M.E.I.C., stated that he was requested by the Winnipeg Branch to urge upon the meeting the desirability of arranging each year for one meeting of Council to which Councillors from all branches would have their expenses paid. The president said that this proposal had been debated by Council on many occasions, and had been approved, as it was considered a most important and desirable event. The cost, however, estimated at some $2,000., could not at present be met out of funds at the Council's disposal.

F. P. Shearwood, M.E.I.C., as Chairman of the Finance Committee, concurred with the president, and was of the opinion that this and other important objects referred to in the Finance Committee's report could only be attained if the membership is willing to agree to an increase in the annual fee.

After further discussion, on the motion of J. W. Sanger, A.M.E.I.C., seconded by P. Burke-Gaffney, A.M.E.I.C., it was unanimously resolved that Council be asked to consider the possibility of arranging for one meeting a year, preferably in Montreal, to which the expenses of all councillors will be paid.

The meeting adjourned at 11.45 a.m., to reconvene at 2.30 p.m.

On reassembling, the retiring president, Dr. Arthur Surveyer, M.E.I.C., delivered his valedictory address. This appears in full in this issue of *The Journal.*

On the conclusion of his address the president announced that he had pleasure in taking advantage of this opportunity to present to the officers of the Toronto Branch the Charter authorizing the formation of that branch.

On the Charter would be found the names of a number of the oldest members of *The Institute*, of whom he believed only one, C. H. Rust, M.E.I.C., was present at the meeting. He asked Prof. T. R. Loudon, M.E.I.C., chairman of the Toronto Branch, to take charge of the Charter, which was the visible expression of the authority granted by *The Institute* for the establishment and operation of the branch. The Charter was accepted and fittingly acknowledged by Prof. Loudon on behalf of the Toronto Branch.

Scrutineers Report

The president read the report of the scrutineers announcing the election of officers as follows:—

President	George A. Walkem, M.E.I.C.
Vice-Presidents:	
Zone B	Peter Gillespie, M.E.I.C.
Zone C	W. G. Mitchell, M.E.I.C.
Zone D	Geo. D. Macdougall, M.E.I.C.
Councillors:	
Victoria Branch District	F. C. Green, M.E.I.C.
Vancouver Branch District	James Muirhead, M.E.I.C.
Lethbridge Branch District	John Dow, M.E.I.C.
Calgary Branch District	R. S. Trowsdale, A.M.E.I.C.
Edmonton Branch District	A. W. Haddow, A.M.E.I.C.
Saskatchewan Branch District	H. R. Mackenzie, A.M.E.I.C.
Winnipeg Branch District	D. L. McLean, A.M.E.I.C.
Lakehead Branch District	G. H. Burbidge, M.E.I.C.
Sault Ste. Marie Branch District	C. H. E. Rounthwaite, A.M.E.I.C.
Border Cities Branch District	J. E. Porter, A.M.E.I.C.
London Branch District	E. V. Buchanan, M.E.I.C.
Niagara Peninsula Branch District	T. S. Scott, M.E.I.C.
Hamilton Branch District	W. F. McLaren, M.E.I.C.
Toronto Branch District	J. M. Oxley, M.E.I.C.
Peterborough Branch District	R. L. Dobbin, M.E.I.C.
Ottawa Branch District	O. S. Finnie, M.E.I.C.
	J. L. Rannie, M.E.I.C.
Kingston Branch District	L. M. Arkley, M.E.I.C.
Montreal Branch District	J. L. Busfield, M.E.I.C.
	C. M. McKergow, M.E.I.C.
Quebec Branch District	A. B. Normandin, M.E.I.C.
Saguenay Branch District	E. Lavoie, M.E.I.C. } Tie
	G. F. Layne, A.M.E.I.C. }
Moncton Branch District	F. O. Condon, M.E.I.C.
St. John Branch District	A. G. Tapley, A.M.E.I.C.
Halifax Branch District	C. H. Wright, M.E.I.C.
Cape Breton Branch District	W. C. Risley, M.E.I.C.

President Surveyer drew attention to the fact that in the election of a councillor for the Saguenay Branch, a tie had occurred between Messrs. E. Lavoie, M.E.I.C., and G. F. Layne, A.M.E.I.C. On motion of Brig.-Gen. C. H. Mitchell, M.E.I.C., seconded by Duncan MacPherson, M.E.I.C., it was resolved that E. Lavoie, M.E.I.C., be elected as councillor from the Saguenay Branch.

On the motion of Major Geo. A. Walkem, M.E.I.C., seconded by C. K. McLeod, A.M.E.I.C., it was resolved to convey to the scrutineers a vote of thanks for the efficient manner in which they carried out their duties on the previous day in Montreal.

The president next requested C. H. Rust, M.E.I.C., to conduct the incoming president to the chair, and briefly welcomed his successor in the presidency of *The Engineering Institute of Canada.*

The newly-elected president, Major Geo. A. Walkem, M.E.I.C., of Vancouver, accordingly took the chair, and expressed the pleasure which he experienced in being so heartily welcomed, and particularly in being conducted to the chair by such an old friend as Mr. Rust, a Charter Member of *The Institute.*

President Walkem was of the opinion that the important problems before *The Institute* at the present time are:—First, how to take care of the students and young graduates entering the profession, particularly with reference to retaining their services in Canada, and, secondly, to find the best methods of co-operation between *The Institute* and the seven provincial associations of professional engineers. He expected that light would be thrown on this question at the forthcoming conference to be held next week in Montreal. He was particularly glad to note an increasing tendency on the part of the members of *The Institute* to take part in public life and interest themselves in civic activities. He desired to congratulate the Toronto Branch on the admirable arrangements made for the conduct of the present meeting, and thought that the members present might fittingly pass a vote of thanks embodying such congratulations.

On the motion of T. S. Scott, M.E.I.C., seconded by J. L. Busfield, M.E.I.C., it was unanimously resolved that the secretary convey to the officers and members of the Toronto Branch the thanks and congratulations of *The Institute* on the occasion of the Fortieth Annual General Meeting, expressing gratitude for the trouble they have taken, and appreciation of the success which has attended their efforts. The resolution was suitably acknowledged by Prof. T. R. Loudon, M.E.I.C., on behalf of Prof. C. R. Young, M.E.I.C., the chairman of the Meetings Committee of the Toronto Branch, and his committee.

There being no other business, the meeting adjourned at 4 p.m.

OBITUARIES

Phelps Johnson, M.E.I.C.

With the death of Phelps Johnson, LL.D., M.E.I.C., which occurred at the Royal Victoria Hospital, Montreal, on February 20th, 1926, *The Institute* has lost one of its outstanding members and one who, through his engineering achievements, became internationally known and honoured and has been recognized as one of the outstanding engineers of this continent.

The late Mr. Johnson was born at Warwick, Orange County, N.Y., on October 23rd, 1849. He was educated in the public schools of Springfield, Mass., and Goldthwaite's Private School, Longmeadow, Mass. He began his engineering career in Springfield where from March 1867 until December 1878 he was engaged as draughtsman and engineer with R. F. Hawkins Iron Works. In 1879 and during the succeeding three years he was assistant engineer with the Wrought Iron Bridge Company at Canton, Ohio.

In February of 1882 he came to Canada and joined the Toronto Bridge Company at Toronto, Ont. In May 1883 he was appointed manager and engineer in charge of the Toronto works of the Dominion Bridge Company Limited, succeeding in June 1888 to the post of chief engineer of the company at Montreal. From 1892 to 1904 he was general manager of that company and from 1904-19 general manager and chief engineer; from 1910-13 he was managing director and from 1913-19 he was president. During the years 1911-20, and during the construction of the Quebec bridge, he was president and general manager of the St. Lawrence Bridge Company Limited. Two years previously he was called in as one of the four experts to advise the Quebec Bridge Commission as to the character of piers, construction, etc., in connection with the structure. The history of this construction is well known to all engineers and it remains one of the outstanding engineering accomplishments of the world. Mr. Johnson had nothing to do with the first undertaking which ended so disastrously, but was connected with the existing structure, which was crowned with such signal success.

PHELPS JOHNSON, M.E.I.C.

Mr. Johnson was elected Member of *The Engineering Institute of Canada*, then the Canadian Society of Civil Engineers, on April 20th, 1893. He was a member of Council during the years 1904-6 inclusive, and the following year, 1907, was elected vice-president. He was again elected a member of Council during the years 1910-12 inclusive, and in 1913 he became president. In 1921 the honorary degree of LL.D. was conferred upon Mr. Johnson by McGill University.

Herbert M. Burwell, M.E.I.C.

It is with sincere regret that we record the death of Herbert M. Burwell, M.E.I.C., which occurred at Vancouver, B.C., on July 25th, 1925. The late Mr. Burwell was born at Port Talbot, Ont., on October 23rd, 1863. He received his early engineering education from private tutors and practised in British Columbia continuously since 1887. From March 1902-1906 he was engineer in charge of construction of the Vancouver Power Company's Hydro-Electric Power development at Lake Buntzen, B.C. In April 1906 he was consulting engineer and in charge of construction of Vancouver water works system. He was also consulting engineer for the city of New Westminster, B.C. water works, and has continued in consulting practice in Vancouver up till the time of his death.

Among his earlier works are the following: design and construction of the Lake Buntzen concrete dam and the Coquitlam Lake rock-filled timber crib dam; construction of the Lake Buntzen pipe line and power house; construction of the westerly half of Coquitlam tunnel, a total length of two and a half miles; extension of Capilano water works system, Vancouver, B.C.; and design and construction of Seymour Creek water works system.

The late Mr. Burwell was elected a Member of *The Engineering Institute of Canada*, then the Canadian Society of Civil Engineers, on January 8th, 1910, and was a councillor of *The Institute* during the years 1920-22 inclusive.

Joseph Arthur Henri Marchand, A.M.E.I.C.

Regret is expressed at the news of the death of Joseph Arthur Henri Marchand, A.M.E.I.C., which occurred after a long illness on December 12th, 1925.

The late Mr. Marchand was for many years connected with the Department of Public Works of Canada and at the time of his death was assistant engineer at the Montreal office of the department. He was a graduate of the Ecole Polytechnique, having received his degree of B.A.Sc. in May 1910. Before joining the staff of the Department of Public Works in March 1913, he had been engaged for two years in making preliminary surveys and construction of the Roberval-Saguenay Railway and Ha-ha Bay Railway in the Saguenay district. Prior to that he had been engaged on lake and railway surveys on the upper St. Maurice Valley.

PERSONALS

A. G. Graham, A.M.E.I.C., who was previously located at Gold Coast Colony, B.W.A., is now assistant engineer in the municipal engineer's office at Point Gray, B.C.

C. R. Bown, Jr.E.I.C., who has been located at Fall River with Messrs. Stone and Webster, Inc., has been transferred to Beaumont, Texas, on the construction of the power station in that city.

J. G. Campbell, A.M.E.I.C., has severed his connections with the Hamilton Bridge Company Limited, and has accepted a position in the draughting department of the Canadian Bridge Company, Limited, at Walkerville, Ont.

G. W. Coward, A.M.E.I.C., has been appointed assistant to the chief engineer of the joint North-East Argentine and Entre Rios Railway Companies at Concordia, Entre Rios, Argentina.

E. E. Lord, A.M.E.I.C., who has been in Vancouver, B.C., on leave for some six or seven months, has returned to Newchwang, N. China, where he is assistant engineer on the Lower Liao River Conservancy.

T. B. Fraser, S.E.I.C., has been appointed to the staff of the Forestry Engineering Branch of the Wayagamack Pulp and Paper Company, Limited, at Three Rivers, Que. Mr. Fraser has for the past two years been with Messrs. Sutcliffe Company Limited, at New Liskeard.

E. K. Macnutt, S.E.I.C., who graduated from McGill University in 1924 and subsequently with the E. B. Eddy Company Limited, Hull, Que., has accepted a position with the Port Alfred Pulp and Paper Corporation, Port Alfred, Que.

John Paris, A.M.E.I.C., who graduated from the University of Toronto, 1924, is resident engineer with the Northern Development Branch of the Department of Lands and Forests on the North Bay-Cobalt road, in charge of residency No. 2, twenty-five miles north of North Bay.

R. S. Baker, A.M.E.I.C., is located at Smooth Rock Falls, Ont., with the Mattagami Pulp and Paper Company, Limited, on the construction of a hundred-ton bleaching plant for the company. During 1924 and 1925 Mr. Baker was with the Riordon Pulp Corporation at Temiskaming, Que.

Arthur Donaldson, Jr.E.I.C., who graduated from the University of Alberta in 1922, is at present with the Burns McDonnell Engineering Co., consulting engineers, Los Angeles, California, as supervising engineer on construction and design in connection with waterworks and sewerage systems.

E. L. Zealand, Jr.E.I.C., has been appointed to the engineering staff of the Aluminum Company of Canada, Limited, Arvida, Que. Mr. Zealand is a graduate of the University of Toronto of the class of 1922, and has been junior engineer on dam and power house construction with the Quebec Development Company at St. Joseph d'Alma, Que., since 1923.

A. W. Swan, A.M.E.I.C., former assistant editor of *The Engineering Journal*, who resigned to return to England in the early part of 1922, and who is at present advertising manager for Evershed & Vignoles, Ltd., Chiswick, London, has been awarded the £50 prize offered by the *Electrical Review* (London) for the best series of six half-page advertisements in that journal for the latter half of 1925.

R. H. N. Lockyer, A.M.E.I.C., formerly assistant superintendent, West Kootenay Power and Light Company's generating stations at Bonnington Falls, B.C., is now in the employ of the Southern California Edison Company on their Big Creek system operating four hydro-electric plants with a combined capacity of 250,000 h.p. and transmitting their power at 220,000 volts.

George P. MacLaren, A.M.E.I.C., formerly engineer maintenance-of-way of the Central Region of the Canadian National Railways, Toronto, has been appointed general tie and timber agent of Canadian National Railways with headquarters at Montreal, succeeding W. H. Grant, who has been granted leave of absence pending retirement after many years of service with the company. Mr. MacLaren served overseas as captain and major with the 10th Canadian Railway Troops.

Roy A. Crysler, A.M.E.I.C., is designing engineer with Messrs. Chapman and Oxley, engineers and architects, Toronto. Mr. Crysler is a graduate of the University of Toronto of the year 1920, and following graduation he was engineer and surveyor with the Town Planning Commission of Niagara Falls, Ont. Later in the same year he joined the staff of the Hydro-Electric Power Commission of Ontario and was located at Niagara Falls. In April 1922 he was appointed engineer with the reinforced concrete branch of the City Architect's Department, Toronto, Ont.

P. E. Cooper, Jr.E.I.C., who for the past three years has been with the Singer Manufacturing Company, has accepted a position with the Canadian International Paper Company, and is engaged on the new construction work now in progress at East Templeton, Que. Mr. Cooper was topographical engineer in charge of surveys on the Singer Manufacturing Company's limits north of Ottawa and later as location engineer in connection with the location of thirty miles of standard gauge railroad in the vicinity of Thurso, Que., and still later as office engineer for the company in connection with the railway and Thurso works construction. He graduated from McGill University in the class of 1923 and had considerable general engineering experience prior to graduation.

F. S. Lazier, M.E.I.C., Enters Private Practice

F. S. Lazier, M.E.I.C., of Thorold, Ont., has resigned as division engineer of the Welland ship canal, and is entering private practice with headquarters at Toronto. Mr. Lazier is a graduate of Queen's University of the

F. S. LAZIER, M.E.I.C.

year 1907. Following graduation Mr. Lazier was engaged on the surveying and construction of the Trent canal, first as instrumentman and later as assistant engineer until April 1908. During the summer of 1908 he was engaged on survey and construction work for National Transcontinental Railway and in November of that year again joined the staff on the construction of the Trent canal as assistant engineer. Two years later he was division engineer of Rice Lake division of the Trent canal and in July 1913 was appointed division engineer on the surveys, design and construction of the Severn division, on which he was engaged until July 1918, when he was appointed engineer-in-charge on power survey of the St. Lawrence river for the Hydro-Electric Power Commission of Ontario. In March 1919 Mr. Lazier was appointed resident engineer on the construction and survey of sections 3 and 4 of the Welland ship canal.

A. G. Tapley, a.m.e.i.c., awarded Gzowski Medal

A. G. Tapley, a.m.e.i.c., who was recently awarded the Gzowski Medal for his paper entitled "Concrete in Sea Water", published in the November 1924 issue of *The Journal*, and who was also recently elected Councillor representing the Saint John Branch, is a native of Saint John, N.B., where he was born in 1880. He received his early education at Fredericton High School and Fredericton Business College, followed by a course with the International Correspondence Schools. His early engineering work was with the Intercolonial Railway with which he became connected in 1898, and between that date and August 1905 he occupied the positions of draughtsman, transitman and engineer in charge of construction. During the following two years he was with the National Transcontinental Railway as leveller, draughtsman, instrumentman and resident engineer. During 1908 he again became connected with the Intercolonial Railway. From 1909 until the present time he has been with the Department of Public Works of Canada as assistant engineer, located in Saint John, N.B.

A. G. TAPLEY, A.M.E.I.C.

He was a member of the executive of the Saint John Branch in 1921 and chairman in 1922, continuing as a member of the executive in the following year.

Max. V. Sauer, m.e.i.c., receives Appointment

Max V. Sauer, m.e.i.c., formerly hydraulic engineer for Canadian Vickers Limited, Montreal, is vice-president of the William Hamilton, Limited, Peterborough, Ont. Previous to joining the staff of the Canadian Vickers Limited, Mr. Sauer was with the engineering department of the Hydro-Electric Power Commission of Ontario. He is a graduate of the School of Practical Science, University of Toronto, of the class of 1901 and took a post-graduate course in 1902, receiving a fellowship in 1903. After his university course he was with the Ontario Power Company at Niagara Falls, first as draughtsman and the following year as assistant to the mechanical engineer. He was appointed chief designer of the Niagara Falls Power Company, Niagara Falls, N.Y., in 1905, and the following year was construction engineer to the Iroquois Construction Company, Buffalo, N.Y. In 1907 he again became associated with the Ontario Power Company as chief designer, then as mechanical assistant to the engineer-in-charge, and subsequently in 1912 as mechanical engineer in full charge of design, field, and inspection department.

MAX V. SAUER, M.E.I.C.

James Blain Woodyatt, a.m.e.i.c., becomes President of Southern Canada Power Company

James Blain Woodyatt, a.m.e.i.c., has been appointed president of the Southern Canada Power Company, Montreal. Mr. Woodyatt was born at Brantford, Ont., on July 2nd, 1886, and after graduating from McGill University in 1904, he was engaged in his first engineering work as chainman with the Niagara and Welland Power Company. The following year he was topographer with the Toronto and Hamilton Railway. Between the years 1906-8 he was with the Canadian Westinghouse Company Limited at Hamilton, Ont., as engineering apprentice and in 1909 he assisted in carrying out investigations on the flow of ice in the St. Lawrence river and in the gulf on behalf of the government. During 1909-10 he was on the sales staff of Allis-Chalmers-Bullock Limited, in Montreal, after which he was appointed superintendent of power with the Sherbrooke Railway and Power Company, Sherbrooke, Que. In this capacity he was with the company until 1913 when he became general superintendent of the Southern Canada Power Company. In 1916 he was appointed general manager of this company and in 1920 vice-president and with his appointment as president of the company at the present time, he retains the position of general manager.

Mr. Woodyatt is connected in an executive capacity with a large number of power companies including the following: Ottawa-Montreal Power Company, Ottawa-Hull Power Company, Ottawa-Hull River Power Company, Northern Canada Power Company, East Kootenay Power Company, Power Corporation of Canada, Dominion Power and Transmission Company, Winnipeg Electric Company, Manitoba Power Company. He is also vice-president of the Canadian Electrical Association.

J. B. WOODYATT, A.M.E.I.C.

Charles Warnock, A.M.E.I.C., Heads New Inspection Company

Chas. Warnock, A.M.E.I.C., formerly president of the Robert W. Hunt and Company Limited, is president of the newly incorporated firm of Chas. Warnock and Company, Limited, Montreal, specializing in the inspection of railway materials, structures, and pulp and paper mill equipment.

Mr. Warnock was born at Fort William, Ont., when it was then called Prince Albert's Landing, on November 9th, 1875. He was educated at Lake Forest University, Forest, Ill., and subsequently was employed with the Illinois Steel Company and other metallurgical firms for a period of eight years. In 1902 he joined the staff of the Robert W. Hunt and Company in the United States and in the following year was sent to Montreal as the company's Canadian representative, opening an office for the company in Montreal and becoming manager of the same. Subsequently, he became vice-president and general manager of the Robert W. Hunt and Company, Limited, following the death of Thomas Irving, and in 1923 after the death of Captain Hunt, Mr. Warnock was elected president of the company. Associated with Mr. Warnock in the new company will be Mr. H. W. Greene, until recently secretary of the Robert W. Hunt and Company Limited, and now vice-president and treasurer of the newly organized company. The foreign interests of the new company will be represented by R. H. Laverie and Sons Inc., of New York City.

President of Ontario's Association of Professional Engineers

Lt.-Col. H. J. Lamb, M.E.I.C., was recently elected president of the Association of Professional Engineers of Ontario. Col. Lamb graduated from the Royal Military College, Kingston, Ont., in 1893, and was subsequently engaged on geological surveys and railway surveys as assistant engineer. His early engineering work included the construction of the street railway of the city of

LT.-COL. H. J. LAMB, M.E.I.C.

Quebec and the erection of steel bridges and masonry substructures for Canadian Pacific Railway. In 1897 he was appointed section engineer on construction of the Crow's Nest Pass Railway for the C.P.R., and was made assistant engineer, maintenance-of-way, on the western division of the C.P.R. the following year. He joined the staff of the Department of Public Works of Canada in 1901 as assistant engineer on construction and maintenance of harbours and rivers. He was promoted to district engineer in charge of harbours and rivers in west of Canada in 1905. From 1909-12 he was engineer in charge representing the Dominion Government on the construction of the Detroit River Tunnel.

His service during the Great War dates from the first days of hostilities and he served throughout as general staff officer at headquarters, 1st and 3rd divisions and also as assistant director on the Air Ministry in London. Col. Lamb was twice mentioned in despatches and was awarded the D.S.O. for conspicuous gallantry during operations in the field. On returning to Canada in 1919 Col. Lamb was appointed supervising district engineer for the Department of Public Works for the Province of Ontario.

G. G. Mills, A.M.E.I.C., Receives Appointment

G. G. Mills, A.M.E.I.C., has been appointed Toronto manager of the Babcock-Wilcox and Goldie-McCulloch Company, Limited, succeeding the late Wm. McKay, who died at his home in Toronto on January 30th, 1926. Mr. Mills was born in Winnipeg, Man., in 1887, and received his primary education at the public and high schools of Toronto and graduated from the School of Practical Science, University of Toronto, with the degree of B.A.Sc. in 1907. From that date until the outbreak of the World War he was engaged in engineering in Canada, the United States and Mexico. He served overseas with the Canadian Artillery and at the conclusion of hostilities was in charge of the vocational department of the province of Quebec. Mr. Mills was appointed manager of the Underfeed Stoker Company of Canada in June 1920, a position he held until the amalgamation of that concern with the Riley Engineering Company on January 1st, 1925, when he became manager and vice-president of the

G. G. MILLS, A.M.E.I.C.

new company, the Riley Engineering and Supply Company. He joined the Babcock-Wilcox and Goldie-McCulloch Company in September 1925. Associated with Mr. Mills in the Toronto office is W. A. Osbourne, who, prior to joining the staff of the Babcock-Wilcox and Goldie-McCulloch Company Limited, at Galt, Ont., was with the Hydro-Electric Power Commission of Ontario on the Chippawa development.

Studies of Bond Between Concrete and Steel

"Studies of Bond between Concrete and Steel" by Professor Duff A. Abrams, M.E.I.C., has just been published as Bulletin 17 of the Structural Materials Research Laboratory, Lewis Institute, Chicago. The report is reprinted from the 1925 Proceedings of the American Society for Testing Materials.

Bond tests were made by applying a pull on one end of 1-in. plain round steel bars embedded axially in 8- by 8-in. concrete cylinders; parallel compression tests were made on 6- by 12-in. concrete cylinders. The concrete covered a wide range in quantity of mixing water, cement and size and grading of aggregate. Tests were made at ages of 7 days to 1 year; 735 pull-out bond tests and 735 parallel compression tests were made.

Conference of Delegates from Provincial Associations of Professional Engineers

A conference of delegates from the seven provincial bodies of professional engineers of Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario and Quebec, was held at the rooms of *The Engineering Institute of Canada*, 176 Mansfield Street, Montreal, on February 2nd, 3rd and 4th, 1926.

The delegates were as follows:—

Messrs. B. L. Thorne, Calgary, and R. J. Gibb, Edmonton, Alberta.
Major Geo. A. Walkem and Mr. E. A. Wheatley, Vancouver, B.C.
Messrs. J. W. Sanger and P. Burke-Gaffney, Winnipeg, Man.
Messrs. D. W. Robb, Amherst, and H. W. L. Doane, Halifax, N.S.
Mr. Alex Gray, St. John, and Prof. E. O. Turner, Fredericton, N.B.
Col. H. J. Lamb, Prof. H. E. T. Haultain and Mr. F. R. Ewart, Toronto, Ont.
Messrs. A. R. Décary, Quebec, and Frederick B. Brown, Montreal, Que.

The conference assembled at ten o'clock on Tuesday morning, February 2nd, and were welcomed by Dr. R. A. Ross, one of the past presidents of *The Institute.*

After a few felicitous words, in which he welcomed the members, Dr. Ross retired; the business of the meeting then commenced; Mr. A. R. Décary was elected chairman for the day, and Mr. E. A. Wheatley secretary for the conference.

Meetings were held morning, afternoon and evening during the three days, and many important points were discussed. On Tuesday, February 2nd, Mr. A. R. Décary was chairman, while on Wednesday and Thursday Professor H. E. T. Haultain and Mr. Frederick B. Brown, respectively, occupied the chair.

The discussion and exchange of ideas proved very valuable to the delegates under the following heads:—

1. Benefits to the Public and to the Engineer arising from Regulation of the Profession.
2. Definitions of Engineer and Engineering.
3. Standards Required for Admission to Practise.
4. Methods of Admission to the Profession.
5. Methods of Internal and External Administration of Engineering Acts.
6. Standards of Remuneration for Professional Engineers.
7. Code of Ethics.
8. Reciprocal Courtesies between Professional Engineering Bodies.
9. Temporary Licenses between Provinces.
10. Transfer of Membership between Provinces.
11. Temporary licenses for Foreign Engineers.
12. Membership of Foreign Engineers.
13. The Story of the Provincial Bodies, — History, present status and outlook.
14. Methods of Co-operation between Professional Engineering Bodies.
15. Features of Activities which help the prestige and influence of the Profession.
16. Moulding Public Opinion.
17. The Education of the Engineer and the Public in regard to the importance of Engineering and The Engineering Acts.
18. The need for Engineers in Public Life.
19. The Co-ordination of Provincial Activities through a central Clearing House.
20. Registered Pupils and Engineers-in-Training.
21. The Desirability of the Use of a Seal for Engineering Documents.
22. The Desirability of the Classification of Engineers into Main Divisions or Branches of Engineering.
23. The Systematic Watching of Federal and Provincial Acts where the interests of the Engineering Profession are concerned.
24. General Welfare.
25. Co-operation with *The Engineering Institute of Canada.*

The delegates made a number of recommendations to be submitted to the Council of each provincial body. It was unanimously felt that the conference had proved valuable, not only for the discussion it produced, but also since it gave much needed personal contact, and the delegates left Montreal with a sense of good fellowship and co-operation which was expressed in the following resolution:—

"Resolved that the Delegates of the Associations, or Corporation, of Professional Engineers of Alberta, British Columbia, Manitoba, New Brunswick, Nova Scotia, Ontario and Quebec desire to express to *The Engineering Institute of Canada* their most grateful thanks and hearty appreciation for its courtesy and thoughtfulness in convening this meeting of Delegates, held on February 2nd, 3rd and 4th, 1926, at the headquarters of *The Institute*, 176 Mansfield Street, Montreal, Quebec, and at which a great many valuable and interesting discussions took place, and further, that the Delegates express to *The Institute* their feeling that the seven provincial bodies of professional engineers here represented desire to co-operate with *The Institute* in everything which will advance the interests of the profession and that the delegates will take back to their respective bodies the sense of good fellowship and close association developed and strengthened by this conference.

"It Was Further Resolved that special appreciation should be expressed for the hospitality of *The Institute* at hotel, club and headquarters in so kindly providing such excellent accommodation in every respect."

ELECTIONS AND TRANSFERS

At the meeting of Council held on January 27th, 1926, the following elections and transfers were effected:

Members

ALLCUTT, Edgar Alfred, B.Sc., M.Sc., (Birmingham Univ.), associate professor of mechanical engineering, University of Toronto, Toronto, Ont.

TEAZE, Moses Hay, B.Sc. (Worcester Polytech. Inst.), project engr., with H. S. Ferguson, M.E.I.C., consltg. engr., New York, N.Y.

Associate Members

ASHWORTH, John Kershaw, designing and sales engr. for Canada, Jones & Glassco Regd. (for the Coventry Chain Co. Ltd., Coventry, England), St. Nicholas Building, Montreal, Que.

CARR, David Leonard, cable sales specialist, Northern Electric Co. Ltd., Montreal, Que.

DUBE, Wilbrod, B.A.Sc., C.E., (Ecole Polytech.), in office of Tanguay & Chenevert, Archts., Quebec, Que.

QUIGLEY, Daniel Hugh, manager, North American Collieries, Coalhurst, Alta.

SPENCE, John James, Diploma, (Univ. of Tor.), demonstrator, Faculty of Applied Science, University of Toronto, Toronto, Ont.

Juniors

ARTHUR, Harold Franklyn, B.Sc. (N.S. Tech. Coll.), asst. to chief elect'l. engr., British Empire Steel Corpn., Glace Bay, N.S.

JOHNSTON, Harry Lloyd, Jr., B.C.L.S., 851 University Street, Montreal, Que.

NENNIGER, Emile, design and preparation of plans, office of Dr. Arthur Surveyer, M.E.I.C., Montreal, Que.

ROSE, Alexander Andrew, B.A.Sc. (Univ. of Tor.), instructor, mechanical drawing and mathematics, Sault Ste. Marie Technical School, Sault Ste. Marie, Ont.

Affiliates

HATFIELD, Hubert A., maritime representative, Babcock-Wilcox & Goldie-McCulloch, Ltd., New Glasgow, N.S.

McDONALD, Alexander, chief inspr., steam locomotives, with supervision over design and specifications, Dominion Steel Corpn., Sydney, N.S.

McMANUS, Michael Howard, contractor, Halifax, N.S.

WATT, John Gordon, engrg. dept., Northern Foundry & Machine Co., Sault Ste. Marie, Ont.

Transferred from the class of Associate Member to that of Member

MORRISON, George, dist. mgr., maritime provinces, English Electric Co. of Canada, Ltd., Sydney, N.S.

ROUSSEAU, Théodore E., B.A.Sc., C.E. (Laval Univ.), chief engr. and gen. mgr., T. E. Rousseau Ltd., engrs. and contractors, Quebec, Que.

STEPHENS, George Leslie, Engr. Lieut.-Commdr., R.C.N., engr. officer, Esquimalt Naval Base and consltg. engr., H.M.C. Dockyard, Esquimalt, B.C.

WYNN, Guy Montague, 2nd vice-president and director, T. Pringle & Sons, Ltd., Industrial Engineers, Montreal, Que.

Transferred from the class of Junior to that of Associate Member

ARDAGH, Sydney Vernon, asst. engr., S.P.R.R. Co. of Mexico, Empalme, Sonora, Mexico.

ROBINSON, William Cecil Elwood, transitman, operating dept., C.P.R., Toronto Terminals, Toronto, Ont.

ROY, Eugène, B.Sc., C.E., (Ecole Polytech.), asst. city engr., City of Outremont, Que.

TEMPEST, Frank, Imperial Oil Refineries, Calgary, Alta.

Transferred from the class of Student to that of Associate Member

ASKIN, Robert James, B.Sc. (Queen's Univ.), engr. in charge of mill efficiency, etc., Fort William Paper Co., Fort William, Ont.

BALL, Francis Caldwell, B.A.Sc. (Univ. of Tor.), dftsman., City of London, Ont.

BEAUDRY, Louis, B.A.Sc., C.E. (Ecole Polytech.), Dept. of Public Works, Quebec, Que.

CHISHOLM, Alexander Harold, B.Sc. (McGill Univ.), chief dftsman., Laurentide Company, Grand Mere, Que.

JONES, Vernon C., B.Sc. (Queen's Univ.), supervising engr., Bell Telephone Co. of Canada, Montreal, Que.

LAJOIE, Joseph Louis Charles, B.A.Sc. (Univ. of Montreal), chief chemist, Imperial Oil Refineries, Montreal East, Que.

VILLENEUVE, Joseph Arthur, B.A.Sc., C.E. (Laval Univ.), 565 Berri Street, Montreal, Que.

Transferred from the class of Student to that of Junior

DIONNE, Joseph Alexandre, B.Sc. (McGill Univ.), engr. of constrn. methods, Bell Telephone Co. of Canada, Montreal, Que.

DUBUC, Antonio E., Electrical Commission of the City of Montreal, Montreal, Que.

GILLEY, James Royden, B.A.Sc. (Univ. of Tor.), comptroller, Hart House, University of Toronto, Toronto, Ont.

LANGLOIS, William Lawrence, B.A.Sc. (Univ. of Tor.), estimating, dfting, etc., with H. G. Acres, M.E.I.C., Niagara Falls, Ont.

OAKS, Harold Anthony, B.A.Sc. (Univ. of Tor.), pilot, Provincial Air Service, i/c Orient Bay Station, Sault Ste. Marie, Ont.

SCHURMAN, Hulbert Hartt, B.Sc. (N.S. Tech. Coll.), meter engr., St. Francis Water Power Co., Thetford Mines, Que.

SIMMERS, Joseph Adolph, B.A.Sc. (Univ. of Tor.), asst. to res. engr., Spanish River Pulp & Paper Mills, Ltd., Sturgeon Falls, Ont.

At the meeting of Council held on February 25th, 1926, the following Students were admitted:

BEAM, Donald Carleton, East House, University of Toronto, Toronto, Ont.

BÉLANGER, Réal, C.E. (Univ. of Montreal), 5283 Park Avenue, Montreal, Que.

BURDETT, George Henry, 29 Botrel Avenue, Montreal, Que.

CHOROLSKY, Eugene, North House, University of Toronto, Toronto, Ont.

COMPLIN, Edward Reginald, 101 Willcocks Street, Toronto, Ont.

CREED, Kenneth B., 645 Union St., Fredericton, N.B.

HOWARD, James Phineas, 37 Clergy St. West, Kingston, Ont.

JENNINGS, George Lorne, 49 St. Clair Avenue, West, Toronto, Ont.

KRIBS, W. Herbert, East House, University of Toronto, Toronto, Ont.

McCLURE, Lindley Wilberforce, 4321 Bordeaux St., Montreal, Que.

MULLIGAN, Henry Iveson, 50 Victoria Street, Montreal, Que.

PETZOLD, Henry Paul, 100 Somerville Avenue, Westmount, Que.

RUSSELL, George Alan, 8 Willcocks Street, Toronto, Ont.

SILVER, Ralph Charles, 743 University Street, Montreal, Que.

SUDDEN, Edwin Alexander, 320 Huron Street, Toronto, Ont.

SWITZER, Henry Rea, 62 Melbourne Avenue, Toronto, Ont.

TAYLOR, Frank Denzil, 348 Sherbrooke Street, West, Montreal, Que.

WHITSON, Duncan David, 617 Huron Street, Toronto, Ont.

WYSE, Lyell Smith, 387 Mance Street, Montreal, Que.

YUILE, William Sclater, 70 Ontario Avenue, Montreal, Que.

CORRESPONDENCE

A Correction

The following communication has been received from the President of *The Institute:—*

The Editor,
The Engineering Journal.

Dear Sir;—

My attention has been called to the article regarding myself published on pages 121-122 of the February number of *The Journal.*

Lieut.-Col. W. G. Tyrrell, D.S.O., R.E., was officer-in-charge of the Kantara Military Railway, and I had the honour of serving under him as engineer in charge of maintenance.

Faithfully yours.

(*Signed*) GEO. A. WALKEM.

NOTE: — Lieut.-Col. Tyrrell, a member of *The Institute,* is a Canadian and a distinguished graduate of the Royal Military College.

Recent Ruling Regarding Income Tax Exemptions

The Secretary has received the following letter from the Inspector of Taxation of the district of Montreal which is published herewith for the information of our members:—

6th January, 1926.

Dear Sir:—

The Commissioner of Taxation has brought to my attention the fact that your members had been advised that depreciation on engineers' instruments and library is a proper deduction in arriving at taxable income.

This information was based on my letter of the 26th of March, 1924. I may say that this letter should have been more explicit, and I understand that Mr. Leroux telephoned your office in the former part of June, 1924, for a copy of your Charter, and the question had been verbally explained.

In order that uniformity be obtained, I submit, for the guidance of your members, the following information for Income Tax purposes.

Association Fees

(a) Only the fee paid to the Corporation of Professional Engineers of the Province of Quebec may be allowed as a deduction in this Province.

(b) A fee paid to *The Engineering Institute of Canada* being a voluntary contribution, is not a permissible deduction.

Depreciation on Instruments

(a) Depreciation on instruments is only allowed where the tax-payer exercises his profession on his own account.

(b) When engaged on salary and is under an agreement to furnish his own instruments, full details must be furnished the Department, in each case, before consideration may be given to the claim.

Depreciation on Library

(a) Depreciation is allowed only when the engineer exercises his profession on his own account.

(b) When employed on salary no depreciation will be allowed.

Will you please acknowledge the receipt of this letter.

Yours very truly,

(*Signed*) P. F. MCCAFFREY,
Inspector of Taxation.

Trade Publications

Link-Belt Limited, Toronto, Ont., have issued a new booklet on their "All-Purpose Crawler Crane", the number of this publication being 895. The book contains 48 pages, generously illustrated to show the use of the drag-line, dipper and trench shovel, skimmer scoop, hook blocks and pile drivers. Data on lifting capacities, approximate operating speeds, line pull, tractive effort, etc., are given. The tables in which this data is arranged have been supplemented by line drawings which show dimensions for operating limits. Finally in a brief and interesting way, information is given on some of the usual, as well as the more ingenious uses to which the various types of cranes can be put.

The Riley Engineering & Supply Company, Limited, Toronto, Ont., have issued a bulletin fully describing the Riley Atritor Unit Pulverizer. The booklet contains some twelve pages describing the system fully and illustrating the various parts of the equipment.

Recent Additions to the Library

Proceedings, Transactions, etc.

Presented by the Societies:

Transactions of the Institution of Civil Engineers of Ireland, Volume 50, 1923-24.
List of Members of the Institution of Civil Engineers of Ireland, 1925.
Year Book of the Western Society of Engineers, 1925.
List of Members of the Society of Engineers, London, 1925.
Transactions of the Institution of Engineers and Shipbuilders in Scotland, Volume 68, 1925.
Proceedings and Transactions of the Royal Society of Canada, Volume XIX, 1925.

Reports, etc.

Presented by the Structural Materials Research Laboratory of the Lewis Institute, Chicago:

Bulletin 16 — Effect of Size and Shape of Test Specimen on Compressive Strength of Concrete by H. F. Gonnerman.
Bulletin 17 — Studies of Bond between Concrete and Steel by Duff A. Abrams, M.E.I.C.

Presented by the Dominion Water Power and Reclamation Service:

Water Resources Paper No. 41: St. Lawrence and Southern Hudson Bay Drainage, Eastern Section, Quebec, 1922-23.
Water Resources Paper No. 45: Atlantic Drainage 1922-23, 1923-24.
Water Resources Paper No. 47: Pacific Drainage British Columbia and the Yukon, 1923-24.

Presented by the Ontario Department of Mines:

Annual Report, 1923, Parts 1-7.
Annual Report, 1925, Part 6.

Presented by the Department of Mines, Canada:

Annual Report, 1925.

Presented by His Majesty's Stationery Office, London:

Report of the Committee of the Privy Council for Scientific and Industrial Research, 1924-25.

Presented by the Board of Commissioners of the Port of New Orleans:

Report, 1925.

Presented by the Engineering Board of Review of the Sanitary District of Chicago:

Parts 2 and 3 of Report of Sewage Disposal, etc.

Technical Books

Presented by E. & F. N. Spon & Company, London:

Economics of Highway Engineering, by H. T. Tudsbery.
Galvanizing, by Heinz Bablik.

Presented by Chapman & Hall:

Metallurgy and its Influence on Modern Progress by R. A. Hadfield.

Presented by L. F. Loree, President of the Delaware & Hudson Company:

A Century of Progress — History of the Delaware & Hudson Company, 1823-1923.

Presented by the Canadian Manufacturers Association:

Canadian Trade Index, 1926.

Lectures on Ice Engineering

Dr. Howard T. Barnes, M.E.I.C., will give four lectures on ice engineering at the Macdonald Physics Building, McGill University, on March 11th, 18th, and 25th, from 5 to 6 p.m. Members of *The Engineering Institute of Canada* may attend these lectures on the same basis as the graduates and under-graduates of McGill, i.e., without charge.

Trade Publication

The De Laval Steam Turbine Company, Trenton, N.J., have issued a sixteen-page bulletin entitled "Superior Speed Reducers for Every Service", describing a line of speed reducers for use with standard or high speed motors driving slow or moderate speed machinery, including worm reduction gears of the horizontal and vertical shaft and double reduction types, also helical gears for low ratios, and double helical gears for high power service. The illustrations include many coloured views, which clearly set forth the details of construction, materials used, the pressure oiling system for heavy duty service, etc.

Association of Professional Engineers of Nova Scotia

ANNUAL MEETING

The annual meeting of the Association of Professional Engineers of Nova Scotia was held at the Green Lantern restaurant, Halifax, on January 21st, 1926. The meeting was attended by fifty-seven members and after the reading and adoption of the minutes of the last meeting, and the reports of the secretary, registrar, and council, the scrutineers reported the results of the election of officers as follows:—

President.........D. W. Robb, M.E.I.C., Amherst.
Vice-President....Hon. J. F. Cahan, A.M.E.I.C., Halifax.
Councillors.......O. S. Cox, A.M.E.I.C., Halifax, G. S. Stairs, A.M.E.I.C., Windsor, H. S. Johnston, M.E.I.C., Halifax, H. W. L. Doane, M.E.I.C., Halifax, J. F. Lumsden, A.M.E.I.C., Halifax, J. E. Belliveau, A.M.E.I.C., Halifax, Wm. H. Noonan, A.M.E.I.C., Halifax, R. M. McKinnon, A.M.E.I.C., Halifax.

Appointed by Governor-in-Council:—
F. R. Faulkner, M.E.I.C., Halifax, F. H. Sexton, Halifax, G. D. Macdougall, M.E.I.C., New Glasgow, T. J. Brown, M.E.I.C., Halifax, L. H. Wheaton, A.M.E.I.C., Halifax, J. L. Allan, M.E.I.C., Dartmouth, W. P. Morrison, M.E.I.C., Dartmouth.

The scrutineers also reported that the amendment to the by-laws had carried. Other business of the meeting included the appointment of the president-elect D. W. Robb, M.E.I.C., and councillor H. W. L. Doane, M.E.I.C., to represent the Association of Professional Engineers of Nova Scotia at the meeting of delegates of the Professional Engineering Associations in Montreal.

In a brief address the newly elected president Mr. Robb thanked the members for the honour conferred upon him by electing him president of the Association. Among other things he referred to the recently issued list of members and by-laws of the Association which have been made available in printed form.

In connection with the conference of delegates of the Professional Associations in Montreal Mr. Robb referred to the report of the Association's Council for discussion at this conference, quoting from this report the sentence "The respect of the public will come when engineers really learn to respect and be loyal to one another"; in other words to co-operate and to fill to the best of their ability the important place that engineers occupy in this progressive and scientific age. He then reviewed the many fields in which engineers are now engaged, speaking more particularly of the various branches of engineering with which members of the Association in Nova Scotia were connected. He urged engineers to take a more personal interest in the matter of the government, advancing the claim that the methods of conducting government business would be greatly improved by the election of engineers as members of parliament.

F. R. Faulkner, M.E.I.C., as representative of the Association at the Annual Meeting of the Association of Professional Engineers of Ontario presented a report of his trip to the meeting.

International Electrotechnical Commission Meetings in New York

The International Electrotechnical Commission desires to call attention to the following important matters which will come before the I.E.C. Advisory Committee at the meetings to be held in New York from April 13th, to 22nd, 1926.

1. Preparation of Part 2 of International Specification for Electrical Machines. (Large Machines.)
2. General discussion on Rating of Electrical Machinery, including presentation of papers by experts on the subject from various countries.
3. Preparation of a Specification for Traction Meters.
4. Revision of the I.E.C. Publication 29 — Hydraulics, including proposals for an International Specification for Hydraulic Turbines.
5. Preparation of an International Specification for Steam Turbines for driving Electrical Plant.
6. Completion of the list of International Graphical Symbols.
7. Preparation of an International basis for the testing of insulating oils.
8. Approval of the International Standards for Lamp Caps and Holders
9. Confirmation of the list of International Standard High Pressures.
10. Preparation of International Standards for High Pressure Tests.
11. Preparation of an International Code of Rules and Regulations for Overhead Lines.
12. Preparation of an International Code of Terminal Markings.
13. Preparation of an International Electrical Vocabulary.
14. Some additional minor matters.

It will be seen that the questions under discussion at this meeting are of vital industrial interest to this country.

Delegates will be present from all the principal countries, and information in regard to the meeting can be obtained from the secretary of the Canadian National Committee of the I.E.C., Electrical Standards Laboratory, Department of Trade and Commerce, Ottawa.

Galvanizing

By Heinz Bablik. Translated by C. T. C. Salter.
E. & F. N. Spon, London, 1926. Cloth, 6 x 9 in., 166 pp., illus., 12/6 net.

This book, as the name implies, is a treatise on galvanizing. It covers the field very thoroughly, describing in detail the different processes with their chemical reactions and giving diagramatic cross-sections of their structures.

The author first devotes some space to "Rust and its Prevention", and then goes on to describe the preparation of surfaces of articles to be galvanized, viz., the pickling bath and the flux; in this description, chemical formulae are given and consideration to acid strength, temperatures, and time of pickling.

The galvanizing process is described in a very comprehensive manner, descriptions and illustrations of equipment are amply employed. Hot galvanizing, electro-galvanizing, Sherardizing and the Schoop process are all fully explained and a chapter is devoted to testing and judging galvanized coatings.

Raw materials used in the galvanizing process, and waste products of the process are the subjects of another chapter.

While it is evident that European practice has furnished the date and methods to the author, the book is one which should be of very great interest to those who produce galvanized articles of any description. It is written in terms which require only ordinary technical knowledge and on this account is the more useful to the man who can use it to best advantage.

H. HORSFALL, M.E.I.C.

EMPLOYMENT BUREAU AND MEMBERS' EXCHANGE

Situations Wanted

ELECTRICAL ENGINEER

Technical graduate, University of Toronto, 25 years of age, good personality, two years Westinghouse electrical engineering training, one year installation and maintenance, familiar with inspection and maintenance of electrical equipment, desires situation with public utility or industrial organization. At present employed. Apply box No. 202-W.

ENGINEERING STUDENT

Engineering student desires position either with mining company or with survey party. Available May 25th. Apply box No. 203-W

CONSTRUCTION ENGINEER

University graduate with fifteen years experience in construction and office work, desires permanent position. Experience covers water power developments, pulp and paper mills, and other industrial plants. Available on short notice. Apply box No. 204-W.

SALES ENGINEER

Advertiser desires to communicate with firm requiring the services of a technical representative or sales manager. Thoroughly experienced in sales work including organization, sales promotion, advertising, correspondence, etc. B.Sc. (Civil). Age 30, married, speaking both languages. Apply Box 205-W.

CIVIL ENGINEER

Technical graduate, University of Manitoba, 25 years of age, good personality, one year surveying experience, two years municipal engineering training, including design and construction of concrete pavements and sewers, reinforced concrete floor design, etc., desires position with municipal engineering firm in Ontario or Quebec. At present employed. Apply Box No. 206-W.

Situations Vacant

PULP AND PAPER MILL DESIGNERS AND DRAUGHTSMEN

A large pulp and paper company, north east of Montreal, requires competent draughtsmen, thoroughly experienced in paper mill work. These positions are on permanent staff and afford excellent opportunity for advancement, with liberal salaries based on experience and qualifications. Give full particulars of experience, etc., with application. Apply to Box No. 151-V.

Members' Exchange

For sale one Buff and Buff 15½-inch engineer's dumpy level in good condition, reasonably priced. Apply box No. 12-E.

Abstracts of Papers read before the Branches

Mining Operations in Northwestern Quebec

Prof. S. N. Graham, Mining Department, Queen's University, Kingston, Ont.

Kingston Branch, January 21st, 1926.

The mining activity or boom in northwestern Quebec is a direct result or extension of the mining industry in Ontario. This Ontario industry is, comparatively speaking, quite new, and if the growth in Quebec is as rapid it will lead to a wonderful development in the northern part of that province. To estimate what may happen in Quebec, we may look to the Sudbury district and study the growth of the nickel industry since the discovery of the deposits in 1883. Twenty years later Cobalt was discovered and the mining industry there now sustains a large population. About six years later, Porcupine was discovered and gold mining in Ontario was put on a firm foundation. Its growth has been so rapid that the production in 1925 will be about thirty millions.

With such an industry in Ontario, it was but natural that prospectors should work eastward into Quebec. That this movement did not take place earlier was probably due to the fact that the prospectors did not look with favour on the Quebec mining laws. Revisions of the law removed some of the objections, and prospecting in Quebec became the fashion, particularly after Ed. Horne's discovery was optioned by the Thompson-Chadburn Syndicate. This discovery was in Rouyn township and though the prospecting has extended east and west, the district takes its name from this township. The area considered, in which many promising prospects have been discovered, extends from the Ontario boundary eastward to the Bell river, a distance of one hundred miles. The width of the zone now most actively prospected is twenty to twenty-five miles, while most of the properties now working are in or near Rouyn township. The possibilities of the larger area are very great.

The district as a whole is accessible in the summer by water routes on the many lakes and rivers. The trip is about one hundred miles from the present terminus of the Canadian Pacific Railway on the east side of lake Temiskaming, and can be made in a day by steam and power boats.

At present various railroad schemes are being considered with a view of reaching the district in the most economical way.

There is a large power development on the Quinze river, and it is reported that this winter construction work will be started on a power line to Rouyn. The district will therefore soon be supplied with two necessities, power and transportation. If it can supply ore, the principle requisite, and this now seems certain, then the stage is well set for successful mining operations.

The heart of the activity is around Osisko, or as it is also called Tremoy lake. It was near the shore of this lake that Ed. Horne made the first discovery of heavy sulphides in 1919. In the fall of 1922 the Thompson-Chadburn Syndicate took an option on this property, paying for it a 10 per cent interest and $320,000., cash payments extending until 1928. The Horne claims form the part of the Noranda Company holdings and with the continually rising prices quoted for Noranda stock, it is difficult to place a value on the holdings of the Lake Tremoy Syndicate, which grub-staked Horne. As the expenses of this syndicate are said to have been altogether about $5,000., its profits are enormous. In fact the story of this syndicate might be called one of the romances of mining and its success is sufficient to encourage other similar grub-staking syndicates.

The history of the Thompson-Chadburn Syndicate is also extremely interesting. The early work on the Horne did not show the gold values hoped for, and at that time while there were slight indications of copper, people were thinking mostly of gold. The Thompson-Chadburn Syndicate then optioned the Powell claims and opened up a vein which gave promise of being a gold producer. They also did a lot of work on a body of auriferous pyrite on the Chadburn claim. Getting only moderate success on these properties, they turned again to the Horne and were successful in discovering some enormous bodies of high grade copper ore.

This turned the thoughts of the prospectors from gold deposits, which up to the present have not proved up very well, to copper. The Amulet property was the next to be discovered and on this some rich copper and copper-zinc ore was discovered. This showing so enthused the prospectors that most of them started looking for copper. The next discovery was the Waite which is reported to have a large body of 17 per cent copper ore. Many other discoveries have been reported this winter, and undoubtedly the camp has a very bright future.

Much of the ore reported is very high grade and this is very apt to cause such a boom as will bring out the usual number of "wild-cats". Some of the ore is said to carry considerable zinc. This may cause metallurgical trouble, or expense, and good engineering is essential in order that even a good property may be successful.

Improvements in the General Plan of the City of Montreal

Geo. R. MacLeod, M.E.I.C., Department of Public Works, City Hall, Montreal, Que.

Montreal Branch, February 18th, 1926.

For the purposes of the construction and maintenance of streets, sidewalks, sewers, pavements and the numerous utilities owned by the city and by public utility companies, it is necessary to have definite and accurate plans and profiles of every street in a city.

These plans are also very necessary for the fixing of the boundary lines between streets and private properties, and the more valuable the property, the greater need there is for precision in establishing these boundaries.

Not only it is necessary to have the plan of each individual street made with clearness and accuracy, but it is necessary to make a general plan that will show without doubt the exact position of each street in relation to all other streets, in such a manner that the whole framework can be plotted together and fitted in the same manner as the frame of any other structure, each member (that is, each street) being given its true length and width so that it may fit in precisely where it belongs.

This feature of a city plan is especially necessary when planning any major projects, or making serious town planning studies.

The whole system of surveys and plans which have been made during the past six or seven years, by the technical service of the city, and especially during the past four years, have been conducted in a manner which keeps these main features in view, namely, accuracy and clearness in each individual plan, and accuracy in the inter-relations of all streets to each other.

With these objects in view, a main triangulation survey was first made, utilizing as far as possible a net-work of survey points established by the Geodetic Survey of Canada, the city engineer co-operating with the Dominion engineers, in such a manner that 45 main survey points were established in Montreal and its suburbs; these points being such a character that the Geodetic Survey could give the exact co-ordinates, otherwise the true position on the earth's surface. These points are so selected that any local surveys in the immediate vicinity of any of them can be connected to the main survey monument.

During the past season, 139 intermediate survey monuments were installed by the engineers of the technical service, and the exact co-ordinates of each of these are being established in reference to the original main triangulation of 45 points.

When completed there will be about 800 of the survey monuments, which consist of permanent concrete piers sunk in the ground below the frost line, each pier being protected by an iron and bronze cover, under which is the copper bolt with suitable point marked thereon for survey purposes.

Not only are these points being used as reference points for all street lines, but the exact elevation of each copper bolt head will be established by precise level survey, and these will hereafter constitute the permanent bench-marks for all our profiles and construction of all kinds carried on in our streets or squares, as well as for giving official levels to all proprietors erecting private buildings.

All of the individual surveys and levellings taken even three or four years before the new monuments were installed can, of course, be referenced to the fixed monuments at any time and this will be done as economical occasion arises.

Care is being taken that when a survey is being made in any portion of a street, it shall be made in such a way that it need never be duplicated. The plan and profile thus established must hereafter serve for the construction of street works, for assessment purposes, for change in homologated lines, for the location of all kinds of utilities such as poles, conduits, pipes, tracks, etc., etc.

Great efforts have been made during the past three or four years to establish homologated lines where none formerly existed, or where old ones had to be changed.

Instead of starting at one end of the city and making a clean sweep to the other extreme of the community, it has been found expedient to make the surveys for these plans where building development seems to be imminent, this applies more particularly to the newer wards, such as Notre-Dame de Grâces, St-Paul, Mercier, Rosemont, Villeray, Ahuntsic, Côte des Neiges, etc., the idea being to control the placing of street lines in advance of new subdivision plans if at all possible.

Other examples are the surveys for widening and straightening older streets, where the traffic density makes it urgent.

The total of new homologated line surveys executed during the past four years, totals about 80 miles of streets, and to tie in the surveys to reference points and lines it was necessary to cover about 30 square miles of city territory, — which, of course, will not have to be traversed again.

These activities will very soon cover the whole of the city, so that private subdivisions can be controlled.

During the past four years over 850 subdivisions were submitted for approval, and many of these were not approved until after they were altered to meet the city engineer's requirements, such as conforming to the existing or projected homologated lines and also the principles governing street grades, drainages, etc.

Special studies have been made of the main drainage districts where trunk sewers do not exist, or where they are incomplete. In the greater part of the city we have for this purpose made up-to-date contour plans, which we consider indispensable in the lay-out of streets, drainage system, water distribution, etc., etc.

Besides the contour plans, we are rapidly plotting the official profiles of every street, accompanied by an individual plan showing all existing works, and the private lots fronting thereon.

These are at a scale of 40 feet to the inch horizontal, and 4 feet to the inch vertical.

As part of the work asked for by the Provisional Town Planning Board of Montreal, a very interesting traffic survey has been made at 195 important intersections in the area bounded by the river St. Lawrence, Atwater Avenue, Pine Avenue and Delorimier Avenue.

About one-third of these traffic counts were made by employees under the direction of the chief engineer of the tramways commission.

These traffic counts were made in January 1925, and August 1925, to obtain both winter and summer conditions.

The data is carefully plotted to show the density of every variety of traffic at any given point, and also a plan ensemble is now being plotted from these individual charts which form a very valuable asset in town planning studies, as well as in traffic regulation activities, from time to time.

Operation of Lethbridge Northern Irrigation District

P. M. Sauder, M.E.I.C., Project Manager,
Lethbridge Northern Irrigation District, Lethbridge, Alta.
Lethbridge Branch, December 19th, 1925.

Mr. Sauder gave a most interesting description of the operation of this irrigation system, which embraces no less than 600 miles of canal of various sizes carrying water from one to seven feet deep, and supplies 100,000 acres of agricultural land just north of Lethbridge.

The system represents a construction cost of $5,500,000 and some idea of the work involved may be gleaned when it is stated that 3,500,000 board feet of lumber was used for bridges and small structures; 20,000 lineal feet of round piling. There were 25 tons of nails and another 25 tons of miscellaneous bolts, washers, etc., used, not to mention the cement and concrete entering into the structures.

There are 110 miles of telephone wires connecting all parts of the system with headquarters.

The system takes its water from the Old Man river at a point nine miles west of Macleod. A dam 524 feet long and 6½ feet high on the south side of the river diverts a stream 7 feet deep into a main canal 33 feet wide at the bottom and 63 feet wide on top.

Four miles from the intake the canal crosses the river through a sheet iron flume, 3,322 feet long and 14 feet wide. Another flume eleven miles from the intake crosses Willow creek and in the course of its progress to Keho reservoir, the main canal finds its way through two great siphon pipes 10½ feet in diameter, one of which is 3,000 feet long and the other 950 feet long.

The main canal empties into Keho lake south east of Barons which has a capacity of 40,000 acre feet of water and serves as a storage reservoir for the east end of the district.

Following the main canal from the intake through Keho to Turin, a canoe trip of 80 miles could be negociated.

"The real test of operating and irrigation district," said Mr. Sauder, "is in the staff's relation to the farmer. We must keep continually in mind that an irrigation system is primarily intended to deliver water for the growing of crops. Especially is this so, with a new system like the Lethbridge Northern where all farmers are just learning irrigation methods. We have chosen our staff carefully with this end in view. Our men must be not only engineers but they must be able to advise on agricultural matters when such advice is asked for. Friction will occur and complaints will be received, but these difficulties can be adjusted by a sympathetic understanding on the part of the staff."

"The growing of crops," he emphasized, "is the sole reason for an irrigation system. Everything must be subordinated to this end and the farmers' viewpoint must be fully respected."

Economy of management was a factor of great importance and Mr. Sauder explained that this year 43,000 acres had been served with water with a staff of five water masters, 18 ditch riders, and 26 teamsters and labourers, the latter being employed only during the irrigation season.

Each year a budget is prepared to cover water service, and capital charges. The water service for 1925 was budgeted at $125,000. and the capital charges at $400,000. or a total of $525,000. On a basis of 100,000 irrigable acres, the assessed rates for 1925 was struck at $5.25 per acre.

Mr. Sauder referred to the assistance being given district farmers by the government under the Colonization Act by which part of the farmers' assessment is carried by the government during a period of years.

"While the Lethbridge Northern," he said, "is unable to get along without government assistance, that does not imply that it is a liability. Lands intelligently farmed and irrigated show a good return over the irrigation rates, and it is only a matter of time before the whole district will be paying its way and shouldering the full rate without assistance.

The success of irrigation depends upon the farmer. He must have the proper farm ditches, both as to size and location. He must know how and when to apply the water and be able to get the necessary assistance to do the work. And, last but not least, he must get service from the operating department. I wish therefore to strongly emphasize the importance of giving real service.

To be a real benefit, however, irrigation must be sold to the farmer. He must thoroughly understand the use of irrigation and must see that it produces a good profit. Irrigation makes much more labour and expense and calls for a much higher degree of intelligence. The provincial and federal governments have given some assistance in locating the head ditches, but the farmers have then been left to work out the rest of their systems themselves. They are seriously handicapped for want of experience and reliable information and the job is slow and discouraging. It is true, that the farmer who masters the job himself is much more likely to be successful than the one who is hand fed, but the test is very severe and it is not surprising that many accomplish very little and become discouraged. Provision should be made for technical assistance and advice in preparing the land, locating the ditches, choosing the crops to grow, deciding best methods of irrigating, and determining the proper time to irrigate. Demonstration plots have been grown in the district but the assistance of demonstration agents who can show the farmers how to produce the good results on his own land are required. The governments should therefore be strongly urged to assist the farmer in getting started in the use of irrigation.

Jenkins Engineering Scholarships Awarded

Scholarships in engineering to be competed for annually were established last year at both University of Toronto and McGill University by Messrs. Jenkins Bros., Limited, of Montreal. The winner of this scholarship at the University of Toronto is Mr. Carol A. Pollock, Kitchener, Ont. The McGill award goes to Guy Rinfret, S.E.I.C., Shawinigan Falls, Que.

Design of Concrete Mixtures

The Structural Materials Research Laboratory of the Lewis Institute, Chicago, have issued a revised edition of Bulletin 1, Design of Concrete Mixtures by Duff A. Abrams, M.E.I.C.

BRANCH NEWS

Calgary Branch

G. P. F. Boese, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch-News Editor.

ANNUAL DINNER

Once more the annual dinner of the branch has come and gone. This year's performance proved to be no exception to the rule in functioning as a successful gathering of the clans. In fact it might almost be said that it eclipsed previous endeavours of its kind in so successfully attaining the main object of such gatherings, namely a happy reunion and fraternizing that are the essence of social affairs of this nature.

After Chairman, A. L. Ford, M.E.I.C., had taken his seat everyone commenced to wear the smile that refuses to budge, together with a dinky little paper cap. Things passed rapidly from the sublime to almost the ridiculous at times. A clever menu outlined in technical style the calorie contents of the foods served, together with the various liquids consumed. In reference to the points plotted on the curve apparently beer contains a maximum calorific value as its tendency was to wander off the chart altogether. The turkey course took a good second place. Such ordinary things as soup and rolls showed up badly, while the values increased somewhat erratically from sherry to nuts.

The calories having been demolished, or rather absorbed into the humane frame, S. G. Porter, M.E.I.C., rose to propose the toast to *The Institute*, outlining its aims and objects in a few clear cut remarks lasting one second short of his allotted time. J. H. Ross, A.M.E.I.C., seconded with a few well selected words, but exceeded his time by one second!

The entertainment side of the programme was excellently arranged, traverse stations indicating the items with a T. P. for intermission. Under the chairmanship of R. S. Stockton, M.E.I.C., and leadership of G. H. Patrick, A.M.E.I.C., things got away to a splendid start and continued to the end in excellent style. Ably assisted by C. A. Lydiatt, B. Plesner, W. G. Guthrie, and C. Elliott, A.M.E.I.C., at the piano, G. H. Patrick, A.M.E.I.C., arranged a programme that was just right, not too long nor too short, and of a quality that one could sit back and take it all in, — together with a little refreshment occasionally, — with great pleasure. W. G. Guthrie's scotch turns produced a sensation of extreme hilarity almost to the choking point, while B. Plesner played his violin with a most sympathetic touch. Altogether the programme was a rare good one, not soon to be forgotten, and was arranged by branch members living at Strathmore, to whom a great credit is due for the results.

Some rare stunts were "pulled off" by our stunt committee of one, namely, W. B. Trotter, A.M.E.I.C., who, dressed in dilapidated silk hat, evening suit, black wig, and pre-war moustaches, made some valuable presentations, typical of which was one to R. S. Stockton, M.E.I.C., of the Order of the Garter (literally). The various presentations, ranging from first prize champion bull to third prize baby beef in the form of rosettes, were made with much gusto with the aid of an umbrella mixed with a grotesque choice of vociferous expletives, that only one of such extremely high calorific value as Mr. Trotter possesses could conjure up.

T. Lees, A.M.E.I.C., ably proposed a hearty vote of thanks to the Strathmore contingent and other entertainers for giving the branch such a very enjoyable evening's entertainment.

Edmonton Branch

W. R. Mount, A.M.E.I.C., Secretary-Treasurer.

At a general meeting held in the MacDonald hotel on January 20th, W. Dixon Craig addressed the branch, his subject being "Law and the Engineer".

The fact that Mr. Craig was some years ago a member of the engineering profession, may be one reason for his undoubted ability to interest and inform a gathering of engineers to-day. All present were of the opinion that Mr. Craig's paper should be printed in full in *The Journal* for the benefit of others besides local members. It is hoped that at a later date this will be found possible.

Halifax Branch

K. L. Dawson, A.M.E.I.C., Secretary-Treasurer.

The annual meeting of the Halifax Branch of *The Engineering Institute of Canada* was held in the St. Julien room of the Halifax hotel on Thursday evening, December 17th, 1925. About sixty members and guests sat down to dinner, during which there was music from the orchestra under the leadership of J. G. Mills and several numbers from *The Institute* song sheet were sung by the diners. Following the toast to the King, the chairman read a letter from Hon. E. N. Rhodes, premier of Nova Scotia, dated at Montreal, regretting his inability to attend because of illness and the instructions from his doctor to refrain from all public functions for a considerable time. It was moved by C. H. Wright, M.E.I.C., seconded by H. B. Pickings, A.M.E.I.C., and carried, that a night letter be sent from the meeting containing our regrets at his inability to be present and wishing him a prompt and complete recovery. The chairman then read a letter from Sir. Andrew Rae Duncan, the chairman of the Royal Commission investigating the coal situation in Nova Scotia, expressing his regrets that circumstances would not permit him to attend.

The chairman then introduced the following guests:—Hon. J. A. Walker, minister of natural resources in the Nova Scotia cabinet. Dr. F. H. Sexton, president of the Nova Scotia Technical College, Mr. A. S. Gunn, A.M.E.I.C vice-chairman of the Moncton Branch, Col. E. C. Phinney, B.A., L.L.B.

The Hon. Mr. Walker spoke briefly expressing his appreciation of the honour of being invited. He mentioned that it was his privilege to be associated frequently with engineers. He thought his first knowledge of engineers came when as a school boy he read Kipling's "Letters of a Family" in which Kipling wrote that among the marvels he found in Canada were the engineers whom he saw in the Rocky Mountains teaching young avallanches to jump over railway tracks. In the engineering profession he had noted a great diversity of activities, the engineers being found even in political circles when it was necessary to find someone to "engineer a campaign". He felt that he could depend on the co-operation of engineers wherever the welfare of the province is concerned.

Dr. F. H. Sexton, comparing *law* and *engineering* as professions, said that law was perhaps more honoufed but not more honourable. The engineering profession is just coming to maturity and the engineer is asking to be accorded things he most rightly deserved. It was the aim of the Nova Scotia Technical College to give the students a broader training which would acquaint them with the wealth and culture of literature so that they will feel more keenly their duty as public citizens. He was glad to see the large representation of engineers which was a proof of the hope that the professional esprit de corps is materializing,

R. S. Gunn brought fraternal greetings from the Moncton Branch.

At this point in the meeting the secretary lead in several songs, after which the speaker of the evening, Col. Phinney delivered his address on "Canada's National Problems".

CANADA'S NATIONAL PROBLEMS.

After a few intimate remarks in which he expressed his appreciation of being asked to address the Halifax Branch of *The Engineering Institute of Canada*, Col. Phinney explained how the use of the Panama canal is changing the trend of the grain business of western Canada.

Leading to the discussion of economic conditions Col. Phinney reviewed the events leading to Confederation, referring particularly to the Conference in Charlottetown in 1864, when the union of the Maritime provinces was being discussed, and the subsequent appeal for the larger union by representatives from Upper Canada and the promise of a railway connecting the Maritime provinces with Quebec and Ontario. He contended that the real essence of the British North America Act lies in the promises made to Nova Scotia at that time.

He referred to the period between Confederation and the Great War as one of prosperity, with rapid development and increasing population, and the period of readjustment following the war, which period he suggested is probably now at an end.

The Conference of the Canadian Boards of Trade held at Winnipeg a few weeks ago, he thought, was an outward sign of a new era, and he remarked on the fact that at this conference there was evidence that every province of the Dominion seemed now to be thinking *Nationally*, considering their problems to be national ones, and national problems to be theirs, relegating to second place their province and domestic problems.

Col. Phinney defined the national problems under three heads:— First, national debt; second, railway; and third, fiscal. Under each of these headings he reviewed the existing conditions, and claimed that the one main solution for all these problems seemed to be the adoption of a proper up-to-date immigration and settlement scheme and that this was advocated by both President Beatty of the Canadian Pacific Railway, and President Thornton of the Canadian National Railways. The type of people to come in under this immigration and settlement scheme said Col. Phinney were:—First English or British decent; second those who have left and won't come back unless there is a better scheme to take care of them than when they left; third, people from eentres of Europe other then "red", that is people of the Nordic races. Under no circumstances should the bars be thrown down for indiscriminate immigration. The steady plodding immigrant who will be satisfied with a fair return is the only type which Nova Scotia can absorb, for her type of soil must be cultivated by this type of person. The other provinces are willing that the Canadian immigration system will recognize our needs and provide for them. It is estimated that such a scheme will make it necessary for the government to spend 250 million dollars over a period of five years, and that it will result in the settling of about 800 thousand people in Canada who will in time, repay the money which has been advanced to them, by paying off a portion of it each year. It is estimated that the government would not loose more than 20 per cent of the money expended in this way.

Referring to the industrial situation Col. Phinney thought that a solution seemed to lie in the education of people towards traffic and trade in Canada. He deplored the quantity of foreign products being purchased where equally good were manufactured in Canada. He thought that there was a field here for government support, because it was a matter of education.

With particular reference to Halifax he urged that co-operation in any good effort on the part of the citizens was essential and showed how the city of St. John had raised $40,000 by private subscription, by which trade commissioners had been sent through Western Canada to urge the routing of freight through St. John ports during the winter months with the result that to the present St. John has already handled much more grain than she did all last winter, and that there is enough freight in sight to keep the port of St. John busy all winter. Similar co-operation will accomplish equivalent results in Halifax

At the close of his address Colonel Phinney was tendered a vote of thanks by chairman McKnight which was moved by C. E. W. Dodwell, Hon. M.E.I.C. and seconded by Vice-President F. A. Bowman, M.E.I.C.

Election of Officers

The scrutineers report presented by F. R. Faulkner, M.E.I.C., chairman, showed that the following branch officers were elected:—Chairman, H. W. L. Doane, M.E.I.C. Members of the Executive Committee residing in Halifax, Prof. D. W. Munn, M.E.I.C., W. A. Winfield, M.E.I.C., H. F. Bennett, A.M.E.I.C., for 1926-27; J. S. Misener, M.E.I.C., for 1926. To represent the members residing more than over twenty-five miles from Halifax, H. C. Burehell, M.E.I.C., Windsor, N.S., C. W. Archibald, A.M.E.I.C. J. S. Misener, M.E.I.C., was elected to fill out the unexpired term of E. M. Archibald, A.M.E.I.C., who has removed to Saint John, N.B.

Chairman W. F. McKnight, A.M.E.I.C., spoke briefly in comment and acknowledgement of the support which had been given him by the branch. He took advantage of the happy precedent afforded by the ehairman of the previous year and did not attempt to deliver a separate address. He suggested that at future meetings we take more advantage of our own local talent, and as an instance referred to the meeting on Water Power Development at which a series of short papers were read. He suggested that our being able to accomplish a Maritime Professional Meeting during the year at an expense of $2.00 per head was the achievement of the year. He appointed F. R. Faulkner, M.E.I.C., and D. W. Munn, A.M.E.I.C., as auditors for the 1925 accounts. He then gave up the chair to the chairman-elect, H. W. L. Doane, M.E.I.C.

The officers of the Halifax Branch for the year 1926 are:—

Chairman	H. W. L. Doane, M.E.I.C.
Vice-Chairman	(To be selected by the executive committee from its own members.)
Seeretary-Treasurer	K. L. Dawson, A.M.E.I.C.
Executive Committee	(In addition to the above):—
(*Retiring 1926*)	W. F. McKnight, A.M.E.I.C., (*ex-officio*).
	H. S. Johnston, M.E.I.C.
	W. P. Copp, A.M.E.I.C.
	J. S. Misener, M.E.I.C.
	R. R. Murray, A.M.E.I.C.
	J. G. W. Campbell, M.E.I.C.
(*Retiring 1927*)	H. F. Bennett, A.M.E.I.C.
	D. W. Munn, M. E. I. C.
	W. A. Winfield, M. E. I. C.
	C. W. Archibald, A.M.E.I.C.
	H. C. Burchell, M.E.I.C.

Kingston Branch

Gordon J. Smith, A.M.E.I.C., Secretary-Treasurer.

Annual Dinner

The annual dinner of the Kingston Branch was held in the Queen's Cafe, Kingston, on the evening of November 23rd.

The meeting was a memorable one in the annals of the branch, as it was the oceasion of the presentation of the Charter to the branch. This pleasant duty was to have been performed by Dr. A. Surveyer, M.E.I.C., the president of *The Institute*, but at the last moment Dr. Surveyer found it impossible to be present and General Sir Alexander Bertram, M.E.I.C., eame in his stead. R. J. Durley, M.E.I.C., the secretary of *The Institute* was also a very welcome guest.

The dinner was in itself very successful, and during it several enjoyable numbers were rendered by Mr. George Kateledsky, a Russian pianist, who is attending Queen's University. There was no formal toast list and after drinking to the King, General Bertram presented the Charter to the branch. The General spoke of the pleasure it gave him to be connected with *The Institute* of which he is treasurer at headquarters, and of the complete harmony that existed in the adminstration of this large organization. Finally he stated that he considered it an honour indeed to present a Charter on which were inscribed the names of the Charter members of the Kingston Branch, who had occupied such prominent and enviable positions in the engineering activities of the Dominion.

The date of the formation of the original Kingston organization was February 17th, 1911, and the Charter members were:

L. W. Gill, M.E.I.C.	W. R. Butler, M.E.I.C.
G. H. Herriott, M.E.I.C.	A. K. Kirkpatrick, M.E.I.C.
W. L. Malcolm, M.E.I.C.	H. B. R. Craig, M.E.I.C.
A. Macphail, M.E.I.C.	G. G. Hare, M.E.I.C.
J. C. Gwillim, M.E.I.C.	E. R. Beckwith, A.M.E.I.C.
J. A. Cochrane	J. G. Lindsay, A.M.E.I.C.
F. F. Miller, M.E.I.C.	

The Charter was received on behalf of the branch by the chairman, R. J. McClelland, A.M.E.I.C., with a few well chosen words of thanks as well as of welcome to the visiting guests.

R. J. Durley, M.E.I.C., spoke next and he covered in a very informal and enjoyable manner, the many activities at headquarters, giving an account of many interesting episodes of his visits to the various branches throughout the Dominion. He asked for any suggestions from the members present, as to changes or improvements that could be made in the general administration.

The meeting was then thrown open for discussion in which many useful points were brought up.

January Meeting

A regular meeting of the Kingston Branch of *The Institute* was held in Carruthers Hall, Queen's University on the evening of January 21st, to hear an address by Prof. S. N. Graham of Queen's Mining Department on "Mining Operations in Northern Quebec" and also a description by the same speaker on "The Objects and Aims of the Professional Engineers' Association of Ontario."

Professor Graham has been in very close touch with the Quebec area since its discovery, being amongst the first professional men to visit the district and his description an abstract of which appears on another page of this issues of this new field was most interesting. In his talk on the Professional Association Prof. Graham said in part:

The Association of Professional Engineers of Ontario

For many years engineers have felt that their status and legal standing in modern society are not what they should be or what the value of their work in the advance of civilization demands. This has led to several efforts at incorporation along similar lines to the medical profession. The old Canadian Society of Civil Engineers which has developed into *The Engineering Institute of Canada*, fathered a bill presented to the Ontario Legislature in 1899. This was not given unanimous support by the engineers of the province as many feared that it gave too much importance to the civil engineering branch. As a result much opposition developed and the bill was not passed. Some of this opposition came from Kingston but the fact that such no longer exists and that exactly the reverse is the present stand is well shown by the resolution passed by the Science Faculty of Queen's University strongly endorsing the Bill when it was presented in 1922.

The present Bill is the result of many long conferences of engineers belonging to all branches of the profession. It is very broad and moderate. It protests the graduate engineer and at the same time gives opportunity for the so-called practical man to prove that he is properly qualified. It will not and it is not intended to keep out the consulting expert from other provinces or countries. Neither does it form an impregnable wall to exclude qualified engineers from other districts. Its basis is qualification just as in the case of the medical and legal professions.

The regulation of engineers practising in Ontario when based on qualifications protects the public from risking their money, health and lives in processes and structures controlled and erected by men who are not properly fitted to do so. It protects the engineer who has spent time and money on an education to fit him to handle these matters. It also protects the pratical man who, by his own efforts in study and experience has become qualified and needs such recognition and endorsement to place him on a more even footing with the college graduate. Against the advantages of such protection is placed the fear of intolerant and autocratic control by a ring or clique. A study of the bill readily shows that there are many safeguards against this.

Since legislation regulating the praetice of engineering has been passed in five provinces of Canada, it would be of great advantage to the profession to have similar legislation in Ontario. In addition to the advantage of free interchange from one province to another a few others might be mentioned,—more general intercourse between all engineers and not only those practising in one branch; legislation would tend to raise the status of the engineer in the community; more general recognition of the importance of the work done by the engineer; freedom from unfair competition with unqualified men; more uniform and satisfactory recompense for the important work of the engineer.

If society is to sanction such a type of bill, which may be called "class legislation", there must be good and sufficient reasons. The precedents established by the medical and legal professions may not be considered sufficient reasons, though it is difficult to see why reasons which apply to other professions should not apply to engineering. Society owes most of the comforts and conveniences of our present civilization to the scientific engineer and, if the march of civilization is to continue, society must take care that it has the engineer to guide it. Since governments support or help support colleges and schools for engineering training, it may reasonably be inferred that they recognize a necessity for such and therefore should have an interest in properly maintaining the status of the engineers they have helped to train. The public also needs some guidance to enable it to judge the qualifications of the men it employs. This need will become constantly greater as our civilization becomes more complex year by year.

Such objections as have been raised against this as class legislation or rather against legislation for this particular class have been extremely well answered in the small booklet prepared for the Association by Frank R. Ewart, M.E.I.C. It has also been said that engineers do not demand the legislation. There is no better answer to this than the large and growing membership of the Association of Professional Engineers of Ontario. The fact that such a large percentage of engineers voluntarily join this society, whose object is obtaining such legislation, is an irrefutable answer.

Lethbridge Branch

N. H. Bradley, A.M.E.I.C., Secretary-Treasurer.

The Lethbridge Branch has always been noted for its singing. There may be other Branches that can sing too. We don't know, but we have a sneaking feeling that for volume and ability to take the high notes, Lethbridge leads. Recently we have added "Oh Katarina" to our repertoire and we recommend it highly to all other branches.

Whether it is because of our singing or the addresses along professional lines, we are receiving splendid support from all branch members. It is seldom that we have less than forty men at our dinners twice a month. Most of these are, of course, Branch Affiliates, but it is the effort of this branch to make our meetings so interesting that they will attract men of other business, and thus indirectly inspire the public with the work of the engineer.

Hydro-Electric Development

On Saturday, November 7th, 1925, we had a splendid discussion on "Hydro-Electric Development" led by R. A. Brown, M.E.I.C., superintendent of the city of Calgary Street Railway and Electric Light Department.

Beet Sugar Industry

On Saturday the 21st, the members and their ladies motored to Raymond and inspected the plant of the Beet Sugar Company. In the evening we were addressed by Superintendent C. R. Wing of the plant and learned the technical process of turning a beet into sugar. Mr. Taylor, field superintendent, followed with details of the agricultural side of beet production. His job this year covered seven thousand acres of growing beets and when it is remembered that beets are still in the pioneer stage here, it may be imagined that his task of instructing farmers is no small one.

Construction of this factory commenced in the early spring and it is something of a tribute to the engineers that it was in operation on October 19th.

One and a half million dollars was the cost of erection and the plant has a capacity of a thousand tons of beets daily. The farmer is guaranteed a base price of $6.00 a ton and with a run this year of 50,000 tons, it represents the circulation of $300,000 among our farmers.

Banff National Parks

On Saturday, December 5th, C. G. Childe, A.M.E.I.C., resident engineer, Banff National Park, showed moving pictures and slides of Banff National Park. His description gave the largely attended meeting an opportunity to get better acquainted with one of Canada's National Play Grounds. Community singing and solos by Messrs. Stott and Rannard after the usual dinner helped to create that feeling of fellowship so essential to meetings.

Operation of Lethbridge Northern Irrigation District

Lethbridge Branch at its dinner meeting on December 19th had for its guests Senator W. A. Buchanan; E. H. Hann, chairman of the Trustee Board of the Lethbridge Northern Irrigation District; and A. B. Hogg, solicitor, the occasion being an address by P. M. Sauder, M.E.I.C., on the Operation of the Lethbridge Northern Irrigation District. It proved a most interesting and profitable evening and the invited guests entered largely into the general discussion which followed the address.

The musical end of the programme was well looked after as usual and violin solo by Mr. Geo. Brown, and vocal solo by Mr. Smith added much to the general enjoyment.

London Branch

E. A. Gray, A.M.E.I.C., Secretary-Treasurer.

The annual meeting of the London Branch was held at the Blue Dragon Tea Room, Wednesday, January 20th at 6.15 p.m.

Following the dinner and the presentation of the secretary's and auditor's reports, the election of officers for the ensuing year was proceeded with, the following being elected:—

Chairman	W. P. Near, M.E.I.C.
Vice-Chairman	J. R. Rostron, A.M.E.I.C.
Secretary-Treasurer	E. A. Gray, A.M.E.I.C.
Executive	E. V. Buchanan, M.E.I.C.
	F. A. Bell, A.M.E.I.C.
	W. M. Veitch, A.M.E.I.C.
	H. A. Brazier, M.E.I.C.
	R. Angus, M.E.I.C.

The retiring chairman, W. C. Miller, A.M.E.I.C., and the chairman-elect, W. P. Near, M.E.I.C., addressed the meeting.

The address of the evening was delivered by Dr. H. R. Kingston of the University of Western Ontario, his subject "Warders of the Skies" proving most interesting to those present.

Several solos were rendered during the evening by Messrs. Wood and Ballantyne and contributed very much to the success of the evening.

The following members were present:—W. P. Near, M.E.I.C., F. M. Brickenden, A.M.E.I.C., Col. I. Leonard, M.E.I.C., F. A. Bell, A.M.E.I.C., J. R. Rostron, A.M.E.I.C., R. Angus, M.E.I.C., W. C. Miller, A.M.E.I.C., C. Talbot, A.M.E.I.C., H. A. Brazier, M.E.I.C., W. M. Veitch, A.M.E.I.C., E. A. Gray, A.M.E.I.C., W. M. Smith, S.E.I.C., G. H. Chalmers, A.M.E.I.C., H. A. McKay, Jr.E.I.C., R. H. B. Cook, S.E.I.C., F. C. Ball, S.E.I.C., G. E. Martin, A.M.E.I.C., and H. B. R. Craig, M.E.I.C.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.
V. C. Blackett, A.M.E.I.C., Branch News Editor.

On January 25th, a number of members of the branch journeyed to Sackville, where a special meeting was held for the benefit of the engineering students of Mount Allison University.

Railroad Location

An exceedingly practical paper on "Railroad Location" was read by A. S. Gunn, A.M.E.I.C., assistant engineer of the Canadian National Railways. Mr. Gunn's remarks, replete with dry wit and humourous personal anecdotes made an ordinarily uninteresting subject not only instructive but extremely entertaining as well.

At the outset, the speaker declared that he did not intend to deal with the theory of railroad location but rather to give a friendly and practical talk that might be of service to any who, through ill-luck or ill-advice might find themselves on a railway survey party.

The successive steps in the building of a railway are: reconnaissance, preliminary survey, location survey and construction.

A reconnaissance party is small, sometimes consisting of but one man who, in a general way, with the aid of an aneroid barometer and hand compass, determines the grade and alignment of several possible routes. These routes having been reduced to two or three, preliminary surveys are run and then the final choice made. The average survey party consists of about fifteen men. The engineer-in-charge who directs operations should be able to do the work of any of the men under him and do it just as well. Two simple rules he would do well to adopt: (1) "Never ask a man to do anything you are unwilling to do yourself". (2) "Take darn good care that what you do ask is done". The transitman should be able in an emergency to take the place of the engineer. He should be able to set up quickly and should form the habit of reading the instrument correctly at the first attempt, without having to take a second, third or fourth reading to check the accuracy of his work. Being in direct touch with the axmen, he should carry a first-aid kit on his person. The qualifications of the leveller, as regards the handling of his instrument, are practically the same as required of the transitmen. The topographer is generally overworked and not sufficiently appreciated. On the accuracy of his work the success of the projected location depends. He should have a good eye for country, particularly contours, that is, he should be able to visualize the shore lines which would be formed by successive rises of water, such as must have occurred in that great freshet that brought disaster to all but father Noah.

The speaker discussed at some length the degrees of accuracy required in various kinds of survey work. He also dealt with the methods employed in running curves. In conclusion, Mr. Gunn touched briefly upon tachometer and aerial surveys.

A vote of thanks, moved by Prof. F. L. West, A.M.E.I.C., and seconded by Carl Anderson, S.E.I.C., was tendered Mr. Gunn for his excellent address.

Tunnelling Experience During the War

Captain R. B. Murray, of Amherst, gave a very interesting illustrated address before the branch, at the regular monthly supper meeting at the Barker House on February 15th, his subject being "Tunnelling Experience during the War".

C. S. G. Rogers, A.M.E.I.C., chairman of the branch, presided. During the evening a vocal solo was rendered by Mr. Geo. C. Davidson, while Dr. F. E. Burden favoured the gathering with a clarinet selection, both numbers being enthusiastically received.

Capt. Murray was an officer in No. 1 Tunnelling Company, attached to General Plummer's Army, and took part in tunnelling work at Hooge, Spoil Bank and Messines Ridge, the latter being, undoubtedly, the scene of the most important tunnelling in the history of warfare. In 1917 he was badly wounded in the Ypres-Menin Road district.

Until the late war, Capt. Murray said, very little attention had been given to military mining, except by the Germans. It had been rendered unnecessary for the reason that no fortification could withstand the shock of modern artillery fire. Some mining was done during the Russo-Japanese war, but none before that since Balaclava.

The advent of trench warfare, however, resulted in mining becoming a highly specialized branch of the service. From the beginning of the war, Germany had a well-trained, thoroughly-equipped mining organization. The Allies, on the other hand, were entirely unprepared, and had to hastily build up a force recruited as far as possible from men skilled in industrial mining.

The duties of a mining or tunnelling corps are two-fold—defensive and offensive. The purpose of defensive mining is to discover and defeat the plans of enemy miners. Two tunnels or galleries are driven out from the front line trench, a cross gallery connecting these two is driven parallel to the front line; from this gallery a number of blind tunnels are pushed forward toward the enemy line, and in these are posted listeners who endeavour to detect sounds of enemy tunnelling. By the aid of the geophone, mining operations can be heard through the earth for a distance of one hundred feet. Should the enemy be discovered at work, a hole is bored towards his galleries with an earth auger, and a charge pushed through and exploded.

In offensive mining, tunnels are driven forward under strong points in the enemy lines, and mines laid and exploded. The reserve trenches are chosen as starting points for these tunnels since they offer better protection from enemy raids. Furthermore, disposal of spoil without knowledge of the operations coming to the enemy, is made easier.

The standard tunnel or gallery is very small, being only two feet wide and four feet high. Comparatively little can be done in the way of ventilation, which, naturally is very poor. Towards the end of the war experiments were made with tunnelling machines, but hostilities ceased before these could be perfected.

At the conclusion of the address, a vote of thanks proposed by A. S. Gunn, A.M.E.I.C., was tendered Capt. Murray by the chairman.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-treasurer.
Stanley A. Neilson, A.M.E.I.C., Branch News Editor.

Features of the Design and Construction of the Isle Maligne Station

On January 7th, the Montreal Branch were fortunate in having as their speaker W. S. Lee, M.E.I.C., who told of a number of the many interesting features in the design and construction of this huge hydro-electric development.

Some of the difficulties which they experienced were extreme cold, a huge volume of water that did not take kindly to being diverted out of its ordinary channel and just to add to their troubles a bad fire in their material handling plant.

Mr. Lee pointed out that it had been a saving in the end to spend large sums of money on construction equipment which had expedited the work. He also made the statement that there had been more time spent on the engineering of the construction plant than on the station itself.

The approximate cost of the development, $30,000,000, is a good example of the size of the figures which Mr. Lee used all evening.

After giving his paper Mr. Lee extended a very hearty invitation to the members of the Montreal Branch to visit him and his associates at the plant next summer. This invitation was warmly applauded and, by the murmuring which followed, it would appear that the members were already arranging parties to go. They probably had in mind the very pleasant visit to the plants at Shawinigan Falls last summer.

Dr. R. A. Ross, M.E.I.C., presided in the absence of Julian C. Smith, M.E.I.C., who was confined to his home, and a vote of thanks was extended to the speaker at the close of his address by Dr. Arthur Surveyer M.E.I.C., on behalf of the branch.

Effect of Personnel on Industry

R. A. C. Henry, M.E.I.C., director of the Bureau of Economics of the Canadian National Railways read a paper on the above subject before the Montreal Branch on January 14th.

The question was put before the meeting, a number of phases of it were discussed but no attempt was made to put forth a solution.

Mr. Henry told in some detail of the workings of the various Boards in the C.N.R. which handle the greivances and keep harmonious relations between the officials and the employees.

In the discussion which followed the speakers each brought out some point which had particular appeal to them.

Dr. R. A. Ross, M.E.I.C., moved the vote of thanks.

Pulp and Paper

The development in the paper making industry and the processes involved from the time the tree is cut until it is sold in the form of newspaper was the theme of the lecture given to the Montreal Branch on January 21st., by H. S. Taylor, M.E.I.C.

Mr. Taylor pointed out that the two essentials to a modern paper mill were wood and water, the wood to supply the material and the water to supply the power and also to be used in the process of reducing the log of wood to the roll of paper. The speaker confined himself to the manufacture of newsprint, it being typical of all paper making. He gave the details of the preparation of the groundwood and the sulphite pulps and of their proper mixing before being introduced into the paper making machine itself.

Mr. Taylor gave some interesting figures of the quantities of paper that are being manufactured each year in Canada. He also gave some data as to the power required, and the materials necessary to keep a modern 400 ton mill running.

With a number of slides the main point that had been brought out in the paper were illustrated, in particular the sequence of operations through the various departments from the time the log comes out of the water until it is shipped as paper on cars or on boats.

J. W. McCammon, A.M.E.I.C., conducted the discussion from the chair.

Protective Features and Emergency Equipment of the Montreal Aqueduct

In opening his lecture on the "Protective Features and Emergency Equipment of the Montreal Aqueduct" before the branch, on January 28th, C. J. Desbaillets M.E.I.C., emphasized the 100 per cent reserve capacity available.

Speaking on what a water works meant to the community, he said that in a city of over one million population, the water works system should be looked upon as the only efficient means of protection against conflagration. The life and health of the citizens, also depended largely on the permanence and quality of the water supply. Therefore it was absolutely essential that the water supply should be free from all interruptions and pollutions.

Mr. Desbaillets then gave a brief account of the workings of the more important sections of emergency apparatus in the Montreal aqueduct.

In the new pumping station, practically the whole equipment was installed on the double system principles. After dealing with many points such as distribution systems, chlorination equipment, the lecturer dealt at some length on the new pipe tunnel under the Lachine canal. Mr. Desbaillets' lecture was illustrated with lantern slides and plans. The chairman was Geo. R. MacLeod, M.E.I.C.

In the discussion which followed the lecture, the question was asked as to what measures had been taken to prevent the pollution of the water, to which Mr. Desbaillets replied that fences had been erected and a motor cycle police squad placed at the boards disposal, whose duty it is to patrol the length of the canal continuously. There will be no more picnics permitted along the banks of the canal.

A number of other points were raised and questions answered, after which J. A. Burnett, M.E.I.C., proposed a vote of thanks to the speaker which was tendered to him by the chairman.

Presentation of Branch Charter

Presentation to the Montreal Branch of its charter from the parent organization was made on February 4th, by Major Geo. A. Walkem, M.L.A., M.E.I.C., of Vancouver, and president-elect of *The Engineering Institute of Canada.* C. J. Desbaillets, M.E.I.C., the chairman of the branch accepted the charter on behalf of his fellow members.

Before proceding to the formal presentation, Major Walkem delivered a short address directed particularly to the students present, upon the lives and contributions of the great men of science.

Electrolysis

Following the presentation of the branch charter on February 4th, P. LeBel, S.E.I.C., delivered his paper on the subject of "Electrolysis". He dealt more particularly with the application of the electrolitic method to the refining of copper. His paper was illustrated with numerous slides and was followed by a very excellent moving picture entitled, "Copper from the mine to the consumer," which showed in some detail the processes which Mr. LeBel had described in his paper.

Pulverized Coal

H. G. Barnhurst, advisory engineer to the Fuller-Lehigh Company, delivered an address on the above subject to the Montreal Branch on February 11th.

Starting with the assumption that coal was the basic fuel for power and other purposes, Mr. Barnhurst gave technical reasons why coal should be pulverized. He then told of the three operations needed, crushing, drying, and pulverizing. The ease with which coal in the pulverized form could be handled was then pointed out, the speaker telling of instances where it was pumped like water for distances of over a mile.

Some quite sharp discussion followed, local protaganists of the stoker method of firing making their side of the story known in no uncertain terms. Others who were not quite so partizan agreed that pulverized fuel was making headway and always had to be taken into consideration when figuring any new installation.

Mr. Barnhurst replied that he had not tried to create the impression that pulverized coal was putting all the others out of the game but that there were many cases where its use had produced considerable savings, there were also cases where it could not compete economically.

The vote of thanks was proposed by John T. Farmer, M.E.I.C., and J. A. McCrory, A.M.E.I.C., occupied the chair.

Dr. Barnes Lectures on Ice Engineering

An invitation has been extended to the members of the Montreal Branch to attend a series of lectures to be given on the subject of "Ice Engineering," by Dr. Howard T. Barnes, M.E.I.C., on March 4th, 11th, 18th, and 25th in the Macdonald Physics Building, McGill University. This series should prove interesting, especially to those who run into ice difficulties in hydro-electric work.

Improvements in the General Plan of the City of Montreal

On February 18th, George R. MacLeod, M.E.I.C., gave a talk to the Montreal Branch on the "Improvements in the General Plan of the City of Montreal". An abstract of this paper is published on page 176.

The discussion which followed was entered into by:—Mayor McLagan of Westmount who said a few words about the Metropolitan Commission, by Mr. Percy Nobbs who explained the position of the City Improvement League and by James Ewing, M.E.I.C., and numerous others.

W. M. Gardner, A.M.E.I.C., of the Montreal Tramways Company in proposing a vote of thanks spoke on the very satisfactory dealing which he had had with the city engineering department as regards lines and levels. J. L. Busfield, M.E.I.C., occupied the chair.

Niagara Peninsula Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

A general meeting of the branch was held on January 20th at St. Catharines for the purpose of discussing the annual dance. It was decided to hold the dance at St. Catharines as soon as possible after Easter.

Amendments to Institute By-Laws

The attention of the meeting was directed to a proposed amendment to by-law 32, which is to be discussed at the Annual General Meeting of *The Institute* in Toronto and later voted upon by letter ballot. This proposed amendment makes certain drastic changes in the policy of *The Institute* as regards "expulsion and discipline". "The present by-law reads in part as follows":—"In case the Council on receiving a complaint in writing, shall be of the opinion that the conduct of any corporate or non-corporate member should become the subject of inquiry ...., or in case twenty or more corporate members shall think fit to draw up and sign a request for such an inquiry...... ; the Council shall first notify by registered mail, the member against whom the complaint is laid, setting forth the charges and by whom made, ... Should any complainant member, after receiving due notice, fail to appear at the inquiry without having previously given reason, ... satisfactory to council, the council shall demand of such delinquent member, ..., that he furnish the defendant member through Council, a written apology satisfactory to Council, or send in his resignation from *The Institute*.

Under the proposed amendment the above provisions are altered or deleted. Council will be vested with very great powers and no twenty or more members will be able to force an inquiry. The name or names of complainant members need not be divulged to the accused and no apology or resignation is called for in the event of charges being dropped.

The meeting considered that any such changes to the present by-law are inadvisable and passed a unanimous resolution to that effect and also moved that the matter be brought to the attention of all other branches.

Henry Goldmark, M.E.I.C., the eminent authority on locks and lock gates, was a visitor to the Welland ship canal last week. It is understood that Mr. Goldmark has just been retained by the state of Maine to report upon an immense tidal power project near Passemequoddy bay. Alex. J. Grant, M.E.I.C., engineer-in-charge of the Welland ship canal and F. E. Sterns, A.M.E.I.C., chief designing engineer, are making a tour of inspection comprising the works at Muscle Shoals, New Orleans ship canal and the Panama Canal. Mr. Sterns was responsible for the design of much of the machinery and steel work on the two latter projects and will be much interested in seeing the result of his work after the practical test of years of operation.

Visit to Hydro-Electric Power House at Queenston

On February 3rd, this branch enjoyed a visit to the Hydro-Electric power house at Queenston, followed by a dinner-meeting at The Inn, Niagara Falls, and a most interesting illustrated address by D. A. Andrus, M.E.I.C., managing engineer in Canada for Sir Wm. Arrol and Company, Limited.

The staff at the power house, headed by H. L. Bucke, M.E.I.C., and L. L. Gisborne, A.M.E.I.C., took charge of their visitors at 3 o'clock in the afternoon and for more than two hours guided tham through a maze of machinery and tunnels and answered innumerable questions.

Seventy-five members signed the register and it reflects great credit on our hosts that to date none of the party has been reported as missing. It is whispered, however, that Mr. Bucke lost his voice.

At the dinner and subsequent meeting, more than a hundred members were present, a record for the season and a tribute to the popularity of this series of engineering reminiscences in foreign lands.

T. S. Scott, M.E.I.C., was recently elected to the Council of *The Engineering Institute* in the place of F. S. Lazier, M.E.I.C., who has deserted. Mr Scott thanked the members of the branch for the honour and then moved a vote of thanks to Mr. Andrus. This was seconded by Alex. Milne, A.M.E.I.C., and heartily applauded. Mr. Milne then extended a general invitation to the branch to attend the dinner, smoker and proceedings of the Canadian Section of the American Waterworks Association to be held at the Welland Inn, St. Catharines on March 4th, 1926.

In explanation of Mr. Lazier's desertion, aforementioned, it may be said that he has joined the ranks of the contracting fraternity and is reported to have stated with great feeling "since then I have been hounded by fate and crucified by brother engineers". Verily! contracting is a sad business.

Visiting members to the meetings were F. W. Cowie, M.E.I.C., late Harbour Engineer at Montreal and now acting in a consulting capacity, and W. J. Johnston, A.M.E.I.C., assistant engineer in the Department of Public Works and secretary-treasurer of the St. John Branch, F. Y. Harcourt, M.E.I.C., district engineer at Port Arthur for the Department of Public Works and Mr. Don Carlos of the Hydro-Electric Power Commission.

Inspection Trip over Welland Ship Canal

Shigeru Sameshima, engineer, Home Department of the Imperial Japanese Government made an inspection trip over the Welland Ship Canal on February 9th. The Japanese Government are replacing the sea wall at Yokohama, damaged by the earthquake, with concrete cribs, similar to those in use on the Canal and they also contemplate a thirty-five mile barge canal between Yokohama and Tokyo.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

A special standing engineering committee to advise the Dominion government on engineering projects with regard to national defence was recommended by Major-General J. H. MacBrien, chief of staff, Department of National Defence, in his address before members of the Ottawa Branch at a luncheon at the Chateau Laurier on January 14th.

General MacBrien emphasized the importance of engineering in national defence, and he urged that military engineers be given practical experience through other federal departments, and that civil engineers be given a thorough military experience which would further the engineering strength of the national defence programme.

The military engineer, past, present and future, was dealt with in a most interesting manner by the speaker. The education, qualifications, experience and value of military engineers in war were particularly dwelt upon by General MacBrien. He said that the future would undoubtedly bring about an evolution in engineering methods, although he warned that old methods should not be discarded for new inventions until they were proved reliable. General MacBrien advocated the closest possible relations between military and civil engineers, stating they were invaluable to the national defence programme.

ANNUAL MEETING

J. D. Craig, M.E.I.C., director general of surveys, Department of Interior, who has a long and distinguished term of public service to his credit, was elected chairman of the Ottawa Branch at its annual meeting held in the Daffodil Tea Rooms on the evening of January 14th. F. C. C. Lynch, A.M.E.I.C., was re-elected secretary-treasurer. New members elected to the Managing Committee were A. E. Dubuc, M.E.I.C., and W. A. Rush, A.M.E.I.C., for two years and Allan K. Hay, A.M.E.I.C., for one year. Members of the 1925 committee who continue in office for another year are: J. A. Ewart, A.M E.I.C., and S. J. Fisher, M.E.I.C.

The report of the retiring chairman, A. F. MacCallum, M.E.I.C., indicated in no uncertain manner, the success that has crowned the efforts of the branch in its various fields. Reference was made to the loss sustained through the deaths of L. F. Brinkman, A.M.E.I.C., J. J. McArthur, M.E.I.C., J. A. Symes, A.M.E.I.C., and W. J. Stewart, M.E.I.C. The reports of F. C. C. Lynch, A.M.E.I.C., secretary-treasurer of the branch, J. D. Craig, M.E.I.C., chairman of the Proceeding Committee, A. G. L. McNaughton, A.M.E.I.C., chairman of the Membership Committee, M. F. Cochrane, A.M.E.I.C., branch librarian, and S. J. Fisher, M.E.I.C., chairman of the Committee on Advertising all indicated that splendid progress has been made during the year.

J. L. Rannie, M.E.I.C., introduced a motion to be placed before the Council in Montreal to the effect that steps should be taken to appoint a representative from *The Institute* on the Advisory Committee which Major-General J. H. MacBrien, chief of staff, Department of National, Defence, is anxious to have formed with a view to utilizing the experience of engineers in the solution of problems that effect the well-being of Canada and the Empire, both from a military and civil view-point, in reality a co-ordination of the brains of civil military engineers and other technical experts.

During the evening the meeting was entertained with songs by Messrs. Jack Grace and Jack Powell.

Sault Ste. Marie Branch

A. H. Russell, Jr.E.I.C., Secretary-Treasurer.

The annual meeting of the Sault Ste. Marie Branch was held on December 18th, 1925 in the Y.W.C.A., following a dinner. The chairman Wm. Seymour M.E.I.C., called the meeting to order and called on L. R. Brown, A.M.E.I.C., city engineer, who gave a talk on "Municipal Subjects of Interest." Mr. Brown first took up the question of the renewal of the Street Railway franchise this coming summer. He outlined the early history of the International Transit Company, explaining the relationship between the existing agreement and franchise which expires on July 1st, 1926. Mr. Pickering, manager of the Transit Company, was present and was able to help out with valuable information. Mr. Brown pointed out that unless the franchise was renewed, the city would be forced to take over the street railway at a price set by arbitration. He stressed the possibility of extensions to present lines which would not be a paying proposition and also the uncertainty of the street railway, due to the motor bus.

Then the question of the diversion of the creeks in the Bay View and Steel Plant subdivision was outlined and as Mr. Brown clearly showed that an expense of $8,000 now would ultimately mean an expenditure of approximately $80,000 for a sewer system and on account of the low value of the houses and lots in this section, it would be impossible for the property owners to carry the additional taxes that would result from such an improvement.

The third subject touched on by the speaker was "Street Lighting". This question arose by the Retail Merchants Association having asked for a better system of street lighting. Mr. Brown outlined the report of the Water and Light Commission to the City Council. He explained the underground and overhead systems as used in different cities, giving a comparison of the costs. Photographs taken by him showing the types of standards and reflectors as used in other cities were exhibited. The costs and the types of standard and reflectors that would suit the conditions in the Soo were explained.

A lively discussion followed Mr. Brown's interesting talk and the interest taken was apparent by the following resolution of J. R. Ross, Jr.E.I.C. and C. H. Speer, M.E.I.C.

> "That it is the opinion of this meeting that in view of the great cost to the city, (approx. $300,000.00) in taking over the street railway we would recommend that the by-law to renew the franchise should carry".
>
> "That as the by-law for the diversion of the creeks in Bay View and Steel Plant subdivisions would later involve an ultimate expenditure of $60,000. to $80,000. for a sewer system, that this by-law should not carry."

A hearty vote of thanks was tendered to Mr. Brown for his splendid talk.

The minutes of the previous meeting were read and reports from the various committees were read and adopted. The secretary's report showed the branch in a good way financially, but the membership had a slight decrease in the district members from last year. The chairman appointed Messrs. Rounthwaite and Jenkinson as auditors.

ELECTION OF OFFICERS

The Nominating Committee then reported the result of the election of officers as follows:—

Chairman........................C. H. Speer, M.E.I.C.
Vice-Chairman....................G. H. Kohl, A.M.E.I.C.
Secretary-Treasurer..............A. H. Russell, A.M.E.I.C.
Executive Committee (2 years)......W. S. Wilson, A.M.E.I.C.
C. R. Murdock, A.M.E.I.C.

The Committee also reported that the adoption of the revised By-Law carried unanimously.

The chairman gave an account of the year's work and thanked the committees for their co-operation during the past year. He stressed the point of attendance and hoped that 1926 would see a larger attendance and also that he would like to see a closer connection with the district members.

C. H. Speer, M.E.I.C., the chairman-elect took the chair and thanked the members for the honour bestowed upon him, and said he hoped to live up to the records of his predecessors. He apparently has given a good deal of thought to the future activities of the branch as the programme that he outlined will make a busy and interesting year for the branch.

The regular meeting of the Sault Ste. Marie Branch was held on January 29th, at 7.30 p.m., at the Y.W.C.A., following a dinner of members and guests.

C. H. Speer, M.E.I.C., chairman, called the meeting to order and introduced the speaker, Mr. James Govan, R.A.I.C., a consulting architect of Toronto, who addressed the meeting on "Canadian Engineering and Architectural Problems".

CANADIAN ENGINEERING AND ARCHITECTURAL PROBLEMS

With the aid of his numerous lantern slides, Mr. Govan clearly demonstrated the advisability of a better design for buildings throughout the country. The design and construction of the average building nowadays fails, he said, to take advantage of the snow which is a natural insulator, and the sun's rays which carry natural heat from the sun. By the proper location of windows and situation with reference to the north, he added, a house that has its walls and roof insulated with any of the numerous insulating materials on the market will be the warmest in the winter and the coolest in the summer.

As the loss in Canada each year is about $60,000,000. due to faulty design and construction, he said that this loss was due to the amount of heat that escaped through the walls and roof of the building. The prevention of heat losses helps in the prevention of fire losses as the insulation used in the walls and roof in any building decreases the fire hazard.

He pointed out that the conductivity of the standard frame construction is 0.267 by test, but with the use of insulating in the walls the conductivity is reduced to 0.05 or one fifth.

Among the charts shown by Mr. Gowan was one giving the relative heat consumptions of twenty-seven houses as follows:

> Five cement, common block and reinforced concrete houses 181.5 to 221. Eight brick houses 13½ inch walls 156 to 188.5. Fourteen wooden (frame) houses 96.5 to 129. The standard adopted for comparison purposes was 100, and the house used was a standard frame construction. The frame house that registered 96.5 had the space between studding filled with shavings.

A recent test carried out by Mr. Govan on four different types of roofs showed that the roof costing the most, due to being insulated with four inches of Insulex would be the most economical, as the consumption of coal per year would be greatly reduced and also the number of feet of radiation necessary to be installed would be greatly reduced.

The concrete roof is the poorest roof that can be put on a building unless it is thoroughly well treated with one of the many insulating materials. He showed a test made on concrete walls and the wall that had not been treated with Insulex lost 395 times as much heat as the one that had been treated with it.

He showed by the use of insulating materials forming the curtain walls between pilasters or columns supporting the steel in fire proof building that the dead loads existing in the average building of that type could be greatly reduced and that in no way was the strength of the building decreased.

The speaker clearly showed that with very little additional cost at the time of construction, the average house of to-day would be much more comfortable to live in, it would have an even temperature, higher humidity and be free from all drafts, and that this additional construction cost would be wiped out the first year on the saving on fuel and heating plant. The question of fuel economy is a vital one to Canadians, he said, at the present time.

The two hours that Mr. Govan used in making his address were considered well spent by all present, and the interest that was aroused was shown by the numerous questions asked and the lengthy discussion on building that followed the address.

On motion of C. H. E. Rounthwaite, A.M.E.I.C., and L. R. Brown, A.M.E.I.C., a hearty vote of thanks was tendered Mr. Govan for his most interesting and instructive talk, and the appreciation of the branch was extended to Mr. J. Biscomb for being instrumental in getting Mr. Govan to come to Sault Ste. Marie.

Saint John Branch

J. W. Johnston, A.M.E.I.C., Secretary-Treasurer.

Following its policy of making available to the general public any lectures of a popular nature the Saint John Branch met at a joint dinner and meeting with the Men's and Women's Canadian Clubs on the evening of January 6th, at the Admiral Beatty hotel. An assembly of over 200 persons enjoyed a fine supper and were later addressed by George P. Mackenzie, A.M.E.I.C., officer-in-charge, Canadian Arctic Expedition, 1925, speaking on the cruise of C. G. S. "Arctic" in northern waters during 1925. The favourable comment from those present at the action of the Saint John Branch in having others to share in the meeting showed that all present were pleased with the innovation.

The address by Mr. Mackenzie dealt with a subject of which the average Canadian knows very little and consequently in which he takes little interest. The fact that Canada's northland is rich in fur products, has mineral possibilities, and is a worth-while part of Canada was forcefully brought home to the audience. It was a good story well told to a gathering including most appropriately the members of the two Canadian Clubs.

In detail the voyage of the steamer "Arctic" from her departure from Quebec on July 1st, 1925, until her return there 102 days later was described. Four reels of moving pictures were shown and included a map showing the progressive stages of the journey.

After leaving Quebec on July 1st. the steamer "Arctic", under Capt. J. E. Bernier as chief navigating officer, sailed along the coast of Labrador. On July 18th, the steamer became wedged in the ice while attempting to reach Cumberland gulf to land supplies at Pangnirtung but after a 20-day struggle had to abandon the effort for the time being. The ship proceeded to Disco island, Greenland, and up the eastern side of the strait to Godhavn, Greenland which was reached on August 10th, Under the Danish government there is a local parliament for Greenland which was then in session. Some of the members of the expedition were entertained on shore by Governor Rosendahl and this courtesy was returned on board ship to the members of the local parliament by the members of the expedition. A noteworthy feature of their stay there was the resolution of good-will to the expedition passed by the members of parliament.

On August 11th, the ship left Godhavn and after many experiences with the ice arrived on August 21st, at Fram harbour, 78 degrees 46 minutes north latitude, this being the most northerly point reached on the voyage. After a stay of several days the ship started on the return voyage calling en route at Craig harbour, on Ellesmere island; Dundas harbour, on Devon island; Pond's inlet on Baffin island; and finally a successful landing was made at Pangnirtung where it was previously unable to land. The ship arrived at Quebec on October 10th.

The trip was made for the purpose of landing of supplies at the posts of the Royal Canadian Mounted Police, for the delivery and collection of mail, and to keep in touch in general with Canada's northern territory. Included in the party on the outward voyage was Dr. L. P. Livingston, as surgeon; L. J. Weeks of the Geological Survey, Department of Mines geologist; Captain Harwood Steele, secretary; Messrs. R. M. Foster and R. S. Finnie, wireless operators; G. H. Valiquette, cinematographer; Inspector Wilcox and several constables of the Royal Canadian Mounted Police.

W. R. Pearce, M.E.I.C., presided over the meeting. Others at the head table included Mr. and Mrs George P. Mackenzie; Lt-Col. E. C. Weyman, O.B.E., president Men's Canadian Club; Mrs. A. H. Fitz-randolph, president Women's Canadian Club; Mrs. H. A. Powell; Hon. R. J. Ritchie; Geoffrey Stead, M.E.I.C. A vote of thanks was extended the speaker on motion of Lt.-Col. Weyman and Mrs. Fitz-randolph.

Dinner and Meeting

Members of the Saint John Branch held a dinner on the evening of January 21st, 1926, at the Admiral Beatty hotel. In addition to branch members there were also in attendance members of the Association of Professional Engineers of the Province of New Brunswick, the annual meeting of the Professional Association being held in the afternoon. Forty-five persons were present and enjoyed a splendid meal- A. R. Crookshank M.E.I.C., presided and guests of honour were Lt.. Commander C. P. Edwards, A.M.E.I.C., Ottawa, and F. O. Condon, M.E.I.C., Moncton, retiring president of the Association of Professional Engineers of New Brunswick. No formal toast list was carried out but the following members spoke briefly, Lt.-Commander C. P. Edwards, A.M.E.I.C. and Messrs. F. O. Condon, M.E.I.C., A. Gray, M.E.I.C., and Geoffrey Stead, M.E.I.C.

Radio Direction Finding

Following the dinner an illustrated lecture on "Radio Direction Finding" was delivered by Lt.- Commander C. P. Edwards, A.M.E.I.C. The subject of this lecture was of especial interest to this locality with a radio direction finding station located in the vicinity of the port of Saint John as one of the safe-guards to navigation.

The story of radio and wireless was traced through the several discoveries since 1878 of J. Clerk Maxwell, Sir Oliver Lodge, Marconi, and others, and mention made of the research work and inventions of one being of assistance to later workers. Previous to radio direction finding being adopted the navigator had to depend on observations on sun and stars for ship's position and where practicable soundings were also of assistance. At present ships within range of radio direction finding stations may be safely guided through fog or darkness around obstructions or shoals. Radio direction finding is also of use in air navigation and by its means many airplanes have been piloted to safety.

The technical features underlying transmitting and receiving wireless stations were explained by a number of slides. The subject was further illustrated by several reels of motion pictures. A vote of thanks was extended on behalf of the branch by Geoffrey Stead M.E.I.C., and F. P. Vaughan, M.E.I.C.

On the following night Lt-Commander Edwards repeated his address at the University of New Brunswick at Fredericton before the engineering students and members of *The Institute* resident in Fredericton. This lecture was also very much enjoyed and the kindness of Lt.-Commander Edwards in repeating his address was very much appreciated.

Saskatchewan Branch

J. W. D. Farrell, A.M.E.I.C., Secretary-Treasurer.

The November meeting of the Saskatchewan Branch was held at the Parliament Buildings restaurant on November 12th, R. N. Blackburn, M.E.I.C., presiding. Following the dinner the meeting was commenced in one of the committee rooms. The programme being the second of a series put on by different occupational groups, was devoted to "Town Planning and Surveying", and was arranged by Messrs. Loucks and Young. By way of atmospheric prologue some excellent lantern slides were exhibited. These had been kindly loaned by the Department of Education and showed the results and benefits of tree planting on the prairies.

Lt.-Col. A. C. Garner, D.S.O., M.E.I.C., called the attention of the branch to the death of the late Gen. Ruttan who had been an outstanding man amongst western engineers. A resolution of deep sympathy and regret at the passing of Gen. Ruttan was moved by Col. Garner and seconded by Stewart Young, A.M.E.I.C., the resolution to be conveyed to the immediate family of the deceased, to Institute headquarters and to the Winnipeg Branch.

Work of some Branches of the Department of the Interior

The chairman then called on Col. Garner for his address on "An Outline of the Work of some Branches of the Department of the Interior" The speaker prefaced his remarks by recalling a very pleasant visit recently made to Ottawa where he was greatly impressed by its natural beauties and spoke of that city as the Edinburgh of Canada. The speaker then outlined the different branches of the department's work, covering Dominion lands, natural resources, water power and reclamation, forestry, parks, observatories, international and provincial boundries and the different classes of surveys such as topographic, geodetic, aerial, etc. While not encroaching on local or provincial adminstration, much of the department's work is international and has earned for Canada a recognized place at international conferences, as for example the Power Conference at Wembley in 1924. By such means Canada is becoming well and favorably known to other nations.

In forestry, the department, from investigations, estimates that originally Canada possessed 1,300,000 square miles of standing timber, of which it is estimated 60 per cent has been destroyed by fire, 13 per cent has been cut, 27 per cent left. The department recognizes the need for conservation, afforestation and fire prevention.

In the Arctic Archipelago, surveying and other work is going on in connection with establishing Sovereignty. Geodetic and boundry surveys and precise levelling are being carried on at different points from coast to coast. Wireless signals broadcasting Standard time have been particularly helpful in geodetic work. Brief descriptions were also given of the two Dominion observatories at Ottawa and Victoria, of the work of the Department of Natural Resources and of the testing laboratory. Topographical surveys include the examination and classification of thirty million acres of land in western Canada during the past six years. Section sheet maps of the Dominion are under preparation, of which thirty-three have been completed and published in the last six years.

In connection with map making and exploration of new areas, Col. Garner exhibited some very fine specimens of aeroplane photography and maps compiled therefrom and outlined the co-operation between the Royal Canadian Air Force and the Department of the Interior that existed for the carrying on of this phase of the work.

In concluding, Col. Garner paid tribute to the work of the Dominion Land Surveyors and the work which they had done in opening up new territories.

HISTORY OF TOWN PLANNING

The chairman then called on Stewart Young, A.M.E.I.C., for his paper on "History of Town Planning". First example of a comprehensive plan is that of Kahun in Egypt built about 3000 B.C. Selinus in Sicily, established in 628 B.C., was also laid out on geometric lines. The Romans in building some of their newer cities followed definite plans with regard to the layout of the cities.

In the middle ages the growth of towns was slow and the arrangement of streets and buildings for the most part haphazard. Towards the end of the mediaeval period prosperity promoted the beautifying of public squares and public buildings.

In the sixteenth century Italian towns commenced straightening and widening their streets and improving public places. The movement spread to France and soon became general throughout Europe.

Town plans may be classified as, radial, rectangular, or a combination of these two.

In the nineteenth century industrial expansion and lack of a directing authority in building and planning of cities lead to traffic congestion and slum conditions. To rectify these evils the zoning system was evolved in Germany and spread to other countries. In England, Port Sunlight and Bournville were built in an effort to achieve model towns. Some time later Letchworth was built following on the ideas advanced by Howard in his book "Garden Cities of Tomorrow".

In the United States progress had been fairly rapid since 1916 and today at least 50 per cent of the urban population in some three hundred and fifty urban cities is under zoning regulations.

In Canada legislative provision has been made in the statutes of most of the Provinces but on the whole little has been done in the way of comprehensive town planning.

PARKS AND BOULEVARDS

The chairman then called on J. M. Craig, Superintendent of City Parks for his address on "Parks and Boulevards". Mr. Craig dealt chiefly with the parks system in Regina saying that it comprised some 257 acres and included about 200 park and play ground areas. A census taken in 1923 showed that there were approximately 43,000 trees in the city counting publicly and privately owned trees but not counting trees in the Parliament Buildings grounds. At present the city has some 65,000 to 75,000 trees in the nursery, of which 5,000 are ready for planting out. Mr Craig advocated the planting of the elm tree on account of its beauty, long life and being fairly free from blights. The Russian poplar has the advantage of quick growth but has a life of only twenty-five to thirty years. The city has about thirty-four miles of improved boulevards in grass and trees and five miles of new boulevards under construction. The cost for maintenance is about 3½ cents per foot annually. In conclusion Mr. Craig outlined plans for the future expansion of Wascana park, including a drive-way along the lake shore easterly to the power house, in co-operation with the provincial government.

SOME COURT DECISIONS BEARING ON SURVEYING

R. W. E. Loucks, A.M.E.I.C., was then called on for his paper on "Some Court Decisions Bearing on Surveying". As the hour was late Mr. Loucks spoke briefly on the following subjects: Conflicting evidence with regard to boundry mound. In this case the decision was given in favor of the evidence supported by the earliest survey. The matter of adverse possession was touched on briefly showing the peculiar situation of ownership without title. A case concerning validity of railway location plans was also described.

JOINT MEETING WITH A. I. E. E.

On December 15th the Saskatchewan Branch E.I.C. joined with the Saskatchewan Section A.I.E.E. in holding a social evening in the City Hall auditorium. The first part of the evening was devoted to a whist drive. Following this, supper was served and the remainder of evening spent in dancing.

Toronto Branch

C. B. Ferris, A.M.E.I.C., Secretary-Treasurer.
J. W. Falkner, A.M.E.I.C., Branch News Editor.

The monthly luncheon of the Toronto Branch was held on January 7th, at the King Edward Hotel, when R. A. C. Henry, M.E.I.C., director of the Bureau of Economics, Canadian National Railways, addressed the branch.

THE MOTOR VEHICLE VS. OTHER FORMS OF TRANSPORTATION

Mr. Henry predicted that to that extent to which the motor vehicle can, all factors considered, perform more economic and convenient service than other existing means of transportation it must ultimately supplant them. He thought it distinctly in the public interest that co-operative effort should strive for the assignment of each of the various available transportation facilities to its most economic field, and that their services should be so co-ordinated as to produce "the most convenient, adequate, regular, expeditious and economic transportation system possible."

"I am not an advocate of undue regulation of any transportation service," said the speaker, "nor do I believe that any special protection should be given to any form of transportation not economically sound. It is a fact, however, that in the period of development of steam and electric railways to date there has been developed a code of regulations applicable to these forms of transportation which materially affect the cost of the transportation provided by these facilities, and it is, I think, but reasonable to suggest that the motor vehicle when engaged in common carrier service should be similarly regulated.

"As regards taxation," he continued, "it would be unwise to unduly tax common carrier motor vehicles. It seems to me but fair that the motor vehicle as a freight or passenger facility,(apart from reasonable private use), should bear the cost of the additional capital and additional maintenance which such traffic involves and pay in addition the same amount relatively that other forms of transportation pay in taxes."

He foresaw a distinct field for the motor-vehicle in handling urban passenger traffic in co-operation with the electric street railway. For suburban passenger traffic it would appear, beyond a certain density of highway traffic, to require a private roadway. For local and interurban passenger hauls, the motor vehicle might in some instances replace steam and electric railway services. Its successful use on long-distance passenger hauls would, however, have to wait on the solution of a number of important problems.

THE WORK OF THE ONTARIO EXPERIMENTAL STATION IN PROMOTING THE ART OF SEWAGE DISPOSAL

On January 21st a paper was read before the Toronto Branch by F. A. Dallyn, M.E.I.C., director, Sanitary Engineering Division, Ontario Department of Health, and A. V. DeLaporte, A.M.E.I.C., chemist in charge of Experimental Station, on "The Relation of the Experimental Station to the Advances in Sewage Disposal in the Last Decade".

After dealing with the history of experimental station work on this continent and in the old country, and explaining the difference between a laboratory experiment, — which was usually on a small or restricted scale, giving little information regarding plant operation or design, — and work in an experimental station, the paper then outlined the reasons that in 1909 had impelled the Ontario Government to place such a station at the disposal of the Provincial Board of Health, showing that since that date there had been developed a mass of data having special regard to Ontario's local climatic conditions, storm water and trade waste problems, discharges into small water courses, and similar problems, that was leading to the installation of better plants for sewage treatment.

Intensive study had been given to the biological processes for the digestion of organic matter in sewage, aerobic vs. anaerobic digestion, experimental work in connection with activated sludge, the effect of agitation, spiral flow tanks, separate digestion, iron content, fertilizing value, stability of effluents, etc. Such study showed the simplicity of control of the activated sludge process.

The paper was very fully illustrated with tables and experimental data, and samples of sewage, sludge, effluents, etc., from different plants were handed around for inspection; following which an experiment was made showing that the oxygen dissolved from the air used for agitation could only account for a fraction of the reduction in the oxygen demand of the sewage so treated.

Professor T. R. Loudon, M.E.I.C., extended the thanks of the branch to the authors for their excellent paper and for the trouble to which they had gone in setting up their apparatus.

LUNCHEON TO GEORGE HOGARTH, M.E.I.C.

A well attended luncheon meeting was held on February 4th, at the King Edward hotel in honour of George Hogarth, M.E.I.C., formerly chief engineer of the Ontario Department of Highways, who was recently appointed deputy minister of public works; Mr. George Henry, minister of public works also being a guest of the meeting.

The chairman, Professor T. R. Loudon, M.E.I.C., offered the congratulations of the meeting to Mr. Hogarth, and expressed his pleasure that Mr. Henry had also found it convenient to be present, following which Mr. Henry addressed the meeting, outlining the functions and the probable future developments of his department, and introducing the new deputy minister.

Mr. Hogarth then addressed the meeting, dealing with the history of the highway system of the province, the different types of highways, and recent improvements in methods of construction and maintenance.

Engineering Specifications

A very timely address was given on February 11th, by S. E. Craig, assistant laboratory engineer, Hydro-Electric Power Commission of Ontario, on "Engineering Specifications".

Mr. Craig dealt with his subject in a very full, practical and interesting manner, paying special attention to the different viewpoints and functions of the engineer, resident engineer, contractor, sub-contractor, inspector, foreman, etc., and dealing with those features that would have to be observed in the writing of a specification to ensure a concise and practical document, readily understood by and equitable to all parties, and resulting in material and workmanship of the desired standards at the lowest cost to the client.

A spirited discussion took place at the conclusion of Mr. Craig's paper.

Annual Meeting Committee's Work Appreciated

The members present passed the following resolution:—"That the hearty thanks and appreciation of the branch be tendered to the Chairman and members of the Annual Meeting Committee for the able and highly satisfactory manner in which they applied their efforts, organized and conducted the Annual General and Professional Meeting for 1926".

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

The Annual meeting of the Victoria Branch was held in the club-room of the branch on Wednesday evening, December 9th, 1925, the room being comfortably filled.

Election of Officers

The chair was taken by G. B. Mitchell, M.E.I.C., chairman of the branch, after dealing with routine matters, Messrs. Carruthers and Hodgson were appointed to act as scrutineers and ballotting took place for officers for 1926, with the following results:—

Chairman.....................J. N. Anderson, A.M.E.I.C.
Vice-Chairman................M. P. Blair, M.E.I.C.
Secretary-Treasurer............E. G. Marriott, A.M.E.I.C.
Executive......................E. P. Girdwood, M.E.I.C.
" ....R. F. Davy. A.M.E.I.C.

The following are also on the Executive, having been elected in 1925 for two years.

E. E. Brydone-Jack, M.E.I.C.
P. Philip, M.E.I.C.
G. B. Mitchell, M.E.I.C., past-chairman, *ex-officio*.

A hearty vote of thanks was passed to the retiring officers for their services, and an honorarium unanimously voted to the retiring Secretary-treasurer for his untiring work of the past five years as treasurer, and then as secretary-treasurer.

The new chairman then took the chair, and after asking the membership of the branch to support the efforts of those who freely gave their time and interest to serve their fellow-engineers, called upon Mr. Mitchell to give his talk on his experiences in Central and South America.

This proved to be a very out-of-the-ordinary address, dealing mostly with the natural history, botany, climate, local customs and other interesting phases of an engineer's life in Nicaragua, Peru and Chile. The paper of course lacks the running comment and humour that made it so enjoyable to those present. It was unanimously voted to be one of the most interesting talks the members had heard, and was followed by reminiscences from other members who had seen life in various parts of the world.

Appointment of Committees

At an executive meeting held on December 15th, the following committees were appointed by the chairman:—

Papers:—Convener, F. L. Macpherson, M.E.I.C., W. S. Drewry A.M.E.I.C., A. F. Mitchell, A.M.E.I.C., A. L. Carruthers, M.E.I.C., K. Chadwick, A.M.E.I.C.

Duties:—To secure speakers, settle place of meeting make all arrangements for use of room, working of lantern, etc. Arrange for outings, visits, speakers for lunches.

Town Planning;—Convener, M. P. Blair, M.E.I.C., R. Fowler, M.E.I.C., F. M. Preston, A.M.E.I.C., F. C. Green, A.M.E.I.C., R. F. Davy, A.M.E.I.C., H. F. Bourne, A.M.E.I.C.

Duties:—To keep in touch with the progress of town planning, report if branch can assist locally, arrange with Papers Committee for speakers if desirable, etc.

Social:—Convener, W. M. Everall, A.M.E.I.C., E. P. Girwood, M.E.I.C., F. G. Aldous, A.M.E.I.C., A. J. Gray, A.M.E.I.C., G. B. Forde, S.E.I.C.

Duties:—To arrange lunches at request of executive, see to details, also arrange details and superintend outings, visits, etc.

Library:—Convener, F. W. Knewstubb, A.M.E.I.C., H. Peters, A.M.E.I.C., H. Icke, A.M.E.I.C., W. M. Stokes, A.M.E.I.C., E. G. Marriott, A.M.E.I.C.

Duties:—To see to upkeep of club-room, and make recommendations as to purchase and disposal of magazines, etc.

Publicity:—Convener:—G. B. Mitchell, M.E.I.C., A. W. R. Wilby, A.M.E.I.C., S. Hodgson, A.M.E.I.C., W. S. Lawrence, Jr. E.I.C., J. H. Blake, A.M.E.I.C.

Duties:—To submit items of public interest concerning engineering and engineers to the press, and secure items of branch news for *The Journal.*

Applications, Attendance, and Legislation committees are composed of the whole Executive.

Winnipeg Branch

James Quail, A.M.E.I.C., Secretary-Treasurer

A regular meeting of the Winnipeg Branch, was held on Thursday December 17th, in the evening.

G. S. Roxburgh, A.M.E.I.C., manager of the Winnipeg office of Fetherstonhaugh and Company, patent barristers, was the speaker of the evening. His subject was 'Patents and Inventions' and was illustrated by lantern slides.

Mr. Roxburgh sketched the history of the development of British Patent Law, that of the United States, and that of Canada. Principles involved in patenting and patents, and what, as the result of the application of the principles, might or might not be patented were discussed. Applications for patents, and the filing of them were explained. Details were given as to the number of patents applied for in different sections and over particular periods, and comparisons were drawn. Attention was directed to the class of patents being applied for, and generally, by whom. Protection of employees in the case of patentable articles worked out in the time of an employer, was noted.

E. P. Fetherstonhaugh, M.E.I.C., moved the vote of thanks.

Preliminary Notice

of Applications for Admission and for Transfer

February 19th, 1926

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in March, 1926.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council, shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering with special reference to the branch of engineering in which he has been engaged. This examination may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects: geography, history, (that of Canada in particular), arithmetic, geometry, euclid (books I, IV and VI), trigonometry, algebra up to and including quadratic equations.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed successfully an examination equivalent to the final examination of a high school or the matriculation of an arts or science course. He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which cash he shall pass an examination equal to that prescribed for admission to the grade of Junior in the foregoing section and he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineer in the advancement of professional knowledge.

> The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BOIVIN—THOMAS JOSEPH, of 189 Holland Ave., Quebec, Que. Born at Quebec, P.Q., Aug. 19th, 1894. Educ., private tuition; I.C.S. structr'l and civil engr'g. diploma; at present continuing course in structr'l. engr'g., Univ. of Wisconsin; 1910-13, constrn. work with M. P. & J. T. Davis, contracting engrs.; 1914-19, checking and designing, and at present chief dftsman., under F. T. Cole, M.E.I.C., Eastern Canada Steel & Iron Works, Ltd., Quebec, P.Q.

References: F. T. Cole, I. Vallee, J. E. Roy, E. Lavigne, A. Fraser.

BOLTON—LAUNCELOT LAWRENCE, of Ottawa, Ont. Born at Portland, Ont., Sept. 14th, 1881; Educ., M. A. 1903, and B.Sc., 1906, Queen's Univ.; 1907-14, geologist and utility engr., Mines Dept., Lake Superior Corpn., Sault Ste. Marie, student asst. under Dr. R. W. Brock, M.E.I.C., studying economic geology of Rosslind Mining Camp, asst. engr., calculation of ore reserves in iron mines in Ontario, Minnesota and Michigan; 1915-26, with Dept. of Mines, Ottawa, as follows:—asst. mining engr., Divn. of Mineral Resources and Statistics—1916, private secretary, Office of Deputy Minister, 1919, Secy., Dept. of Mines, and at present, Asst. Deputy Minister.

References: C. H. Speer, J. D. Jones, R. S. McCormick, C. H. E. Rounthwaite, G. C. Mackenzie, C. Camsell, B. F. Haanel, L. H. Cole.

BOULIAN—JOB IVAN, of Montreal, Que. Born at Mattawa, Ont., Aug. 9th, 1888; Educ., Case School of Applied Sci., Cleveland, Ohio, 1915-17, and partial course electricity, McGill Univ., 1919-20; 1910-12, rodman and instr'man., Algoma Central & Hudson Bay Rly.; 1912-14, chief of party, traverse and hydrographic survey, Algoma Steel Corpn., power dept., J. S. H. Wurtele, M.E.I.C., chief engr.; 1917-19, overseas; 1919 to date, dftsman., designer, field engr., supt. of transmission line and substation constrn., and at present, asst. constrn. engr., Southern Canada Power Co., Ltd., Montreal, Que.

References: J. B. Woodyatt, J. S. H. Wurtele, J. H. Trimingham, F. F. Griffin, T. C. Connell.

BRETCHEN—MAX, of 834,—7th Street South, Lethbridge, Alta. Born at Winterthur, Switzerland, May 22nd, 1895; Educ., Land Surveyer, Diploma from Swiss Confederation, 1918. At present taking I.C.S. rly. engrg.; In Switzerland, surveying and mapping in mountainous districts, topographical work in connection with constrn. of waterworks, pipe lines, reservoirs, constrn. of roads and drainage etc.; 1920-23, dftsman., field and office, C.N.R.; 1923 to date, with C.P.R. as follows: 1923, instr'man. on mtce., 1923-24, dftsman. and instr'man. on location, 1924 to date, instr'man. on constrn.

References: E. A. Kelly, T. Lees, H. R. Miles, L. S. Daynes, T. W. White.

BRIDGE—ALEXANDER CHARLES, of 230 Prud'homme Ave., N.D.G., Montreal, Que. Born at Swansea, South Wales, Dec. 27th, 1894; Educ., High School, Belfast, Ireland; 1910-12, ap'tice., Canadian Car & Foundry Co., Ltd.; 1912-14, Dominion Bridge Co., Ltd.; 1914-16, Canadian Car & Foundry; 1916-18, dfting., Canadian Allis-Chalmers; 1918 (8 mos.) military service; 1919-20, chief dftsman., John McDougall Co.; 1920-23, mech'l. designer, Darling Bros.; 1923 to date, chief dftsman., Canada Sugar Refining Co., Ltd., Montreal.

References: D. C. Tennant, J. B. Bladon, J. D. Alder, R. E. Chadwick, C. W. Burroughs, K. G. Cameron, F. W. Taylor-Bailey.

BROUGHTON—WILLIAM HAMILTON, of Calgary Alta. Born at Great Grimsby, England, May 18th, 1878; Educ., Hull Municipal Tech. Coll., 1898-1900, Goldsmith's Coll., London, 1906-07; 1st class British Ed. of Trade and 1st class Alberta Steam Engineer's Certificates; 1895-1900, articled ap'tice., mech. engr'g., with Amos & Smith, Hull, Eng.; 1900-01, machinist, Britton & Co., Grimsby; 1901-05, marine engr., The Wilson Line, Hull; 1905-07, consltg. engr., supervising constrn., etc., steam trawlers; 1907-14, marine supt., S. Pearson & Son, Ltd., London, Eng.; 1914-20, partner, The Red Deer Iron Works; 1921 to date, instructor in industrial mech. engr'g., The Provincial Inst. of Technology & Art, Calgary, Alta.

References: W. D. Armstrong, B. L. Thorne, K. Moodie, J. A. Spreckley, C. C. Richards, R. M. Dingwall, J. H. Ross, J. T. Watson.

BRYANT—ORVILLE FRANK, of Grand'Mere, Que. Born at Meredith, U.S.A. Aug. 27th, 1887; Educ., B.S., New Hampshire Univ., 1910; 1911, chemist, New York, New Haven and Hartford Railroad; 1912-14, chemical engr., Nekoosa-Edwards Paper Co., Port Edwards, Wisconsin; 1914-18, Chief, div. of pulp and paper, Forest Products Laboratories, Montreal; 1918-20, tech. supt., Bennett Ltd., Chambly, P.Q.; 1920, chemical engr., Laurentide Co., Ltd., Grand'Mere, Que., to date.

References: H. O. Keay, H. E. Bates, E. Wilson, J. S. Bates, W. G. Mitchell.

CAMERON—EDWARD PARKE, of 260 Hampton Ave., Montreal, Que. Born at London, Ont., May 24th, 1893. Educ., B.Sc., (Chem. Eng.) McGill Univ., 1920; 1914, student employment, Gulf Pulp & Paper Co., Clarke City, P.Q.; 1920 to date with Forest Products Laboratories of Can., Montreal, as follows: 1920-22, assoc. chemist i/c research, 1923 to date, chemist and chief of Division of Pulp & Paper. (Placed on loan to the Research Section Can. Pulp & Paper Assoc. by the Federal Govt. Apr. 1925 to act as Director of Division of Pulp and Paper under co-operative research agreement between this Assocn. and Govt.)

References: J. S. Bates, D. R. Cameron, W. E. Blue, F. E. Bronson, S. A. Neilson.

CARSON—WILLIAM JAMES, of Grand'Mere, Que. Born at Danville, Que., Aug. 11th, 1894; Educ., A. A., Danville Academy, 1910; and I.C.S. course in surveying and mapping; 1910-11, rodman; 1911-12, field engr's. asst. and mech. dfting., with Laurentide Co., Ltd., Grand'Mere; 1912-15, field engr. on constrn., Laurentide Power Co. Plant and dam, including topogr. survey of St. Maurice River; 1915-16, forest surveys for Forestry Dept., same company; 1916-19, overseas; 1919-22, field engr. for constrn. water supply for City of Grand'Mere, and 1922 (May-Sept.) design of new sewage layout for city; 1922 to date, woods engr., also field engr. for constrn. around plant, with Laurentide Co., Ltd.

References: H. O. Keay, H. E. Bates, E. Wilson, C. E. Gelinas, W. S. Lea, J. F. Laurence, J. A. Michaud, J. A. Bernier.

COOTE—JAMES PERCY, of Nelson, B.C. Born at Leamington, England. Feb. 13th, 1890; Educ., pupil, John E. Sweet, consltg. engr., Syracuse, N.Y., 1906-11, and pupil, J. Rose, M.Sc., London, Eng., 1911-12; 1912-13, asst. on survey and road location, British Columbia; 1914, design and erection of timber and concrete structures; 1915-19, Lieut. Capt. and Adj. Maj. in command, Royal Engrs.; 1920 to date, locating and res. engr., location, design and constrn., highways and bridges, Dept. of Public Works, British Columbia.

References: A. Robertson, P. Philip, P. E. Doncaster, A. McCulloch, W. Ramsay.

CURRY—ANGUS DOWNES MATHWIN, of Ottawa, Ont. Born at Newcastle-on-Tyne, England, Aug. 14th, 1889; Educ., private studies, Royal Naval Engineering Coll., Keyham, Eng., 1904-08; 1908-10, ap'tice., with the White Star Line, Liverpool, England; Aug. 1910 given commission as Eng. Sub. Lieut., R.C.N.; promoted to Engr. Lieut., R.C.N., 1912, and to Engr. Lieut. Commnr., R.C.N., 1920; instruction of engineering at Royal Canadian Naval Coll., 1914-15 and part 1917; 1919-24, in charge consecutively of machinery of H.M.C.S. "Nicke", H.M.C.S. 'Patriot", H.M.S. "Wanderer"; 1924-25, i/c refitting of light cruisers and destroyers, H.M.Dockyard, Chatham, England; at present, asst. to consulting naval engr., Dept. of National Defence (Naval Service) Ottawa, Ont.

References: T. C. Phillips, J. F. Bell, G. L. Stephens, R. H. Wood, A. G. L. McNaughton.

CUTTLE—WILLIAM GORDON, of Grand'Mere, Que. Born at Montreal, Que., May 8th, 1895; Educ., B.Sc., McGill Univ., 1923; 1920 (summer) instr'man., and 1921 (summer) asst., Can. Geological Surveys; 1922 (summer) asst., C.P.R. Natural Resources Survey; since graduation to date, steam plant supt., Laurentide Co., Ltd., Grand'Mere, Que.

References: H. O. Keay, E. Brown, A. R. Roberts, H. E. Bates, D. Bremner.

DENNISON—GEORGE HENRY EDWARD, of Sault Ste Marie, Ont. Born at Renfrew, Ont., Feb. 10th, 1898. Educ., Grad., R.M.C., 1920; 1917 (summer) on survey work Georgian Bay Islands, with G. L. Ramsay, D.L.S.; July 1923 to date, with Spanish River Pulp & Paper Mills on office and gen'l. dfting., surveying, etc.

References: Geo. H. Kohl, J. W. LeB. Ross, J. L. Lang, R. A. Campbell, W. S. Wilson.

ELLIS—FRANK DORMER, of 35 Normandy Blvd., Toronto, Ont. Born at Toronto, Oct. 30th, 1895; Educ., B.A.Sc., Univ. of Tor., 1918; 1917 (Apr.-Oct.) instr'man. Toronto Harbour Commn.; 1918-19, engr. i/c wood testing, Can. Aeroplane Co., Toronto; 1919-20, dftsman., i/c steel design, T. B. Coon & Son, architects, Toronto; 1920-21, instr'man., i/c sub-residency, Dept. Public Highways; 1921 (Apr.-Nov.) asst. supt., Johnson Bros. Co., Ltd., gen. contrs., Brantford, Ont.; 1921-24, field supt., same company; 1924 (Apr.-May) res. engr., on Port Colborne Waterworks, for E. H. Darling, M.E., Hamilton, Ont.; 1924-25, constrn. engr., Gardner Constrn. Co., Welland, Ont.; June 1925 to date, divnl. engr., constrn. dept., Sterling Appraisal Co., Ltd., Toronto, Ont.

References: E. H. Darling, H. P. Heywood, R. S. C. Bothwell, R. Marshall, C. R. Scott, E. A. James, N. D. Wilson, N. G. McDonald, P. Gillespie.

FORTIER—HENRI, of 4368 Delorimier Ave., Montreal, Que. Born at Lachute, Que., Oct. 13th, 1886; Educ., C.E., Laval Univ., 1915; 1911-13, 2 years with Arthur Surveyer, M.E.I.C., and A. Frigon, A.M.E.I.C., on hydro-elec. plants and city survey; 1915 to date as follows: 7 years, with Canadian Inspectn. & Testing Co., Montreal, on inspectn. structural steel; last 5 yrs. i/c cement laboratory; 5 mos., engr. and supt., erection of plant of Silica Co.; 5 mos., asst. supt., Standard Line Co., Joliette, on design structural steel bldgs., etc.; 3 yrs., tech. service, City of Montreal, and at present, engr., Technical Service of the City of Montreal.

References: G. R. MacLeod, J. G. Caron, N. J. A. Vermette, L. G. Boisseau, W. T. Jamieson, L. Laferme, C. E. P. Moretti.

FORTIER—LEWIS HENRY, of 60 Duggan Ave., Toronto, Ont. Born at Toronto, Oct. 23rd, 1887; Educ., Trinity Coll. School and one year, S.P.S., Toronto; 1905-1906, with Speight & Van Nostrand, land surveyers, Toronto; 1907-10, office and field work, Roadway Section, City of Toronto; 1910, gen'l. contracting, Toronto; 1911-12, asst. engr. on sewers and paving, 1912-16, supt. of streets, Moose Jaw; 1917-18, field engr., Imperial Munitions Board, Aviation Section; 1922-25, field engr. and inspr., Toronto Transportation Commn.; at present, field engr. and salesman, The Barrett Co., Limited, Toronto Branch.

References: J. C. Antonisen, G. G. Powell, G. T. Clarke, G. Hogarth, C. B. Ferris, J. B. Clark Keith, D. W. Harvey.

GILMORE—ROSS EARLBY, of Ottawa, Ont. Born at Ringwood, Ont., May 25th, 1888; Educ., B.A., 1911, M.A., 1913. McMaster Univ., Toronto, and M.Sc., 1916, University of Illinois; 1916-17, chemical engr'g. work on wood carbonization products at Forest Products Laboratories, Montreal; 1917-19, engr'g. (Research) chemist on lignite coal carbonization at Mines Branch, Fuel Testing Station; 1919-22, chief chemist, Standard Chemical Co., Montreal; 1922 to date, supt., Fuel Testing Laboratories, Mines Branch, Dept. of Mines, Ottawa.

References: B. F. C. Haanel, E. Stansfield, L. H. Cole, R. C. Berry, A. E. MacRae, R. A. Strong, A. A. Swinnerton, G. A. Browne.

HERBISON—ROBERT MILLIKEN, of Lachine, Que. Born at Aghadowey, Ireland, 4th June, 1890; Educ., engr'g. course, Clydebank Tech. Coll., 1906-11, and engr'g. course, Royal Tech. Coll., Scotland, 1911-14; 1906-12, engr'g ap'tice., and 1912-14, engr'g. designer with J. Brown & Co., Ltd., engrs. and shipbuilders, Scotland; 1914-19, engr. asst. to Engr. Rear Admiral of 1st Battle Squadron, Royal Navy, responsible for all reports and surveys on machinery, etc.; 1919-24, teacher, machine constrn. and design, Royal Techl Coll., Scotland; 1919-24, asst. to engr'g. mgr., J. Brown & Co., Ltd., Scotland; 1924 to date, mech'l. designer and field engr., Dominion Bridge Co., Ltd., Lachine, Que.

References: F. P. Shearwood, F. Newell, C. W. Burroughs, D. C. Tennant, C. E. Herd, A. Peden, R. H. Findlay, A. T. Perrin.

HYMAN—HOWARD DAVISON, of 249, Marcil Ave., Montreal, Que. Born at Montreal, Aug. 30th, 1903; Educ., B.Sc., McGill Univ., 1925; 1923 (summer) surveying and dfting., C.N.R.; 1924 (summer) dfting., Bell Telephone Co. of Can.; 1925 (summer) engr., with Byers & Co., Ltd., Montreal, reinf. concrete bldgs., for Chas. E. Frosst & Co., and Sherwin-Williams Co.; Oct. 1925 to date, dftsman., working on new bleach plant, Mattagami Pulp & Paper Co., Ltd., Smooth Rock Falls, Ont.

References: R. S. Baker, A. D. Jost, H. M. MacKay, E. Brown, A. J. Kelly, R. DeL. French.

JONES—CHARLES HUGH LePAULLEUR, of Sault Ste. Marie, Ont. Born at Montreal, Que., May 1st, 1876; Educ., App. Sci., McGill Univ., 1891-93; 1892-93, field party work and dfring room, Montreal Harbor Engr., under the late Sir John Kennedy; 1894-99, with C.P.R., mech. shops; 1900, constrn. work, Michipicoten Branch, Algoma Central and Hudson Bay Railroad; 1900-03, assisted in planning and constrn. details, Algoma Central & Hudson Bay Rly. main line, Manitoulin & North Shore Railroad, Sault Ste. Marie Pulp & Paper Co., and others; 1904-10 asst. gen'l. mgr., Lake Superior Corpn.; 1910 to date, (except for War service) mgr., gen'l. mgr., or Vice-Pres., at various times with Lake Superior Paper Co., The Spanish River Pulp & Paper Mills, Fort William Paper Co., Ltd., Manitoba Pulp & Paper Co., Ltd., and Kaministiquia Power Co.

References: R. S. McCormick, J. D. Jones, A. E. Pickering, L. R. Brown, G. H. Kohl, C. H. E. Rounthwaite, J. W. LeB. Ross.

KEENAN—PERCY ALEXANDER, of 43, Station Rd., Mimico, Ont. Born at Murray River, P.E.I., Oct. 7th, 1898; Educ., 1st year cert., Prince of Wales Coll., Charlottetown, P.E.I.; 1919-22, rodman and instr'man., surveys and bldg. constrn. with Pickings & Roland, Engrs. and Surveyors, Halifax, N.S.; 1922 to date, asst. engr., on highway and bridge constrn., Toronto & Hamilton Highway Commn., and Dept. of Public Highways, Ontario.

References: G. Hogarth, R. M. Smith, S. A. Cummiford, A. Hay, A. B. Crealock, H. P. Pickings, C. St. J. Wilson.

KENNEDY—DUNCAN, Montreal, Que. Born at Duror, Scotland. April 8th, 1882; Educ., 1904-05, Glasgow Tech. Coll., and pvte. study and tuition; 1899-04, pupil in civil engr'g., with John Best, contractor, Scotland; 1905-06, engr., with Warden Estate Co., Lower Egypt., surveying; 1906-09, asst. engr. on constrn. Isna Barrage, River Nile, and heightening Assuan Dam, with John Aird & Co., in Egypt; 1910, with same company, res. engr., and agent i/c constrn.; 1911-13, engr. i/c. outfall works, etc., constrn. Cairo Main Drainage, with Hughes & Lancaster, Egypt; 1915-19, res. engr., constrn. and mtce., airship station for Admiralty Works Dept.; 1919-21, engr. i/c road constrn., in Greece, gen'l. repres. of Coy., Nenchatel Asphalte Co., Ltd., of London, Eng.; 1922-23, engr. i/c reinf. concrete, with Hughes & Lancaster, Ltd., England; 1924-25, with Quebec Development Co., i/c hydro-elec. station at Isle Maligne; at present, res. engr., on substructure of Montreal South Shore Bridge, for Monsarrat & Pratley, Montreal.

References: C. N. Monsarrat, P. L. Pratley, A. F. Byers, C. J. Desbaillets, A. D. Swan, H. G. Cochrane.

LEGG—HARRY GALE, of 68 Waverley Street, Ottawa, Ont. Born at Bredport, England, Set. 19 th, 1884; Educ., 1902-05, 3 years articled pupil to R. Tomlinson Stewart, A.M.I.C.E., engr. and surveyor, Orsett Co., England; 1905-06, with Messrs. Bennett Son & Berry, consltg. engrs., London, England, and attending engrg. schools in engrg. and surveying; 1906-07, temporary employment, London (Ont.) office, Dept. Public Works; 1907-09, i/c of constrn. of sewers and sewage disposal plant, water works, etc., under the late Col. W. M. Davis, City Engr. of Kitchener; 1909-13, town engr., Preston, Ont.; 1913 to date, engr. to the chief archt's. branch, Dept. of Public Works, Ottawa, Ont.

References: D. A. Williamson, A. F. Macallum, R. deB. Corriveau, C. E. Baltzer C. R. Coutlee.

LeROY—WILLIAM LINDSEY, of Queenston, Ont. Born at Bryson, Que., April 23rd, 1871; Educ., Quebec Model School; 1901-02, concrete foreman; 1903-19, asst. supt. and supt., for various companies, principally Viele, Blackwell & Buck, New York, on constrn, of dams, power houses, etc., and erection of bldgs., etc.; 1919 to date, with the H.E.P.C. of Ontario, superintending power house constrn. at the Queenston-Chippawa Power Development.

References: H. G. Acres, R. L. Hearn, A. V. Trimble, W. S. Orr, H. L. Bucke.

McBRIDE—LAWRENCE DANIEL, of 160 Albert Street, E., Sault Ste. Marie, Ont. Born at Sault Ste Marie, Jan. 16th, 1906; Educ., High School and one year tech. school; at present, junior dftsman., engr'g. dept., Algoma Steel Corpn., Sault Ste. Marie, Ont.

References: C. H. Speer, F. Smallwood, W. S. Wilson, C. Stenbol, A. H. Russell.

McKILLOP—VERNON ARCHIBALD, of 209 Windsor Ave., London, Ont. Born at West Lorne, Ont., Mar. 12th, 1899; Educ., B.A.Sc., Univ. of Toronto, 1924; 1919-20 (4 mos.) armature winding dept., Westinghouse E. & M. Co., Pittsburgh, Pa.; 1920 (5 mos.) transformer tests, same company; 1921 (4 mos.) asst. operator, H.E.P.C. Station, St. Thomas, Ont.; May 1924 to date, asst. elec'l engr., Public Utilities Commn., London, Ont.

References: E. V. Buchanan, E. A. Gray, W. P. Near, C. R. Young, P. Gillespie, R. W. Angus, I. Leonard.

MILLER—ROSCOE ROBINSON, of Westboro, Ont. Born at Mount Albert, Ont., Feb. 25th, 1886; Educ., B.A., Queen's Univ., 1911; 1919-26, Secretarial Asst. to Federal Commissioner of Highways, A. W. Campbell, M.E.I.C.; at present, principal clerk, Highways Branch, Dept. Rlys. and Canals, Ottawa, Ont.

References: A. W. Campbell, E. B. Jost, D. W. McLachlan, L. Sherwood, A. Hay.

MONTIZAMBERT—HARRY BELL, of Strathmore, Alta. Born at Quebec, P.Q., July 14th, 1881; Educ., study from text books and correspondence; 1903-08, rodman and instr'man., C.P.R., Ontario Divn.; 1908-12, instr'man., and acting res. engr., G.T.P. Rly., Western Lines, prelim. and location surveys and constrn.; 1912-15, asst. engr., Manitoba Dept. of P.W. (reclamations); 1923, temp. instru'ment work in Manitoba for Dominion Dept. of P.W.; 1924, res. engr., C.N.R., Western Lines (construction); 1925 to date, res. engr., Highways Br. Dept. of Public Works, Alberta.

References: H. P. Keith, H. A. Dixon, H. A. Bowman, R. S. Stockton, J. E. St. Laurent, G. H. Patrick, A. E. Rowbotham, H. D. H. Scott, R. W. McKinnon, F. A. W. MacLean, N. Barritt, C. R. Lys.

MURRAY—MATTHEW RANDOLPH, of St. Narcisse, Que. Born at Dalbeattie, Scotland, Feb. 19th, 1893; Educ., C. E. Royal Tech. Coll., Glasgow, 1912, and Sci. Course, Dumfries Academy, Scotland, 1906-09, 1911 (summer) asst. engr. on constrn., air driven tunnel, Glasgow Corpn., Scotland; 1912 (May-July) rodman, and Jul. 1912-Nov. 1914, dftsman., on constrn. Campbellford Lake Ont. & Western Rly., for C.P.R.; Dec. 1914-19, overseas; Aug. 1919-20, instr'man. on prelim. survey; 1920-21, chief of party constrn. 60,000 volt line Victoriaville and Thetford Mines, 1921-22, field engr. on constrn. power house extension Shawinigan Falls, 1922-24, field engr., constrn. power house and dam at LaGabelle, Que., and 1924 to date, field engr. on constrn. power house and dam, Tunnel at St. Narcisse, Que., for Shawinigan Engineering Co., Ltd.

References: F. McArthur, C. Luscombe, C. R. Lindsey, H. J. Ward, R. Rinfret.

O'BRIEN—JOHN AMBROSE, of 114, Wellington Street, Ottawa, Ont. Born at Renfrew, Ont., May 27th, 1885; Educ., Renfrew Collegiate and S.P.S., 2 years; 1906-15, railway contracting; 1917 to date, managing director, M. J. O'Brien, Ltd.

References: J. G. G. Kerry, J. G. Dickinson, G. E. Bell, L. T. Martin, R. O. Sweezey.

PEARSON—VERNON, of 9840, 89th Avenue, Edmonton, Alta. Born at Rye, Sussex, England, Apr. 1st, 1889; Educ., Public School; and Maths., Mechanics and Machine Drawing at Brassey Inst., Hastings; 1904-09, ap'tice., with Corpn. of Hastings, Mech. Dept.; 1909-10, with Sevenoaks Iron Works; 1910-14, with Lethbridge Iron Works; 1914-17, i/c electrification of Canmore Coal Co. property at Canmore, 1917-18, asst. chief engr., 1918-19, chief engr.; 1919-23, supt. Public Utilities for Town of MacLeod; June 1923 to date, mech'l. supt. of the Provincial Government of Alberta.

References: H. J. McEwen, J. Haddin, A. L. Ford, R. S. Trowsdale, H. W. Meech, J. D. Robertson, W. J. Cunningham, E. W. Bowness.

POTTER—CHARLES EDWARD, of 46 Rowanwood Ave., Toronto, Ont. Born at Buffalo, N.Y., Aug. 10th, 1902. Educ., B.A. Sc., Univ. of Toronto, 1925; 1922 (summer) mine surveying at Wright Hargreaves Mine; 1923 (summer) maintenance dept., C.N. Rlys., Toronto; 1924 (summer) Ontario Land Surveys under T. J. Patten, Q.L.S., D.L.S.; 1925 (May-Dec.) instr'man. and engr'g. clerk with Geodetic Surveys of Canada; at present, transitman, Wayagamack Pulp & Paper Co., Three Rivers, Que.

References: G. F. Dalton, G. H. McCallum, J. L. Rannie, C. R. Young, T. R. Loudon, N. E. D. Sheppard.

QUIGLEY—HARRY STEPHEN, of 3504 Park Ave., Montreal, Que. Born at Toronto, Ont. May 3rd, 1888; Educ., Harbord Collegiate Inst.; 1916-19, Lieut. and Capt., Can. Engrs.; 1920, Air Station Supt., Can. Air Board; 1921-22, chief pilot, Price Bros. & Co.; 1923-24, i/c. flying operations for Dept. of Lands and Forests of Quebec, with Price Bros., and others; at present, contractor of Aerial Services.

References: E. W. Stedman, A. W. G. Wilson, A. T. N. Cowley, D. C. M. Hume, J. L. Gordon.

REID—JAMES WILLIAM, of Calgary, Alta. Born at Harvey, N.B., Nov. 15th, 1892; Educ., B.Sc., McGill Univ., 1914; during vacations and after graduation with C.P.R., mech. and engr'g. depts.; 1914-19 overseas; Trainmaster, C.P.R., until 1920; engaged in private business in Vancouver, B.C.; 1921 to date, Inspector Rly. Safety Appliances, inspecting rly. equipment, investigations, compilation of reports, etc., Board of Railway Commnrs., Calgary, Alta.

References: H. O. Keay, A. T. Kerr, W. S. Fetherstonhaugh, W. H. Tobey, G. B. Dixon, J. F. Lawrence, J. Haddin, R. S. Trowsdale.

ROSS—ALEXANDER DANIEL, of 346 St. Francois Xavier Str., Three Rivers, Que.; Educ., M.Sc., Mass. Inst. of Tech., 1923: 1920-23 (18 mos.) student engr'g. course, General Elec. Co., at Lynn and Schenectady; 1923-25, paper mill electrification specialist for Can. Gen. Elec. Co.—first six months in the industrial engr'g. dept., at Schenectady, and rest of time working in Canada; April 1925 to date, asst. elec'l. engr., design, installn. and supervisn. of elec'l work for new paper mill, with Wayagamack News Ltd., Three Rivers, Que.

References: W. E. Ross, G. N. Thomas, J. H. Cornish, R. P. Freeman, J. N. Finlayson.

SHELDRAKE—LORIMER SPARHAM, of Box 66, Duncan, B.C. Born at Lakefield, Ont., Aug. 4th, 1886; Educ., course in rly. engr'g., School of Technology, Calgary; 1904-11, with C.P.R. on constrn. and location; 1912-13, constrn., Oregon & Washington Rly., & Navigation Co., instr'man. under W. Berkley; 1919, transitman on mtce. of way, C.P.R.; 1922-23, locating and supervising constrn. of rly. for Island Logging Co., Victoria; 1923-24, locating rly. for the Puget Sound Lumber Co., Victoria; from Sooke to Jordan River, B.C.; 1924 to date, locating and supervising constrn. of railway for The Island Logging Co. of Victoria, and the Mayo Lumber Co. of Duncan B.C.

References: W. A. James, J. G. Reid, G. W. Coburn, E. P. Girdwood.

SMITH—ROBERT MACFIE, of 462 Mackay Str., Apt. 9, Montreal, Que. Born at Toronto, Ont., Sept. 2nd, 1898; Educ., B.A., 1921, B.Sc. (E.E.) 1923, McGill Univ.; 1923-25, student engr'g. course, General Electric Co., Schenectady, N.Y.; at present, apprenticeship course with Shawinigan Water & Power Co., Montreal.

References: E. Brown, C. V. Christie, C. M. McKergow, F. S. Keith, A. S. Runciman.

STEWART—JOSEPH DUNCAN, of 360 Whitney Ave., Sydney, N.S. Born at St. Heliers, Island of Jersey, Sept. 20th, 1880; Educ., High School and private study; 1902-04, tracing, etc., and 1904-07, dftsman., Lackawana Steel Co.; 1907-08, dftsman., Dominion Iron & Steel Co.; 1908-11 dftsman., Dominion Coal Co.; 1911 to date, with Dominion Coal Co., as follows: 1911-18, ch. dftsman., 1918-20, acting chief engr., 1921 to date, asst. chief engr.

References: D. H. McDougall, G. D. Macdougall, A. L. Hay, W. Herd, A. Dawes, K. G. Cameron.

TOYE—ARTHUR McFARLEN, of 82 Waverley Rd., Toronto. Born at Toronto, Ont., June 26th, 1900; Educ., B.A.Sc., Univ. of Toronto, 1925; 1923 (May-Aug.) gen'l. constrn. work with W. E. Tidy, contractor, Toronto; 1925 to date, dfting. and design on reinf. concrete work with Chapman & Oxley Architects, Toronto.

References: T. R. Loudon, C. R. Young, P. Gillespie, J. M. Oxley, A. L. Birrell.

WEST—CECIL GEORGE, of Thornloe, Ont. Born at Toronto, Ont., Apr. 8th, 1900; Educ., I.C.S., surveying and mapping course; 1921 ((Jan.-Apr.) special investigation, H.E.P.C., Niagara Falls, Ont.; 1922-24 (25 months) chainman, rodman, Temiskaming & Nor. Ont. Rly. constrn., and similar work from Mar. to Aug. 1925; Sept. 1924-Jan. 1925, rld. loc., Morrow & Beatty, Cochrane, Ont., and Jan.-Mar. 1925, rld. loc., same company at Kapuskasing, Ont.; Sept. 1925-Feb. 1926, rld. loc., Abitibi Pulp & Paper Co., Iroquois Falls, Ont.

References: S. B. Clement, W. R. Maher, J. Dick, J. M. Gilchrist.

WORLD—HARRY PERCIVAL, of 67 Gilmour Ave., Toronto, Ont. Born at Toronto, Aug. 10th, 1904; Educ., Toronto Tech. School, Machine Design., etc., 1920-22; 1923 surveying; 1919-24, dftsman., works dept., Consumers Gas Co., Toronto; 1924-25, dftsman., C.P.Rly. Co. Toronto.

References: B. Ripley, V. A. G. Dey, G. H. Davis, C. J. Crowley, J. G. Jack, W. C. E. Robinson, C. F. Draper.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO MEMBER

de HART—JOSEPH BERTRAM, of Lethbridge, Alta. Born at Newcastle-on-Tyne, England, Aug. 9th, 1890; Educ., B.Sc. (Civil) 1910, B. Sc. (Mining) 1911, and M.Sc. (Mining) 1912, McGill Univ.; Mine Manager's Certs., Alberta, Saskatchewan and British Columbia; Canadian Copper Co. (Smelter), Prospecting Gowganda; Internat. Coal & Coke Co., Dom. Govt. Coal Tests, Sydney, C.B.; timbering and timekeeping, Lethbridge Collieries Ltd.; firebossing and pit bossing, Internat. Coal & Coke; 1914-15, mgr., Twin City Coal Co.; 1915-18, mgr., North American Collieries, Ltd., Coalhurst, and 1918-19, gen'l supt.; 1919-22, mgr., Monarch Coll.; 1922-23, engr. and mgr., Cadomin Coal Co.; 1923 to date, district inspr. of mines, Government of the Province of A berta.

References: N. Marshall, R. Livingstone, J. Dow, G. N. Houston, N. H. Bradley.

HARRIS—RICHARD C., of 1016, 15th Ave., W., Calgary, Alta. Born at Hebron, N.S., March 1st, 1880; Educ., 3 yrs., S.P.S., Toronto; 1906-08, instr'man. on constrn., C.P.R.; 1908-10, instr'man, mtce. of way, C.P.R.; 1910-12, res. engr., Medicine Hat; 1912-15, res. engr. at Calgary, i/c constrn., Ogden shop yards; 1915-18, res. engr., at Edmonton i/o mtce. of way, and constrn. on the division; 1918 to date, divn. engr., Calgary Division, C.P.R.

References: J. M. R. Fairbairn, A. S. Dawson, F. W. Alexander, F. Lee, H. [illegible]

SHARPE—D. NEVILLE, of Washington, D.C. Born at Lindsay, Ont., Sept. 9th, 1886; Educ., Grad. in C.E., Univ. of Tor., 1911; 1911-13, municipal surveys in vicinity of City of Winnipeg; 1913-21, concrete inspr., on aqueduct for Greater Winnipeg Water District, and for last four years asst. divn. engr.; 1922, on transmission line surveys for Manitoba Power Co.; 1922 to date, supt. of laying operations with Lock Joint Pipe Company, Washington, D.C.

References: W. G. Chace, W. M. Scott, D. L. McLean, F. H. Martin, M. V. Sauer.

TRAILL—JOHN JAMES, of 15 Fulton Ave., Toronto, Ont. Born at Hamilton, Ont., Oct. 13th, 1884; Educ., B.A.Sc., 1906, C.E. 1919, Univ. of Toronto; 1907 (5 mos.) sea-wall surveys and bridge constrn., City of Toronto; 1913 (4 mos.) City of Toronto, cost data, Sewers; 1914 (5 mos.) hydrographic investigations, H.E.P.C.; 1915 (5 mos) 1916 (4 mos.) Lake of the Woods Tech. Board; 1917-18-19 (13 mos.) hydraulic investigations and design, H.E.P.C.; 1910-1920, Lecturer and Asst. Prof. in Hydraulics, Univ. of Toronto; Feb. 1920 to date, engr. of tests, hydraulic dept., Hydro-Elec. Power Commn. of Ontario.

References: T. H. Hogg, R. S. Lea, L. M. Arkley, M. V. Sauer, R. L. Hearn, S. S. Scovil, J. A. Aeberli.

FOR TRANSFER FROM JUNIOR TO HIGHER GRADE

BOSTWICK—ROBERT RENDALL, of Montreal, Que. Born at Kingston, N.B., April 22nd, 1890. Educ., private studies; 1910-15, rodman and dftsman., C.P.R.; 1915 to date, with Canadian National Railways as follows: one year drafting and field work, res. engr's office, Truro, N.S.; five years dfting. and checking plans and estimates, chief engr's. office, Moncton, N.B.; four years to date, dfting., checking, designing and estimating standard plans, engineer of standards office, Montreal, Que.

References: C. B. Brown, W. A. Duff, F. B. Tapley, J. A. Ellis, A. E. Oulton, J. Whitelaw, F. O. Condon.

CROMBIE—HUGH ARTHUR, of 96, Westmount Blvd., Montreal, Que. Born at Saginaw, Mich., U.S.A., Sept. 23rd, 1896; Educ., B.Sc., (Mech.) McGill Univ., 1918; 1912 (summer) chainman, C.P.R.; 1913 (summer) rodman, G.T.Rly.; 1914 (summer) timekeeper, Cook Construction Co.; 1915 (summer) locomotive fireman, C.N.R.; 1916-17, Lieut., overseas, Can. Engrs.; 1918 (May-Oct.) dftsman., Can. Nor. Rly.; 1918-19, machinist's helper, Canadian Allis-Chalmers Co.; 1919-20, machinist ap'tice., C.N.R.; 1920 (Mar. to Sept.) dftsman., Dominion Engineering Works; March 1920 to date, Dominion Engineering Works, Ltd., as follows. 1920-23, working on preparation of estimates and costs, 1923 to date, i/c estimating dept.

References: G. H. Duggan, G. E. Bell, H. G. Welsford, H. S. Van Patter, F. P. Shearwood, F. Newell, F. I. Ker, C. S. Gzowski.

DUSTAN—ERNEST BRUCE, of 125, Sherwood Ave., Toronto, Ont. Born at Pictou, N.S., Sept. 9th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1920: 1911-12-13-, (17 mos.) bridge erection, structur'l. shops and drawing office, Maritime Bridge Co., Ltd., New Glasgow, N.S.; 1915-19, overseas; 1920-23, making and checking shop drawings for bridges, etc., Canadian Bridge Co., Ltd., Walkerville, Ont. 1923 to date, designing structr'l. dftsman., with Hydro-Electric Power Commn. of Ontario, Toronto, Ont.

References: F. R. Kester, C. M. Goodrich, S. E. McGorman, J. W. Falkner, H. K. Wicksteed, C. R. Young, P. Gillespie.

EADIE—ROBERT SCOTT, of 124 Hampton Ave., Montreal, Que. Born at Ottawa, Ont., Aug. 29th, 1895; Educ., B.Sc. and M. Sc., McGill Univ., 1920 and 1922; 1916-19, overseas; 1919 (June-Sept.) engr. on bldg. constrn.; 1920 (May-Sept.) engr'g. work on valuation G.T.Rly; 1920-24. lecturer in maths., and demonstrator in civil engr'g., McGill Univ.; 1922-23 (summers) drawing office, Dominion Bridge Co., Lachine 1924 to date, with Dominion Bridge Co., Lachine, Que., on design and estimating steel structures.

References: F. P. Shearwood, L. R. Wilson, D. C. Tennant, H. M. MacKay, E. Brown, R. DeL. French, C. M. McKergow.

FULTZ—STEPHEN LLOYD, of 64 Cedar Str., Halifax, N.S. Born at Sackville, N.S., Oct. 15th, 1895; Educ., B.Sc. (C.E.) N.S. Tech., Coll., 1920, 1914 (summer) rodman, N.S. Highway Dept.; 1915 (summer) inspr. and instr'man., with Foley Bros., Halifax Ocean Terminals; 1916 (summer), inspr. on plant constrn., N.S. Tramways & Power Co., Halifax, N.S.; 1916-19, overseas; 1920 (May-Nov.) supervisor of steel reinforcing and inspr. of reinf. concrete, apartment bldg., Halifax; 1920-22, with N.S. Power Commn., as follows: chief of survey party and Nov. 1921 to May 1922, supt. of constrn. on concrete and timber crib storage dams at Five Mile Lake; 1922 (May-Sept.), inspr. of street paving, Halifax City Engr's. Dept.; Sept. 1922-Oct. 1925, with N.S. Power Commn., as follows: asst. engr., constrn. Maley Falls Development, at Sheet Harbour, and res. engr. and supt. of constrn. on completion of this developmt. and constrn. Ruth Falls Developmt., and operator, Ruth Falls Generating Station.

References: K. H. Smith, H. S. Johnston, J. F. Lumsden, F. R. Faulkner, H. W. Doane, M.C. Hendry.

GRIGG—CHARLES DUNCAN, of 331 Louis Ave., Windsor, Ont. Born at Toronto, Aug. 1st, 1891; Educ., Tech. High School, and 2 years course I.C.S., surveying and mapping; 1912-14, rodman, dftsman. etc. C.P.R.; 1914-15, transitman i/c party, C.P. Rly., London, Ont.; 1915-19, overseas; 1919, with C.N.Ry., Capreol, Ont., as follows: Apr.-Aug. transitman, grading, Aug.-Jan. 1920, res. engr., i/c extensive lifting and lining operations, Ottawa Divn.; 1920 (Jan.-Mar.), transitman with Owen McKay, C.E., Walkerville, Ont., rly. and municipal work; 1920 (Mar.-Nov.) res. engr., i/c Island Lake Colony subdivn., employed by W. J. Miller, Detroit, Mich.; Nov. 1920 to date, with H. W. Pattersou (of McColl & Patterson) Town Engr., Walkerville and Ford City, designing, laying out and inspecting work.

References: H. W. Patterson, C. R. McColl, M. E. Brian, J. E. Porter, J. C. Keith, C. A. Mullen, T. A. S. Munford, W. A. Ewing.

HAMER—THURSTON MOSELEY, of 3980 Lake Park Avenue, Chicago, Ill. Born at Mexico City, Feb. 22nd, 1892; Educ., B.Sc. McGill Univ. 1913, three years post-graduate practical apprenticeship in various operating depts. C.P.R.; 1916-17, special travelling car service agent, C.N.R.; 1917-20, on staff of Bell Telephone Co. of Canada, and under direction of toll equipment engr., studied toll equipment engrg.; 1920-22, asst. engr., P. & M. Co., Montreal; 1922-24, on gen. telephone sales staff, Northern Electric Co., preparing estimates, etc.; Aug. 1924, appointed asst. to the mgr., railroad engrn. dept., Air Reduction Sales Co., New York, and in May 1925, promoted to take charge of western territory of dept., as western railroad engrg. representative, with headquarters at Chicago.

References: H. O. Keay, B. C. Nolan, W. C. Adams, W. S. Vipond, T. Eardley-Wilmot.

LAKE—HENRY MORTON, of 152 Upton Rd., Sault Ste Marie, Ont. Born at Toronto, Ont., July 18th 1890; Educ., I.C.S. (Mech. Engr'g.) 1910; 1904-08, ap'tice. machinist at G.T.Rly. shops, Lindsay, Ont.; 1908-09, with McLaughlin Motor Car Co., Oshawa, testing motors; 1909-11, laying out on surface table for Algoma Iron Works, Sault Ste Marie; 1911-14, dftsman., with Algoma Steel Corpn., Sault Ste Marie; 1914-17, partner, firm L. H. Lake & Son, gen'l engr'g and structr'l. work; 1917-19, checker, Algoma Constrn. & Engr'g Co.; 1919-21, design'g. new mill for Algoma Steel Corpn.; 1921-22, estimating for McNamara Bros. & Thornton, Sault Ste Marie and Toronto; 1922-23, designed, built and installed patent appliances for Candn. Vater Dryer & Woodworking Co., at Island Lake, Ont.; 1923-24, i/c designs on bank reclamation for Spanish River P & P. Co.; 1924-25, i/c designs gen'l. plant extensions, etc., Internat. Nickel Co., Sudhury, Ont.; at present, i/c designs modern open hearth furnaces, Algoma Steel Corpn., Sault Ste Marie, Ont.

References: C. H. Speer, F. Smallwood, H. A. Morey, C. S. Millard, W. S. Wilson.

LEE—ROBERT BRERETON, of Ottawa, Ont. Born at Aylmer, Que., Aug. 1st, 1890; Educ., High School and home study; 1908-12, City Hall, Ottawa, 2 years as dftsman., and 2 years as ch. dftsman., and asst. engr.; 1912 to date, Jr. Tidal & Current Surveyor, Hydrographic Branch, Marine Dept., as follows: 4 years as dftsman., 5 years engr'g. clerk and asst., and 5 years, Jr. Tidal & Current Surveyor.

References: W. B. Dawson, N. J. Ker, H. W. Jones, W. F. M. Bryce, C. P. Edwards.

McKINNEY—JAMES HAROLD, of St. John, N.B. Born at St. John, N.B., March 5th, 1889; Educ., I.C.S.; 3 mos. on valley rly. survey; 2 years, with J. W. Wilson, D.L.S., on survey timber limits; 1912 to date, with Dept. of Public Works as follows: 1912-18, constrn. Beacon Bar Wharves, sheds etc., from Fall 1918 to date on Courtenay Bay Development—since 1919 i/c all sounding, preparing estimates and plans Courtenay Bay Dredging, assisting in gen'l. work of constrn., present position Junior Engineer of Dept.

References: A. Gray, E. G. Cameron, E. A. Thomas, F. L. Richardson, A. R. Dufresne, W. E. Bonn.

NORRIS—CHARLES ADAM, of 546 Grosvenor Ave., Westmount, Que. Born at Montreal, Que., Nov. 23rd, 1896; Educ., B.A.Sc., Univ. of Tor., 1923; 1919 (2 mos.) student, Sproatt & Rolph, architects, Toronto; 1920 (May-Aug.) supt. i/c constrn., for Bremner, Norris & Co., Ltd., Montreal, on their work for Can. Explosives Ltd., at Brownsburg, Que.; 1922 (May-Oct.) designed and built residence for R. L. Cummer, 14, Walmsley Blvd., Toronto; 1923 (Apr.-Nov.) res. engr., Bremner, Norris & Co., on contract at Grand Ligne, Que.; at present, constrn. engr., with same company.

References: D. Bremner, J. H. Norris, C. K. McLeod, N. E. D. Sheppard, C. H. Mitchell.

FOR TRANSFER FROM STUDENT TO HIGHER GRADE

BRITTAIN—CHARLES LESLIE, of 189 Dowling Ave., Toronto, Ont. Born at Moncton, N.B., Sept. 15th, 1902; Educ., B.A.Sc., Univ. of Toronto, 1924; during vacations employed by Consumers Gas Company, The George B. Meadows Co., Neptune Meter Co., and Massey Harris Co., Toronto; at present, in laboratory of Gutta Percha and Rubber, Ltd., Toronto, experimental test and control work in connection with vulcanizing etc.

References: R. W. Angus, C. R. Young, J. R. Cockhurn, T. R. Loudon, W. J. Smither, C. H. Mitchell.

BURBANK—JEROME DOUGLAS, of 36 Close Ave., Toronto, Ont. Born at Toronto, Ont., July 13th, 1897; Educ., B.A.Sc., Univ. of Tor., 1925; 5 mos. radio course U.S. Naval Radio School, Harvard Univ., 1918; 1915-17, dredge inspr., rodman and sounder, with Toronto Harbour Commn.; May 1916-Jan. 1917, signaller, Can. Army; 1918 (Feb.-June), mech'l. helper, Spadina Shops, G.T.R., Toronto; 1918-19, radio operator, U.S. Navy; 1919-20, chief radio operator of S.S. "Vittorio Emanuelle III", also with U.S. Shipping Board, Marconi Co. of Amer., and Kerr Steamship Co., New York; 1921 (Apr.-June) varied experience, assembling storage batteries; 1922 (Apr.-June) material clerk, Toronto Transportation Commn.; 1922 (July-Oct.) radio inspr., Can. Independent Telephone Co.; 1923 (Apr.-Sept.) student distribution dept., Toronto Hydro-Elec. Commn.; 1924, (May-Sept.) inventory recorder, Bell Telephone Co.; Dec. 1924 to Mar. 1925, radio service man, Robert Simpson Co.; July 1925 to date, elec'l. helper, Can. Nat. Elec. Rlys., Niagara, St. Catharines and Toronto Rly.

References: C. H. Mitchell, C. R. Young, T. R. Loudon, J. R. Cockburn, P. Gillespie.

FORSTER—IRWIN HICKSON, of Bridgeburg, Ont. Born at Toronto, Ont., June 26th, 1901; Educ., B.A.Sc., Univ. of Toronto, 1923; 3 mos. machine shop, Dodge Mfg. Co. Toronto; 3 mos., same Turnbull Elevator Co., Toronto; May 1923 to date with Horton Steel Works, Bridgeburg, as follows: 1923 24, dftsman. and checker, 1924 (Sept.-Dec.) field engr. on gasholder erection, Peterboro, 1924-25, field engr., Hull, Que., and i/c design penstock Powell River Co., 1925 (June-Sept.) i/c tank foundations and installn. of pumping plant at Thornesville, Ont., and Sept. 1925 to date, i/c design work on penstocks surge tanks, etc.

References: C. H. Scheman, C. R. Young, A. E. K. Bunnell, P. Gillespie, C. S. Boyd, T. R. Loudon.

HEARTZ—RICHARD EDGAR, of 147 Kindersley Rd., Mount Royal, Que. Born at Marshfield, P.E.I., Aug. 18th, 1895; Educ., B.Sc., McGill Univ., 1917; 1917 (summer) field and office work at La Loutre Dam for Fraser Brace & Co.; 1917-19, flying instructor Lieut., R.A.F., 1919-20, field and office work, Fraser Brace & Co., on Big Eddy Dam at Turbine Ont.; 1920 to date with Shawinigan Engineering Co., Montreal, on hydro-elec. constrn. as follows: 1920-22, design, supervisn. and erection form work no. 2 power house extension, Shawinigan Falls—1922-24, res. engr., La Gabelle development—1924-25, res. engr., St. Narcisse Development, Que., and at present gen'l. office work, Montreal.

References: C. S. Saunders, S. Svenningson, J. A. McCrory, C. R. Lindsey, C. Luscomhe, E. Brown.

HEATLEY—A. HAROLD, of 1020, 22nd Street, Niagara Falls, N.Y. Born at Brampton, Ont., Aug. 29th, 1897; Educ., B.A.Sc., Univ. of Tor., 1922, M.A., 1923; 1923 to date, chemist on analytical work, research, developmt. and production, with Roessler & Hasslacher Chemical Co., Niagara Falls, N.Y.

References: W. D. Walcott, W. P. Dale, J. R. Cockhurn, C. R. Young, H. E. T. Haultain.

HIGBEE—JOHN CARVETH, of 324½ North Lake View Drive, Sebring, Florida Born at Galt, Ont., May 5th, 1898; Educ., B.A.Sc., Univ. of Toronto, 1923; 1920 (summer) i/c field party, Toronto Harbour Commn.; 1922-23 (summers) asst. town engr., Brampton, Ont.; 1923-24, dfting. and field work, C.N.R., electric lines; 1924-25, with City of Cleveland Dept. of Water, as chief of party on constrn. Baldwin Filtration Plant; December 1925 to date, engr. of properties, with Clayton C. Townes Co. of Cleveland, at present on Lake Sebring Development at Sebring, Fla., U.S.A.

References: P. Gillespie, C. R. Young, N. D. Wilson, S. B. Wass, I. F. Willsie, H. L. Vercoe, E. T. Wilkie.

LANCTOT—RAYMOND, of 1908 Van Horne Ave., Montreal. Born at St. Hyacinthe, Que., Apr. 25th, 1903; Educ., B.Sc. McGill Univ., 1924; 1920 (summer) surveying for Riordon Pulp & Paper Co.; 1924-25, with Casavant Bros., dftsman., and on research work; Sept. 1925 to date, engr., elec'l. dept., Montreal Water Board, Montreal.

References: C. J. Desbaillets, J. F. Brett, C. M. McKergow, E. Brown, H. M. MacKay, H. Terreault.

McCURDY—LYALL RADCLIFFE, of 768 Shuter Str., Montreal, Que. Born at New Glasgow, N.S., July 16th, 1897; Educ., B.Sc. (Mech.) McGill Univ., 1921. At present taking M.Sc. course; 1918-20-22 (summers) dfting., freight car layout, estimating etc., engr'g. dept., Eastern Car Co., Ltd., New Glasgow, N.S.; 1924-25 (part summers) laboratory work on artificial stone under Prof. R. DeL. French, McGill Univ.; 1922 to date, sessional lecturer and demonstrator, Dept. of Mech. Engr'g., McGill Univ., Montreal.

References: C. M. McKergow, A. R. Roberts, R. DeL. French, G. D. Macdougall, J. N. Finlayson, A. R. Chambers.

McLAGAN—THOMAS RODGIE, of Grand'Mere, Que. Born at Westmount, Que., Jan. 22nd, 1897; Educ., B.Sc. McGill Univ., 1923; During college vacations employed in gen. paper mill operation work; 1923-25, asst. to gen. mgr., Dryden Paper Co. Ltd., Dryden, Ont.; 1925 to date, asst. supt., mech'l. pulp mill, Laurentide Company, Grand'Mere, Que.

References: H. O. Keay, E. Brown, C. M. McKergow, A. R. Roberts, J. S. Wilson.

PATTERSON—ARTHUR L., of 4222 Dorchester Str., Westmount, Que. Born at Montreal, Oct. 20th, 1892; Educ., B.Sc. (Mech.) McGill Univ., 1914; 1912 (4 mos.) erecting shop, C.P.R. Angus Shops; 1913 (4 mos.) dfting., Cedar Rapids Mann & Power Co.; 1914 (3 mos.) dfting., Shawinigan Water & Power Co.; 1914-19, Lieut., R.F.A.; 1919 to date, structr'l. and hydro-elec. design, Shawinigan Engineering Co., Montreal, Que.

References: C. S. Saunders, S. Svenningson, J. A. McCrory, E. Brown, A. B. Rogers, C. E. Herd.

POE—ALEXANDER SPENCE, of Montreal, Que. Born at Montreal, Que., Mar. 9th, 1896; Educ., B.Sc., McGill Univ., 1917; 1914 (summer) with Jas. Robertson Co.; 1915 (summer) C.N.R.; 1916 (summer) dftsman., Cand. Electro-Products Co.; 1917 (summer) in office of A. F. Byers Co.; 1918-19, Lieut. Canadian Engrs.; 1919 to date, structr'l. and hydro-electric design, Shawinigan Engineering Co., Montreal.

References: S. Svenningsen, J. A. McCrory, A. B. Rogers, J. D. Stott, R. H. Mather, E. Brown, J. L. T. Martin.

SMEATON—VICTOR CHARLES WILLIAM, of Toronto, Ont. Born at London, Ont., July 9th, 1897. Educ., 2 yrs. Applied Science, McGill Univ.; structural designing course, Toronto Tech. School; 1915-18, military service; 1919 (4 mos.) dftsman., National Shipbuilding Corpn., Three Rivers, Que.; 1919-20, computer, G.T.Rly.; 1922 (June-Oct.), asst. engr., Thompson Starret Constrn. Co., Three Rivers; 1923-24, instr'man., H.E.P.C., Port Arthur; 1924, to date, computer, valuation dept., Canadian National Rlys., Toronto, Ont.

References: A. Crumpton, C. M. McKergow, J. B. Wain, N. M. Barclay, E. G. Hewson.

SMITH—GEORGE WESTWOOD, of Weston, Ont. Born at Elmira, Ont., Oct. 14th, 1900; Educ., B.A.Sc., Univ. of Toronto, 1923; 1921-22 (summers), municipal work (office and field) with Frank Barber and Assoc.; 1923-24, res. engr., under Horace L. Seymour, M.E.I.C., on municipal work, Town of Weston; 1924, similar work with Orville Rolfson, Walkerville; 1924-25, asst. res. engr., with James, Proctor & Redfern, on York Twp. Sewerage system; at present, engr., with Lago Petroleum Corp., Maracaibo, Venezuela, S.A.

References: O. L. Flanagan, H. L. Seymour, W. B. Redfern, E. M. Proctor, O. Rolfson, I. MacNab.

WILSON—WILLIAM STEWART, of 20 Humewood Drive, Toronto, Ont. Born at Louise, Ont., Jan. 17th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1921; 1911-12-13-14 (summers) working on bldg. constrn.; 1915-19, overseas; 1920 (summer) dftsman., C.N.R., Bridge Engr's. Office, C. P. Disney, M.E.I.C.; 1921-22, building contracting; 1922-23, estimator for Maritime Construction Co., Toronto; 1923 (Apr.-Oct.) contracting (own business); 1924 (summer) same; 1925 (May-Oct.) estimator and engr., Dowling Williams, Ltd., gen'l. contrs., Toronto; Sessions 1923-24, 1924-25 and at present, demonstrator in engr'g. drawing, Faculty of App. Sci., University of Toronto, Toronto, Ont.

References: J. R. Cockburn, T. R. Loudon, C. R. Young, W. J. Smither, P. Gillespie, A. D. LePan, P. V. Jermyn, W. B. Dunbar, C. P. Disney.

WOOLWARD—CHARLES DESMOND, of 756 University Str., Montreal, Que. Born at Port of Spain, Trinidad, B.W.I., Oct. 3rd, 1896; Educ., B.Sc., McGill Univ., 1922; 1916 (summer) machine shop, Canada Cement Co.; 1916-19, overseas; 1920 (summer) instr'man., Montreal Tramways Co.; 1921 (summer) mining and surveying, Hollinger Gold Mines; 1922 (May-July) checker, Mt. Royal Hotel, Thompson Starret; July 1922 to Sept. 1923, instr'man., C.N.R.; 1923-25, steel design and dfting., John S. Metcalfe Co.; at present, engr'g. dftsman., Foundation Co. of Canada, Montreal.

References: H. M. MacKay, G. J. Dodd, W. Walker, W. Griesbach, G. H. Frith.

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Some Recent Stress Analyses by Means of the Photoelastic Method

An Historical Survey of its Development with Some Recent Investigations carried on by this Method

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As is well known, the mathematical theory of elasticity is the fundamental tool for the determination of the state of stress at all points of a structure. However, its scope is limited, on account of the unsolvable equations to which it leads, even for some of the very simplest cases encountered in practice. Simplifying assumptions are then made and approximate solutions are obtained. Such empirical calculations are acceptable when they have been sufficiently checked by experience, if in other words the factor of safety has been for each particular case adequately adjusted. For new types of construction, for the explanation of unexpected failures, whenever it is of importance to distribute the material in the most economical manner, approximate calculations are often inadequate. The photoelastic method is a method which uses the effects of mechanical stress on polarized light and thereby permits, for the majority of the cases of plane stress, the direct measuring of the state of stress at any point of a stressed model made of transparent material such as celluloid. The measurements are readily translated into the stresses which will exist in the full size structure made of structural material. A brief description of the method will be given first, followed by an account of some of the recent stress analyses made by means of this method.

Historical Survey of Development of the Method

Temporary double refraction observed in transparent amorphous material, when put under thermal and mechanical stress, was first studied by the English physicist, Sir David Brewster. He published[1] several papers reporting his various investigations beginning in 1814 until 1830. Later, A. Fresnel[2], F. E. Neumann[3], Clerk Maxwell[4], and G. Wortheim[5], made further contributions to the study of temporary double refraction.

Although Maxwell had already pointed out the possibility of employing temporary double refraction for the study of problems in elasticity, C. Wilson[6] was first to attempt solving problems of the distribution of mechanical stress in an elastic body by analysis of the double refraction. More recently F. Pockels[7] and especially L. N. G. Filon[8] determined in a more complete manner the laws relating the double refraction to the state of stress, thereby paving the way to Mesnager's work.

A. Mesnager[9], in his remarkable study of the stresses in the La Balme bridge, developed the method which up to the present day forms the corner stone of the photoelastic method of stress analysis. Mesnager's work should receive credit for the later development of this method.

E. G. Coker[10] applying Mesnager's methods, developed the technique of the photoelastic method by studying a series of problems of stress distribution for which there existed an analytical solution, such as the stresses around a circular hole in a plate. He thereby showed that agreement exists between the results of photoelastic analysis and those obtained by analytical methods, where such analysis was possible without

(1) Sir David Brewster — Phil. Trans. Royal Soc. London, 1814, 1815, 1816, 1830.
(2) A. Fresnel — Annales de Chimie et de Physique, 1822, 1846.
(3) F. E. Neumann — Abhandl. der Kön. Akad. der Wissensch. zu Berlin, 1841.
(4) Clerk Maxwell — Trans. Royal Soc. Edinburgh, 1853.
(5) G. Wertheim — Annales de Chimie et de Physique, 1854.
(6) C. Wieson — The London, Edinburgh and Dublin Phil. Mag. and Journ. of Sc., 1888.
(7) F. Pöckels — Wiedemanns Annalen, 1902.
(8) L. N. G. Filon — Proc. Cambridge Phil. Soc., 1902, 1903.
Phil. Trans. Royal Soc. London, 1904.
Proc. Royal Soc., 1910, 1914.
Phil. Mag., 1912.
(9) A. Mesnager — Annales des Ponts et Chaussées, 1903, 1913.
(10) E. G. Coker — Phil. Mag. 1910.
Proc. Royal Soc. 1912.
Proc. Phys. Soc. London, 1912.
Trans. Inst. Naval Architects, 1910.
Proc. Inst. Civil Engineers, 1921.

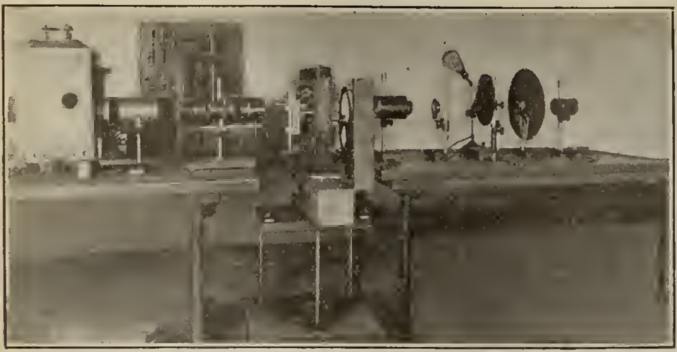

Figure No. 1.—Coker's Photoelastic Apparatus.

introducing simplifying assumptions or approximations. The limitations of agreement between the result of a stress analysis by means of the photoelastic method and the stress distribution in an actual structure have been studied theoretically by L. N. G. Filon[11]. In the photoelastic apparatus which were developed by E. G. Coker, the optical part is due to Silvanus Thomson, and the principle of the measurements by means of a lateral extensometer is due to Mesnager.

A photoelastic laboratory for the investigation of engineering stress problems was first started by the Research Laboratory of the General Electric Company, in Schenectady, N. Y., and later developed by co-operation between the General Electric Company and the Massachusetts Institute of Technology. In this laboratory, under the direction of A. L. Kimball and the author, with the collaboration of T. H. Frost and other associates[12], a series of problems have been investigated which were submitted by various departments of the General Electric Company, and other industries. The apparatus of E. G. Coker were redesigned in order to adapt them to investigations for the more complicated stress distributions. L. N. G. Filon's method was put into use, by means of which the state of stress for all two dimensional elastic stress problems can be determined from the isoclinic and the isochromatic lines only, thereby eliminating the difficult measurements of transverse change in thickness by means of a lateral extensometer.

Definition of the State of Stress

Let us consider at any point A inside of a loaded elastic body a small plane surface. A resultant force F will act on this surface of area a and the resultant stress across this plane will be $\frac{F}{a}$. In general it will not be normal to the surface A. However, there exist at each point in the case of the plane stress two orientations for those surfaces where the resultant stress is normal to the surface. Those two surfaces are normal to each other and are called the planes of principal stress at point A. The resultant stresses on the planes of principal stress are the two principal stresses at A. Lines tangent to the directions of the principal stresses at all points are the lines of principal stress. The maximum principal stress at any point is the maximum normal stress at that point.

The component of F in the plane a is the shearing stress. It is zero in the planes of principal stress, and is a maximum in the planes bisecting the planes of principal stress. The magnitude of the maximum shearing stress is equal to one-half the difference of the two principal stresses.

The normal component S_n of the stress on any plane whose direction cosines are l and m with respect to the planes of principal stress, is given by:

$$S_n = l^2 p + m^2 q$$

where p and q are the values of the two principal stresses.

Knowing the principal stresses, the deformations in any direction are obtained by means of the stress-strain relations.

It is therefore seen that the directions and the magnitudes of the principal stresses at any point A define completely the elastic state at that point.

We shall now describe shortly how the directions and magnitudes of the principal stresses are obtained by means of the photoelastic method in the case of two dimensional stress.

Resumé of the Photoelastic Method

The directions of the principal stresses are obtained by examining the transparent model by means of plane polarized light. Indeed if plane polarized light is first passed through a stressed transparent model, normally to the plane of the two principal stresses, and afterwards through a second Nicol prism, whose principal section is perpendicular to the principal section of the polarizing prism, the field remains dark only at those points where the principal stresses are parallel and perpendicular to the principal sections of the crossed Nicols.

By rotating the Nicol prisms, the directions of the principal stresses at all points of the model are obtained and the lines of principal stresses can be readily drawn.

The differences of the two principal stresses are obtained by examining the transparent model by means of circularly polarized light. Indeed mechanical stresses cause the model to become double refracting and the isochromatic bands which are obtained when polychromatic light is used, are the loci of the points of equal relative retardation of the ordinary and extraordinary rays in the double refracting model. They are the loci of equal values of the differences of the principal stresses. By a compensation method, based upon the interposition in a suitable direction of a comparison member of constant cross-section, put under uniform tension in an appropriate frame, the value of the differences of the principal stresses is obtained at any desirable point of the model.

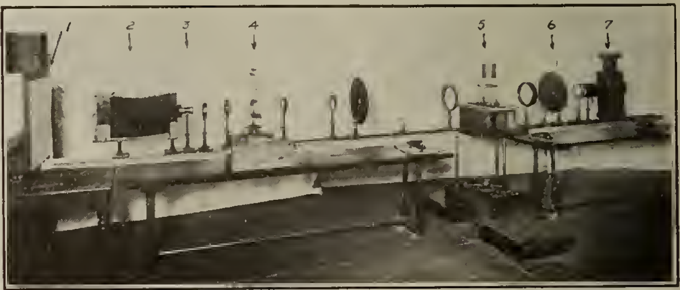

Figure No. 2.—Heyman's Photoelastic Apparatus.

(1) Screen for Inspection.
(2) Photographic Camera.
(3) Analyzer.
(4) Loading Frame for Comparison Member.
(5) Position of the Celluloid Model*
(6) Polarizer.
(7) Source of Light.

* A model up to 3.50 meters can be introduced here by increasing the distance between the two lenses and a focussed image of model and comparison member is still obtained on the screen.

(11) L. N. G. Filon — Engineering, London, Oct. 19, 1923.
(12) See reference list.

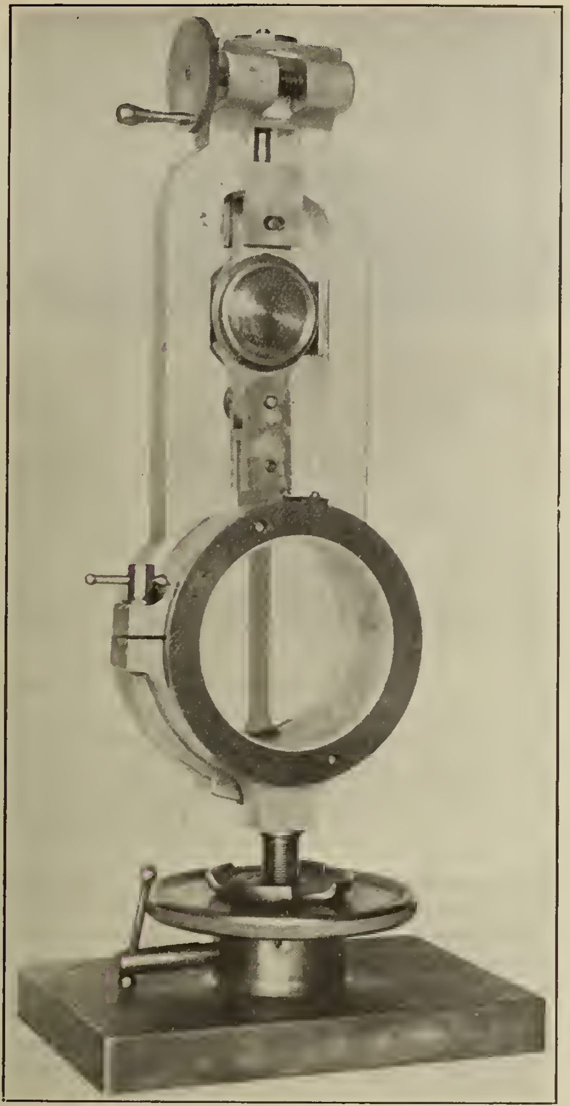

Figure No. 3.—The Loading Frame Designed by Heyman & Frost for the Comparison Member in Heyman's Photo-elastic Apparatus.

The separate values of the two principal stresses at any point are then derived from the following relations:

$$\frac{\delta p}{\delta s_1} + \frac{p-q}{\rho_2} = 0$$

$$\frac{\delta q}{\delta s_2} + \frac{p-q}{\rho_1} = 0$$

where s_1 and s_2 are arcs taken along the lines of principal stress corresponding to the stresses p and q respectively, and f_1 and f_2 are the radii of curvature of the two lines of principal stress. These equations can be readily obtained by expressing the equilibrium of a curved elementary rectangle bounded by four near lines of principal stress.

By integration along the lines of principal stress, we obtain:

$$p = p_0 - \int_0^A \frac{p-q}{\rho_2}\, ds_1$$

$$q = q_0 - \int_0^B \frac{p-q}{\rho_1}\, ds_2$$

Figure No. 4.—Pinions Ruptured by Radial Pressure Applied at the Bore.

where ρ_1 and ρ_2 are known from observation under plane polarized light, $(p\text{–}q)$ from measurement under circularly polarized light.

The separate values of the two principal stresses can thereby be obtained at any desirable point of the model.

Relation between the Stress Distribution in a Transparent Model and the Actual Structure

The linear reduction of dimensions and load is a matter of common practice and will not be discussed here. The more special question which arises is whether it is legitimate to compare the stress distribution which has been determined on a celluloid model with that existing in a homogeneous engineering material.

It will be remembered that the theory of elasticity is based upon three postulates, namely:

1. The material is isotropic, i.e. it has the same elastic properties in all directions.
2. The deformations per unit length are sufficiently small so that the square of any of them can be neglected when compared to the first power value.
3. The material obeys Hooke's law of linear proportionality between stress and strain.

The stress distribution in all materials which fulfil the above three conditions obeys the general equations of elasticity. Now, it can be shown by means of those equations that the stress distribution is independent of the elastic constants of the material, i.e. independent of the nature of the material, in the general case of plane or two dimensional stress. Hence the stress distribution determined in a celluloid model, — celluloid satisfying the three conditions given above, — is the same, — all other things being equal, — as the stress distribution existing in any structural material which is isotropic,

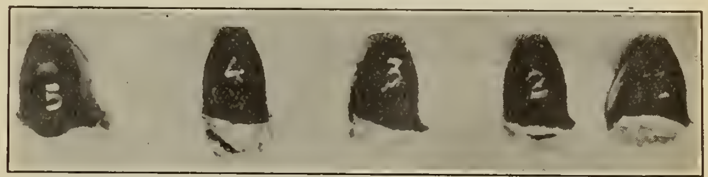

Figure No. 5.—Fractured Teeth of a Series of Pinions Tested by Repeated Compact.

Tooth No. 1 shows a fracture without radial pressure.
Tooth No. 2 shows a slightly convex fracture of a pinion having a radial pressure resulting from forcing a plug into the bore with a load of 5,000 pounds.
Tooth No. 3 shows a gear tooth having double the radial presure of Tooth No. 2.
Tooth No. 4 shows a tooth broken from a pinion having a radial pressure five times that of Tooth No. 2.
Tooth No. 5 is a tooth broken from a gear having eight times the radial pressure of Tooth No. 2.

Figure No. 6.—Example of a Service Fracture Resulting from very high Radial Stresses.

presents small deformations per unit length and obeys Hooke's law. Only the reduction of dimensions and of the external load have to be taken into consideration.

Some Recent Investigations by Means of the Photoelastic Method

A study of the stresses in gear pinions was first started under static loading. The stress distribution after the pinion has been shrunk on to the shaft was first examined. For the calculation of those stresses, the pinion is usually considered as a ring whose outside diameter is the average between the root and the outside diameter of the pinion. The radial and tangential stresses rr and $\theta\theta$ at a point r from the center, are calculated by means of the relations

$$\left.\begin{aligned} rr &= p\frac{r^2_1(r^2-r^2_2)}{r^2(r^2_1-r^2_2)} \\ \theta\theta &= p\frac{r^2_1(r^2-r^2_2)}{r_2(r^2_1-r^2_2)} \end{aligned}\right\} \qquad (1)$$

Where r_1 and r_2 are the inside and outside diameters of the ring and p the uniform radial pressure applied at the inside boundary, the stresses resulting from the relations (1) for a pinion will be smaller than those for a ring whose outside diameter would be equal to the root diameter of the teeth of the pinion, and greater than those for a ring whose outside diameter would be equal to the outside diameter of the pinion, for same values of p. The photoelastic analysis showed that the maximum stress in the pinion was greater than either of the above stresses. This is due to the irregularities of outside contour formed by the teeth, which cause a non-uniform stress distribution and result in regions of higher stress.

Mechanical rupture tests by means of radial pressure subsequently carried out on steel rings and pinions, are recapitulated in the table below and are confirmatory of the photoelastic results.

	Inside diameter (inches)	Outside diameter (inches)	Root diameter (inches)	Rupture load* (lbs.)
Ring...........	1.854	3.5	...	85,000
Ring...........	1.854	2.5	...	51,000
Pinion.........	1.854	3.5	2.5	47,000

*Axial load applied to the conical plug forced into the conical bore of the rings and pinions.

The photoelastic analysis also showed that the maximum stress existed at the periphery of the bore beneath the teeth. Consequently, it was expected, contrary to ordinary expectation, that rupture would start at the inside periphery under the teeth and would not occur through the thinner layer of material between the teeth. Figure No. 4 shows pinions, ruptured afterwards in mechanical tests.

The stress distribution under the simultaneous application of radial shrinking pressure and static torque applied at the teeth was also studied. It was found that the stress distribution across the root sections of the teeth cannot be approximated by the cantilever formula but presents variations which depend on the shape of the teeth and the relative value of the torque and the shrinking pressure.

When the shrinking pressure is small, the section of maximum stresses runs linearly across the root section of the tooth and failure would be expected to present approximately a flat section. As the ratio of the shrinking pressure to the torque increases the section of maximum stresses takes the form of a V, whose apex is directed towards the bore and whose aperture decreases as the above ratio increases. If the torque is very small compared to the radial pressure, the section of maximum stresses runs radially as illustrated by the ruptures shown in figure No. 4. Mechanical rupture tests were made and figures Nos. 5 and 6 show a series of ruptured teeth for increasing ratios of the shrinking pressure to the torque.

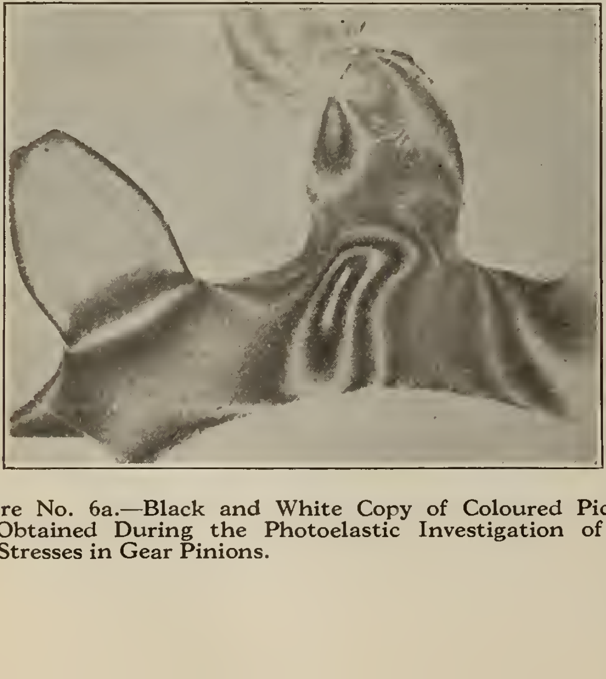

Figure No. 6a.—Black and White Copy of Coloured Picture Obtained During the Photoelastic Investigation of the Stresses in Gear Pinions.

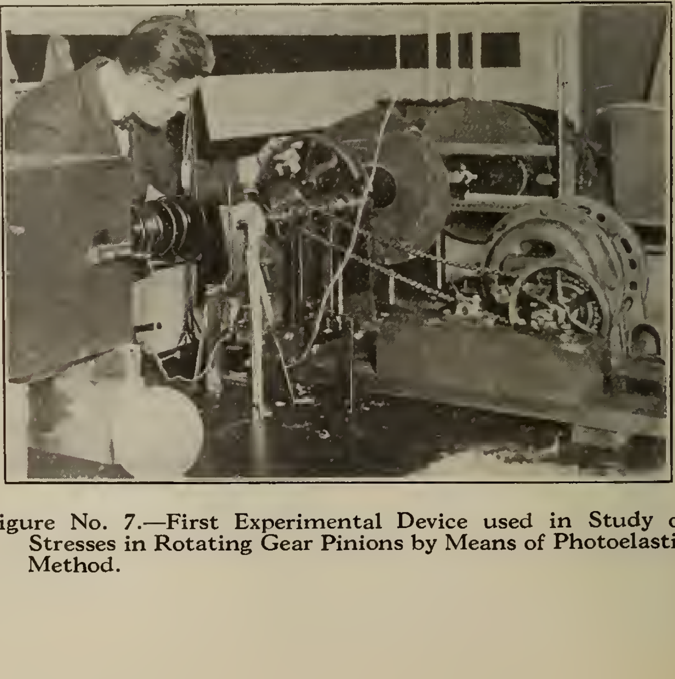

Figure No. 7.—First Experimental Device used in Study of Stresses in Rotating Gear Pinions by Means of Photoelastic Method.

Figure No. 8.—Later Experimental Device used in Study of Stresses in Rotating Gear Pinions by Means of Photoelastic Method.

The question having also arisen if dynamic stresses of a vibratory nature might not be more important in rapidly rotating pinions than the stresses solely due to shrinking pressure and constant torque, the photoelastic study was extended to rotating pinions. By means of a repeated electric spark, which is made to synchronize with the passing of the pinion at every revolution through the same position, a stationary image in the photoelastic apparatus of the moving pinions is obtained. Moreover, for speeds exceeding 700 revolutions per minute, the image perceived by the eye becomes continuous.

Figure No. 7 shows the first driving device used for applying a known torque to the pinions, which could be rotated at speeds up to 1200 r.p.m. It was found that the maximum stress increased with the speed but the interpretation of the results was not possible due to the mechanical complication of the driving and driven devices. A new set-up was built consisting of two identical halves which each comprise one electric motor (driving end) or generator (driven end), one steel shaft, one celluloid pinion. These apparatus are shown in figure No. 8. The stresses for speeds up to 2200 r.p.m. are being investigated at present.

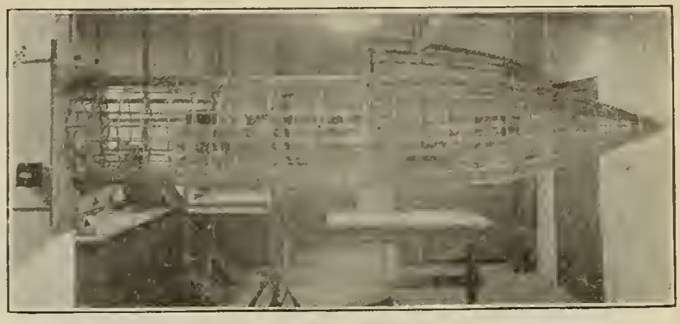

Figure No. 9.—Celluloid Model of the Frame Structure of the U. S. S. Shenandoah.

As recent investigation by means of the photoelastic method, a study of the stresses in the frame structure of the rigid airship U. S. S. Shenandoah should be mentioned. The complication of the frame structure of the ship is such that unusual difficulties accompany the calculations of the stresses in the different members. Approximately a 1/30 full size celluloid model of the structure was built as closely similar on the point of view of stress distribution to the full size structure. Figure No. 9 is a photograph of the model on which extensive measurements of the stresses were made.

Except for Mesnager's investigation of the stresses in the La Balme bridge, at which time he developed the photoelastic method, it seems surprising that occasion does not seem to have arisen as yet to apply the photoelastic method to any important problem of bridge construction. A great number of stress problems of different nature have been and are under investigation at present for industry. The results of the majority are not our property and information cannot be divulged.

Let it, however, be said that seldom has so powerful a tool for the determination of the stresses actually existing in engineering structures become available, and that a more extensive use of it to problems of structural design could hardly be too strongly recommended for the purpose both of safety and economy.

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Discussion on Generation of Explosive Gases in Electric Water Heaters and Boilers

Discussion of paper presented by J. W. Shipley, Assistant Professor of Chemistry, University of Manitoba, Winnipeg, Man., and A. Blackie, National Testing Laboratories, Winnipeg, Man., before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

Messrs. F. T. Kaelin, M.E.I.C., and H. W. Matheson

Messrs. Kaelin and Matheson remarked that this paper dealt with experiments connected with the investigation of the explosion of an electric water heater used to heat a house in Winnipeg. One of them had had the opportunity of being present at the examination of the exploded water heater, and had found no direct proof that the accident was due to an explosion of gases, as it might have been due to the faulty installation of the piping leading to the expansion tank. The piping to the expansion tank in this case was much too small to take care of any extraordinary shutting off of heating requirements. The explosion, therefore, might have been caused by a sudden increase in pressure which would rupture the flat steel top of the heater and the explosion would then be due to the sudden evaporation of the heated water under pressure. Furthermore, the heater in question had only been running for a period of five days, and with normal production of hydrogen from such a heater there would be insufficient hydrogen and oxygen formed in the system during this time to give an explosive mixture.

They admitted, however, apart from these considerations, that an electric water heater operated under the conditions outlined in this paper would be unsafe, unless precautions were taken to vent the non-condensable gases. This might be done readily and by the installation of a valve at the top of the boiler and at a suitable distance from the heat, such that when the valve became cold it automatically opened, and again closed when heated by the escape of steam. The design and use of such electric water heaters was a field, however, in which they had no experience.

With reference to the formation of hydrogen and oxygen in electric steam generators, the authors in their paper had merely stated the facts that hydrogen and oxygen were formed, and that they were explosive under certain conditions. In the account of their experiments the authors gave no information regarding the current density used on their electrodes, which was one of the most important features in the control of the formation of non-condensable gases.

Determinations of hydrogen and oxygen in the original installations at Shawinigan had shown the hydrogen to run as high as 15 to 30 parts per million of steam. It had since been found, however, that this could be greatly reduced by modifying the electrode design and by controlling the current density used, which preferably should not rise above ¾ ampere per square inch. It had been found important to design the high tension electrode in such a way as to give as even a distribution as possible of the current over the whole area. A large percentage of the steam was formed on the high tension electrode surface, due to the large voltage drop at this point, with the consequent formation of a steam envelope over the surface of this electrode, particularly when this consisted of a cylindrical tube. This tended to cause a high current density at the base of the electrode, which gave rise to arcing. A new design of electrode consisted of a series of conical frustra placed in such a way that the steam passed up through the centre of the inner high tension electrode and away from the path of the current. This gave a more uniform distribution of the current over the whole electrode. With this design of boiler at the Belgo Paper Company's plant, a series of five tests had been made, with an operating load of 25,000 k.w. and current density of from .5 to .75 amperes per square inch, and the average hydrogen given off as shown by the five tests made had been 0.7 parts per million, which was practically as low as given in a coal-fired boiler. The boiler had been operated on 60-cycle power. It might be stated, however, that it was found difficult to maintain this low percentage of hydrogen in the steam, having in mind the various conditions under which the boilers operated in various parts of the country.

In general it might be stated from the results of a series of experiments carried out in a glass boiler, that the hydrogen and oxygen formation was due to arcing in the water, and by "arcing" was meant not a power arc, but an arc extending from the high tension electrode to the water particles. This experimental boiler had been arranged so that the voltage could be readily controlled and the arcing was visible, and in all cases this showed that when no arcing occurred the hydrogen averaged from one to four parts per million of steam, but as soon as arcing started the hydrogen jumped very quickly from the above mentioned amount to an amount of the order of 100 parts per million, but this latter amount depended upon the intensity of the arcing. The important points, therefore, to be concerned with in the use of electric steam generators were the proper control of the current density, to avoid arcing by the proper immersion of the electrode, and the correct withdrawal of the impure water from the base of the boiler.

With reference to the origin of the hydrogen and oxygen, it should be mentioned that the hydrogen is only formed in quantity when arcing takes place, and it would seem that the gases are formed by the thermal decomposition of water vapour at the temperature of the arc, the gases being suddenly cooled by the surrounding water which prevents their recombination. On the other hand, there was a possibility that arcing would cause rectification and consequent electrolysis, but so far they had been unable to get any evidence in support of the latter contention. In the steam from an ordinary coal-fired boiler the amount of hydrogen varied from .3 to 1.5 parts per million of steam, and they would expect this amount to be formed in the electric boiler from the same cause, namely; the reaction of steam on iron.

Their experiments confirmed certain of those cited by the authors in that the oxygen occurred in the non-condensable gases in a lesser proportion than would be expected from its formation from water. Their experiments, however, proved that in the normal operation of a boiler without arcing this oxygen largely disappeared, not because it attacked the iron of the electrodes, but because it oxidized the organic impurities in the water. To confirm this, they had analyzed the sludge accumulating in the base of the boiler and had found only a very small percentage of iron present. The oxygen disappearing might, of course, vary with the organic content of the water used. If, however, the boiler was operated under such a condition that arcing occurred, then the electrodes would be attacked, due to the formation of colloidal iron. Any serious loss of electrode weight would, therefore, indicate arcing in the boiler.

With reference to the danger of explosion in buildings or establishments heated by steam from electric boilers, in their experience they had seen little or no danger in this connection, and would mention that no further explosions had come to their knowledge. The electric boiler business had grown to large proportions, so that at the present time in Canada and the United States boilers of a total capacity of 400,000 k.w. were installed. In manufacturing establishments where steam is utilized, the small amounts of hydrogen in the gases did not, of course, cause any danger unless they were allowed to accumulate in some portion of the system where they might be ignited. In ordinary manufacturing establishments this was impossible, since the hydrogen was swept on through the heaters with the condensate and the non-condensable gases were vented in the hot-well. In the case of public buildings the same held true. The hotel at Shawinigan Falls had now been heated with an electric steam generator for three years, the gases in the radiators had been analyzed several times and practically no hydrogen had been found present in any case.

Mr. E. V. Caton, M.E.I.C.

Mr. Caton remarked that the authors were to be congratulated upon researches into a new field. The question of electrolysis by A. C. currents was one which had not been very widely investigated and also was one that had not appealed to the industrial world. With the use of electric boilers and other types of submerged electrode heaters it had, however, become one which was worthy of careful study, and the researches of the writers had indicated that considerable work yet remains to be done.

No definite conclusion could be arrived at, either as to the conditions which tend to produce gases by electrolysis or the means for preventing these. That the paper itself conclusively proved that explosive gases are generated in boilers operating with submerged electrodes could not be denied, but that these gases are a source of danger must not be taken too seriously.

The quantity of gases actually evolved as a proportion of the steam generated was extremely small, and, provided proper precautions were taken to prevent the trapping of these gases and the ignition by spark or arc, the danger was practically negligible and was no more than is usual in the operation of any high pressure power boiler.

The boiler which exploded was of such a design as to trap all the gases generated, which accumulated in the electrode chamber. There was a strong possibility of an arc being drawn between the electrodes and the water surface at light loads, and from experience now available he did not believe that a design of this nature would ever be made again. Whether the explosion had been due to gases was, of course, impossible to state definitely. An inspection of the boiler after the explosion and an examination of the damage done indicated that the explosion was of a very severe nature, and assuming that the initial explosion had been due to gases, the subsequent occurrence would, of course, be the same as if the boiler had exploded by steam. A steady rise in steam pressure would, in all probability, have shown itself by the bursting or breaking of some of the auxiliary apparatus rather than the boiler. However, this matter had been very fully threshed out at the time and no definite conclusion could be arrived at.

Mr. J. W. Sanger, A.M.E.I.C.

Mr. Sanger remarked that his close connection with the authors' investigations on the generation of explosive gases in electric boilers prompted him to stress the object of the research. Although the explosion of an electric boiler, from some cause which could not be established, was the reason for giving the subject serious consideration, the scope of the enquiry was confined to qualitative and quantitative studies of the oxygen-hydrogen gases generated and the possibility of their accumulation in the boiler, or at some remote point in a heating system attached thereto.

He believed that certain definite conclusions must be accepted, the most important of which were as follows:—

(1) Hydrogen and oxygen are generated in all alternating current electric boilers and are combined and proportioned in such a manner that they can be ignited—provided that the type of boiler and the operating conditions are of a certain character.

(2) Oxygen-hydrogen gas mixture in large quantities has been found in commercial steam heating installations. Samples of this gas have been withdrawn and exploded.

(3) The dilution of the explosive gas mixture with steam or carbon dioxide does not seem to prevent its ignition.

(4) In an electric steam boiler, if there is no place where the gases can separate themselves from the steam and collect in large quantities, there is no danger.

(5) There is no conclusive proof to show that the explosive gases are generated by electrolysis.

(6) There is no danger if the mixture of explosive gases and steam always exists in the proportion in which they are generated.

He was of the opinion that future research should be conducted with the main object of finding out how the gases are generated, as this would lead most quickly to the development of preventative measures. Some observations showed that high current-density at the electrode had a marked effect on the rate at which the gases are generated. Other observations showed that the relation between the quantity of gas and the current-density is by no means constant. In fact there were good grounds for believing that the explosive gases are generated from steam and not from water, which would upset the electrolysis theory altogether.

Electrode current-density was not as easy to control as might be imagined. While the average current-density on an electrode surface could easily be fixed, there were sure to be a number of "hot spots" at the point of contact between the surface of the water and the electrode. Experience had shown that these "hot spots" may increase local potential stresses in such a manner that they ultimately develop into short circuits.

In concluding he would recommend that investigators resist the natural desire to conduct their researches with high current-density electrodes. Current-densities of less than one ampere per square inch would give more consistent results, and would eliminate a number of peculiar conditions which accompany high current-densities.

Mr. W. P. Dobson, M.E.I.C.

Mr. Dobson remarked that in the type of heater considered in this paper, the water is used as the conducting medium. The case of the heater should, therefore, be grounded in order to eliminate the possibility of shock. This was especially important where the heater may be used for domestic water heating, as serious injury might result from a shock of as low a voltage as 110. If higher voltages were used, this precaution became even more necessary.

Mr. H. L. Sanborn

Mr. Sanborn remarked that doubtless the primary cause of the Winnipeg explosion, wherein an electric boiler used for heating purposes wrecked a house, could be directly traced to the use of a closed system, allowing explosive gases to collect over a period of time and ultimately being subjected to an arc or spark resulting in the explosion. This danger of a closed system was now generally recognized.

He did not consider that the data in this well written paper were applicable to the present comparatively minor use of electric water heaters, but rather to the larger use of surplus hydro-electric energy in the form of large blocks of power in electric steam generators.

This paper of Messrs. Shipley and Blackie, dealing with the subject only in general terms, while proving pretty conclusively that explosive gases in fairly large quantities are formed by the generation of steam from electricity, did not make any specific recommendation as to how this condition ought to be remedied; or whether or not it may be safely controlled.

The paper was well timed, however, coming, as it did, shortly after the pioneer application of 13,000 volts to electric steam generation by the Abitibi Power and Paper Company, whose first unit of a 20,000 kw. Kaelin single-phase three tank electric steam generator had been placed in operation December 2, 1925, to be followed by a second duplicate unit, and a third three-phase 13,000 volt 20,000 kw. single tank Canadian General Electric unit, a total of 60,000 kw. Prior to this 6,600 volts had been the usual voltage in commercial use, and for the past four years had been successfully employed by the Laurentide, Shawinigan, and Price Bros. companies, without hydrogen explosions.

With regard to the data presented, there was no doubt about the correctness of the theory of electrolysis by single-phase alternating current, especially at 25 cycles.

It was interesting to note that hydrogen was no newcomer in coal-fired steam mains but could, and did, form by the action of steam on iron. It followed that in meter piping, hot wells, paper machine dryers and other places wherein hydrogen might be trapped, this situation had actually been prevailing since the advent of the use of steam, but that vents and natural neutralizers had prevented the fact from being generally recognized.

Moreover, since combustion was impossible except with sufficient oxygen present to support it, a logical conclusion would be to evacuate the oxygen from any and all sources, and if this were done, explosion or combustion of the other gases formed would be quite impossible.

It had also been proposed to deactivate and deaerate the feed water before its entry into the boiler, thus removing to a large extent both the air in the water and the oxygen previously absorbed by the water.

If, as is usually the case, the feed water contained free CO_2 and bicarbonates, the CO_2 was usually somewhat increased by this pretreatment, and being an inert gas, the dilution of the gaseous mixture evolved would be somewhat greater, so that the limits of inflammability of the mixture would be narrowed considerably. This was shown in the paper, where in one test carbon dioxide made non-explosive a gas mixture containing 34.5 per cent of hydrogen.

The next point was that if hydrogen were present in combination with sufficient oxygen to cause combustion, and if the ignition temperature of hydrogen were from 1076 to 1094 degrees Fahr. it would be reasonable to assume that ignition could only be caused by the presence of an arc; apparently no amount of increase in compression of the hydrogen would cause it to reach a sufficiently high temperature to ignite spontaneously, because the hydrogen being in the presence of steam would be in or nearly in thermal equilibrium with the steam.

It was considered safe to assume, from the observations so far made on the first electric steam-generator at Iroquois Falls, that when delivering steam at the approximate rate of 62,000 lbs. per hour, the liberation of hydrogen with the steam as produced was so rapid that any explosion in the three single-phase 20,000 kw. tanks was impossible.

Tests were being carried on at various points in the distribution system, but these had not yet advanced to such a point as to be checked and used at this time.

Would it be possible, after removing most of the oxygen in the feed water, to instal some form of absorption apparatus on the main header of the boiler for the purpose of removing oxygen mixed with the steam? For example charcoal would absorb approximately 9.25 times its weight of oxygen, and the oxygen was capable of being removed by means of a vacuum pump; it had also been suggested that an alkaline solution of pyrogallol would absorb oxygen, but this was doubtless not an economic possibility.

It appeared that lime, $Ca(OH)_2$, could be added to our feed water, somewhat preventing corrosion of the electrodes, also decreasing scale, and greatly decreasing the amount of hydrogen liberated.

The current density should be properly maintained.

What would be the rate of evolution at variable voltages?

The paper stated that the accumulation of gases in radiators or other cooling parts of a system provided with steam from an electric boiler, must be considered extremely hazardous — should this statement not be confined to small heaters for domestic heating purposes and was it applicable to power plant steam from large electric steam generators?

Would the authors state, from their experiments, what they would consider the relative hazard as between the three shell single electrode type of generator and the single shell three electrode type, operating on a three phase system 12,000 volts, using ground plate, the capacity of the generators compared being at least 10,000 kw.?

The paper indicated that the addition of salts to the electrolyte increased the amount of oxygen and hydrogen gases given off at the electrodes; it could, therefore, be deduced that the greater the proportion of condensate used in an electric boiler, the less of those explosive gases would be given off at the electrodes; was it not therefore advisable to run such boilers with as much condensate as possible, and thus produce a minimum quantity of hydrogen, rather than to use raw water and get a large volume of hydrogen while depending on the gases dissolved in the raw water to reduce the violence of the explosion?

Did the authors not consider that their experiments were carried out in too small a scale to render their conclusions applicable to electric steam generators of large capacity, and that with a more systematic investigation as to the proper working conditions, an electric boiler could be built, such as were now in service or were now being installed, which would be just as safe as a fuel fired boiler? Did the authors believe that the generation of steam using water as a resister would always be accompanied with the danger of an explosion? While appreciating the full worth of the facts as outlined in the paper as a general summary of dangers to look for and prepare against, he felt that the problems involved in the design and operation of electric steam generators could be solved with resultant safety and efficiency.

Mr. C. E. Sisson, M.E.I.C.

Mr. Sisson remarked that the paper when read without reference to other data gave a somewhat alarming impression, quite out of proportion to any possible danger that might exist, at least in the case of electric steam boilers, a large number of which had been in operation for some time without giving any trouble. Of course, the accident which took place in Winnipeg could not be ignored, but it had not been definitely determined, so far as he was aware, that the explosion was caused by ignition of gases generated within the heater.

The experiments of the authors showed that the amount of hydrogen generated in an electric steam boiler was dependent upon the material used in the electrodes and the amount of current passed or the current density of the electrodes. It had also been found with electrodes of certain composition that the liberation of gases was very much decreased after the boiler had been in operation a considerable time.

With the proper design of boiler it had been found that for every cubic foot of water evaporated there is formed 0.002 cubic foot of hydrogen measured at atmospheric pressure. One cubic foot of water, however, gave 1687 cubic feet of steam measured at normal pressure, so that the ratio of the volume of hydrogen and the volume of steam would be one to 840,000. As the addition of only twenty parts of air to one part of hydrogen was sufficient to prevent an explosion of the latter, it would be seen that 840,000 parts of steam diluted the hydrogen so far that the possibility of explosion was too remote to be considered.

He believed that the hydrogen mixtures which collected in radiators, traps, etc., on condensation were not explosive mixtures of the first magnitude as the authors had stated. Owing to the fact that air and carbon dioxide are liberated along with and in relatively larger quantities than the hydrogen, these mixtures must not be considered as composed of pure hydrogen and pure oxygen but should be classed with hydrogen-air mixtures. The most explosive mixture of hydrogen and air was composed of one part hydrogen to 2.4 parts air and the maximum theoretical explosion pressure of this mixture is 102 lbs. per square inch gauge (Kratz and Rosecrans — University of Illinois Bulletin No. 133, page 52).

Practically no pressures greater than 95 lbs. per square inch gauge had been recorded. Increasing the hydrogen or increasing the air lowered the explosion pressure. The 9 per cent hydrogen mixture, which, as the authors point out, may collect on condensation of steam, would fall far short of an explosion pressure of 100 lbs. per square inch, and certainly therefore should not be put in the class with high explosives. However, one had a somewhat uncomfortable feeling on realizing that it was possible to have a more or less explosive mixture in radiators, etc., and due caution should be taken for venting these in the same way as is desirable and necessary in the case of their being supplied from a coal-fired boiler.

Discussion on the Fuel Problem in Canada

Discussion of paper presented by Lesslie R. Thomson, M.E.I.C., Consulting Engineer, Montreal, before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 29th, 1926.

Mr. G. R. Pratt, A.M.E.I.C.

Mr. Pratt remarked that from the point of view of history and statistics Canada's coal problem was excellently put by the author, but that from the point of view of an engineer his paper seemed lacking in constructive effort.

The following main facts had been brought out:—

1. Canada has 16 per cent of the world's coal, which is sufficient, if used, to place Canada in a position independent of any other nation as regards fuel.

2. Canada has a coal industry in the East with ample coal reserves to supply a large part of Canada's fuel requirements, but it is in an insolvent condition because it cannot sell its coal at the going price in the market (not because there are no markets).

3. Canada has a coal industry in the West with unlimited coal reserves which could supply the whole of Canada's fuel. The factor which prevents this is not the price of coal at the pit, but the cost of transporting it to the place where there is a market.

4. Canada has an industrialized area in Central Canada with no coal within its borders, which at the present time is purchasing its fuel from its manufacturing competitor.

5. Due to the present over production of coal by this competitor, and due to inequality of laws which permit of dumping the surplus coal, Central Canada is obtaining coal at very low cost.

6. That apparently the life of this industrialized area depends upon a continuance of the supply of coal from its competitor.

Why were the coal reserves referred to in item (1) always considered as a valuable resource if they were to be outlawed on account of their location? If these coals were not to be used, they merely locked up capital which might be used to better purpose elsewhere.

Referring to items (2) and (3) he was of the opinion that under the present rates for transportation the markets for Canadian coal could not be extended to any great extent, and that no rate which will include all the so-called costs of operation would permit of moving Canadian coal over long distances.

The railroads insist that it is their right to establish rates which will cover the cost of operation and show a profit, regardless of the effect of such a rate on the activities of others. Canada should insist that the railroads make full use of their equipment. Instead of holding idle equipment in waiting for high priced freight, any non-competitive freight would be profitable. The movement of coal could be made from east and west into the central area, pay the cost of movement as compared with keeping the equipment idle, and permit of the coal meeting foreign competition.

As regards the supply of Central Canada, a study of public statements made across the line warranted the belief that the American supply would not always be given so freely as at present.

Industry in Central Canada would at some time have to face a condition of embargo on United States coal, or a gradual movement of Canadian industry to coal districts in Canada.

The author had stated that the members of the E.I.C. Fuel Committee were unanimous in their findings. If the minutes of the various meetings were gone over it would be found that the Western members objected very strongly to the local viewpoint of the investigation and insisted that the investigation of fuel conditions should be on a national basis.

With regard to the work of the Dominion Fuel Board, the scope of this board should be extended to the solving of the fuel problem upon a national basis and should include the marketing problems of both East and West.

Too much attention had been given to the need of converting the raw coal into coke, for this idea was not economically sound unless the coke were to be considered as a by-product to some other commodity obtained from the raw coal.

He questioned the desirability of establishing coking plants solely for the purpose of making domestic coke with Nova Scotia coal, unless there were a profitable market for the by-products.

Mr. James McEvoy, M.E.I.C.

Mr. McEvoy remarked that the author had approached the fuel question with direct honesty of purpose, free from any local self-interest, and had not allowed national sentiment in the matter of the origin of our fuel supply to obscure his vision of what was really best for our national welfare.

The author had used the expression "metallurgical coke", probably in contra-distinction to gas-house coke. However, the coke considered by many persons as the best kind for domestic fuel was neither gas house coke, nor was it suitable for metallurgy. It was a coke similar to metallurgical coke but allowed to retain a small amount of volatile matter, say up to as high as 5 or 6 per cent. This coke could be produced by moderately low temperature coking, but that method was slow and the throughput correspondingly low. In high temperature fast coking the difficulty was to get a uniform grade and avoid loss by crumbling of portions of the charge which had not firmly cohered.

It would be useful if we had a name for such fuel to distinguish it from straight metallurgical coke.

Leaving coke fuel out of the question for the moment, the author brought out very clearly the difficulty of supplying Central Canada with all Canadian coal, on account of the long hauls. Whether a tariff on coal with a subsidy for long hauls would be a benefit to Canada in the long run or not was very debatable. It would undoubtedly give more employment and increase the prosperity in our coal mining communities, and it would give more tonnage for our railways. It would also, to the extent to which it became effective, retain in Canada a percentage of the money which was now sent out to purchase foreign coals.

On the other hand, however, it would inevitably increase the cost of living and of manufacturing, and as a consequence tend to reduce our export trade. The burden of tariff and subsidy would not be carried evenly by all the people of Canada, but a disproportionately large part of the burden would have to be carried by the individuals in the central part.

He believed that too much stress was laid upon the advantage of retaining in Canada the money which was now paid out for foreign fuel. The whole amount so spent was only about one per cent of the total amount of our exports. The disturbance of trade by increased cost of living and manufacturing might easily cause a reduction in exports of several times that percentage and leave the country as a whole much worse off than before such uneconomic experiment was attempted.

Perhaps we might venture to lay down as an axiom that only suitable coals of high calorific value should be transported for long distances. In cases where the transportation charge was the greater part of the price of delivery, there was no need of argument to prove the soundness of this axiom.

The author had given food for serious thought in pointing out the falling off in efficiency in the mines of Eastern Canada, similar to the decrease in the British mines, and in contrast the rise in efficiency in the Pennsylvania mines.

Mr. Frederick Burnett

Mr. Burnett remarked that the development of a "Made in Canada" substitute for Pennsylvania anthracite as a domestic fuel was of extreme importance, and that coke from bituminous coals imported from the United States, appeared at this time to be the only product worthy of serious consideration.

Even under the present exceptionally favourable circumstances for importation of coal from Alberta and Nova Scotia, these could not meet other available fuels of similar grade in price or efficiency in utilization. What could they hope to accomplish under normal conditions?

Importation of good grades of Welsh anthracite should be encouraged, as these coals had no equal as domestic fuel and were well worth the extra cost over American anthracite.

He pointed out that the Canadian public is now becoming educated to the high value of coke as a domestic fuel, when properly prepared and sized. Any Ontario company or utility which could produce coke for sale at a price per ton slightly lower than anthracite would be assured of a good market.

A partial solution of our domestic fuel problem in Central Canada would be attained if the existing gas utilities of the province of Ontario made all coal gas in place of manufacturing a very large volume of carburetted water gas, requiring large quantities of anthracite or coke and imported gas oil.

Why were these coal gas plants not installed? Because electricity for cooking and water heating had been sold at such low rates throughout Ontario that expansion of the gas utilities had been retarded, and they quite naturally feared to venture upon large capital expenditures when electric enthusiasts were everywhere predicting the eventual displacement of gas altogether by electricity.

The Dominion Fuel Board had seen fit to report that by-product coke ovens were the Alpha and Omega methods of producing domestic coke, but the fact remained that such installations could not be made profitable at any point in central Canada unless the chief by-product, gas, could be disposed of at remunerative rates, which was not possible, except at one or two points, by reason of the fact that other types of high temperature coal carbonization plant are available which show better financial returns than by-product coke ovens, in connection with gas supply.

It seemed to him unfortunate that the Dominion Fuel Board should not have investigated and included in their reports a study of the other types of high temperature carbonizing plant. Where comparisons were made between coke from coke ovens and from "gas retorts", the coke from the old fashioned horizontal retorts was the product used for comparison. That was somewhat unfair, as the later type gas ovens and vertical retort systems produced a most excellent domestic coke, without the imperfections in structure and variable physical properties which were inherent in coke made in the old style retorts.

To attain more freedom from dependence upon Pennsylvania anthracite the logical sequence of action appeared to be:

1. Import good grades of Welsh anthracite.
2. Promote the installation of coal gas plant to replace the carburetted water gas process now so largely in use at Ontario gas works, thereby increasing the available supply of domestic fuel.
3. Build coking plants wherever they can be shown to be commercial possibilities, and self-sustaining without government bonusing.

Professor R. W. Angus, M.E.I.C.

Professor Angus referred to the author's statement that "except in time of war, that coal will reach the consumer which, in the long run, is the most economical", and believed that the consumer would select the article which he thought best suited to his purpose, and which could be purchased for the least possible price. It should be remembered that the location of the coal beds was determined long before the international boundaries were established, and that there would always be a marked tendency for people to select coal from the nearest available source of supply, unless some economic reason prevented its use.

He thought that most householders were willing to pay an extra price for fuel that they could use without undue trouble, and from which they knew the type of results to expect. On the other hand the number of persons using coke and other substitutes for anthracite was increasing.

In the table on page 66 the author had made a very interesting comparison of the cost of coal in Toronto which came from various sources, showing that the cheapest bituminous coal used in the Toronto district was secured from the United States, the price of Alberta coal being high, even when the extremely small freight rate of $6.00 per ton was charged. There seemed to be little doubt that Alberta coal would have to bear, in the end, the exact cost of transportation, which would bring it up to a still higher price.

In the interests of economy he did not believe that our national railway should haul coal at less than cost, because that would put a burden on the people of Canada as a whole, for the benefit of a few who would get the benefit of the reduced rate.

He felt that under the present circumstances Alberta coal could not be economically used in Ontario.

Mr. A. W. McMaster, A.M.E.I.C.

Mr. McMaster remarked that the author had suggested Montreal as the limit of the Eastern section, but that the problem was really one of transportation and the transfer of coal from ocean-carrying vessel to lake carrying vessel. If the grain carriers could be induced to take coal on the return trip, he saw no reason why the differential of 50 cents per ton against American coal could not be overcome.

He also wished to give full credit to the Dominion Fuel Board for their investigations and study of this problem.

Referring to the author's curves showing that Nova Scotia mining costs had gone up where, on the other hand, West Virginia and Alberta coal costs had gone down, he desired to point out that 70 per cent of the present Cape Breton output came from submarine areas. Shafts could not be put any further out than on the edge of the ocean, and some of the workings were now 1½ miles from the shore. Under present operating conditions Cape Breton mines were producing about 22,000 tons per day, and without much capital expenditure the output of Nova Scotia coal could be increased to approximately 10,000,000 tons per year. He believed, however, that the peak cost had been reached and that costs were coming down. On the other hand, West Virginia fields were non-union, most of the mines were shallow, dry and non-gaseous, a condition which also applied to most of the Alberta coal fields. In both cases the problem of winning coal was easier than the problems facing the Eastern Canadian operator. This to some extent explained the difference in the curves referred to.

The author had mentioned the domestic fuel situation and referred to by-product coke as a substitute for anthracite and the building of coke plants in Toronto, Montreal and Ottawa, where the gas products could be taken care of with existing equipment. He had no doubt that coke as a domestic fuel was superior to the anthracite we were getting from the country to the south of us.

In regard to using bituminous coal for domestic purposes, he wished to point out that most of the people of the civilized world to-day were using it for heating, and the eastern provinces of our country had always used bituminous coal for heating their homes.

He looked forward to developments such that coke made from Canadian coal would replace anthracite, which is really a luxury fuel, for this purpose.

Mr. C. P. Hotchkiss, A.M.E.I.C.

Mr. Hotchkiss remarked that on account of his connection with the Dominion Fuel Board, and because of the fact that this question is being discussed by Parliament almost every day, he should not be expected to express any personal opinions.

He believed that what had been said regarding the attitude and work of the Board would perhaps indicate the difficulties of the Board's position in trying to keep in mind the welfare of the whole country, rather than being swayed by sectional interests. The national aspect of the problem must always be considered.

He would remind both the East and the West that the Board's primary object is to extend their markets and build up the coal industry of this country insofar as this seems possible in the best interests of the nation as a whole.

As regards the present situation, he was of the opinion that the strike in the anthracite fields of the United States had been one of the best things that could possibly have happened for Canada. Four or five years ago Central Canada normally consumed about 5,000,000 tons of American anthracite, and was wholly dependent on this fuel for domestic purposes. In 1924 we only consumed about 3,500,000 tons, and this year, 1925, we only brought in a little over 3,000,000 tons. He believed that we were saving a huge amount of money in being forced to turn to other fuels, and that the other fuels were just as good.

He thought that Mr. Pratt had cleared up another point, and that the general public were under a misapprehension as to just what our fuel problem was. We continually heard of the $100,000,000 or the $200,000,000 that were going out of this country for fuel. Mr. Pratt, he believed, had made the definite statement that we cannot hope to bring Alberta industrial coal into Ontario. We could get imported industrial coal in here at between $5. and $6. a ton. Complete fuel independence would mean replacing this coal by either Alberta, British, or Nova Scotia coal. A great many people thought when they urged a $7. freight rate for Alberta coal, that if such a rate were obtained, this coal would replace all the foreign coal that is now used in Ontario.

Mr. Jesse Gouge

Mr. Gouge remarked that he belonged to the Coal Operators Convention of Alberta, a body which is desirous of furthering the sale of Alberta domestic coal in the province of Ontario. He had been impressed with the fact that speakers in the discussion had so far sounded nothing but a note of despair on the subject of substituting Canadian domestic coal for the fuel ordinarily used in Ontario.

From his knowledge of the fuel situation as a coal operator of many years' experience, and from his association's experience in shipping fifty thousand tons of Alberta domestic coal into the province of Ontario, he ventured to prophesy that within five years there would be no anthracite problem in Ontario because Alberta domestic coal would be used there. He believed that Alberta domestic coal had every feature of desirability possessed by anthracite. It had cleanliness and absolute freedom from soot and dirt. The only objection raised against it was that it had not as many heat units.

The western domestic coal could be taken because of its quicker lighting, quicker heating, and ability to reduce the fire by an application of drafts, and it could be adapted to the necessities to such an extent as to save the extra amount of heat units wasted with anthracite coal because the fire could not be controlled.

He felt sure that with a seven dollar freight rate, Alberta coal would replace anthracite coal in Ontario. He did not discuss the problem from the industrial point of view because he did not think that there was a well posted coal operator in western Canada who believed that the time would ever come, short of an absolute embargo, when he could put his coal into Ontario on an economical basis and compete with American coal for industrial purposes.

In Alberta they desired the railways to take their coal at a rate which would pay the railways, and he was of the opinion that with a seven dollar freight rate the domestic coal of western Canada could come to Ontario and be satisfactory to the purchasers and to the coal dealers.

His mission was to see whether at this time, when there is a fuel shortage in Ontario, and when anthracite coal cannot be procured, the supply of Alberta coal cannot be enlarged and the rate of seven dollars per ton continued well on into the spring.

Mr. Thomson's Reply

THE AUTHOR, in reply, observed that he differed from Mr. Pratt, who had stated that American coal was dumped into Canadian markets. He ventured to disagree with this as a broad statement. That there had been some dumping was true, but that all American shipments to Canada are dumped was, in his opinion, not correct.

Nor did he believe that Mr. Pratt was correct in his statement that the Canadian railroads could handle a large share of the needs of Ontario if Alberta were to supply them. The railway members of *The Institute's* Fuel Committee had stated that 500,000 tons per annum would be about the amount which could be handled by the railways at present, unless large capital expenditures were made for new equipment.

It was not unreasonable to see an embargo upon the export of American anthracite coal, but to prophesy an embargo on the export of American bituminous coal was hardly justified in view of the immense quantities of the bituminous reserves.

The author wished to emphasize again that in the event of a considerable movement of coal from Alberta on a commercial or semi-commercial basis, the competing American coal in Ontario would not be anthracite, but would be some of the high quality low volatile bituminous coals. Hence he believed that the oft repeated comparisons of prices with American anthracite were misleading.

Mr. Gouge's remarks were emphatic but perhaps not so convincing to the author as to some others. Mr. Gouge prophesied a glittering future within five years in the acute fuel area, but the author doubted whether in the absence of new tariffs or bounties, the realization of the dream would be as rosy as Mr. Gouge believed.

The kernel of the whole question was as follows: The author believed that under the present condition of prices, tariffs, etc., Alberta coals could not compete at Toronto. If for national reasons it were desirable to become self-supporting in coal, then this could be done only by means of tariffs or bounties. This obviously would be a matter for governmental decision, but before such a decision could be given from a national point of view, it would be necessary to know the facts, to reach an intelligent understanding of them, and then lay down a competent national policy.

Discussion on Fuel Preparation and Treatment

Discussion of paper presented by J. L. Landt, Consulting Engineer, Buffalo, N.Y., before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 29th, 1926.

Mr. R. E. Gilmore

MR. GILMORE remarked that the terms "carbonization" and "coking", which were used by the author interchangeably, did not necessarily mean the same thing. Carbonization applied to the heat treatment of solid fuels in general, while the term coking applied more particularly to those coals, belonging mostly to the bituminous class, which on being heated without access of air, cake, melt or coalesce into a coke structure. The manufacture of metallurgical coke on the one hand and city gas on the other hand, had in the past been carried out by high temperature processes, and the fuel used had been restricted to high grade bituminous coals. In low temperature carbonization processes, as pointed out by the author, the prospect was that the poorer grades of bituminous coals and the lower grade non-coking coals may be used. The author mentioned three methods of utilizing the solid residue product of low temperature carbonization, viz.; as low temperature coke, a briquetted product, or as powdered fuel. In this connection it might be pointed out that for the non-coking coals, the carbonized residue or char would have to stand the extra expense of being briquetted to find use as a domestic or household fuel, as it could not very well be used for this purpose in the powdered state.

Good coking bituminous coals occurred in the Maritime Provinces and in British Columbia, while 70 per cent of the coal in Alberta, where was to be found the bulk of the country's coal, belonged to the non-coking sub-bituminous and lignite grades known as "domestic" coals. These non-coking Alberta coals were used extensively for household purposes and, inasmuch as they burned with a white or blue smoke, did not require carbonization treatment to render them smokeless as did the ordinary soft coals. With these coals carbonization followed by briquetting, where a pitch binder is added, failed in most cases to produce a household fuel superior to the lump coal or even the screened run of mine. Unless, therefore, the yield of gas and oil by-products were large, the inducements for carbonizing would not be promising.

In England low temperature carbonization supplemented the high temperature processes as an important factor in ridding the industrial centres of the smoke nuisance. There, where low temperature coke containing 7 to 10 per cent volatile matter is welcomed as an easily ignited open grate fuel, and is considered superior to the high temperature products with 1 to 3 per cent volatile matter, coke was being used as a substitute for smoky soft coals. Low temperature coke, however, was more friable, that is, more liable to crumble when handling, than the better grades of high temperature coke, and in Canada, at least for central Canada where coke is a substitute for anthracite, this difference should be kept in mind; the requirements here being for a properly sized, clean, dense and non-friable coke such as produced in by-product ovens.

He believed that the temperature range given by the author for the low temperature processes, namely 450° to 550° C. was low. While 550° C. was given by the eminent authority, Franz Fischer, as the maximum temperature of reaction to produce genuine primary tar, the carbonization temperature might, apparently, be as high as 700° to 750° C., that is 1350° F., without producing naphthalene, a characteristic constituent of high temperature tar. Low temperature tar contained the olefins, naphthenes and paraffin, as in crude petroleum, and also phenols, whereas in the high temperature product the typical coal tar aromatic hydrocarbons, namely benzol, naphthalene and anthracene, were evidently products of secondary decomposition above 750° C. of the primary tar constituents. Attention was constantly being drawn to the phenol content of low temperature tar, as giving such tar an enhanced value for creosoting purposes. When the cost of extraction and refining of these phenols to meet fairly stringent specifications was taken into account, the net value was not so promising. In England the low temperature tar oils are desired to mix with crude petroleum for use as fuel oil, and in Canada for some time to come there are many reasons for not counting on low temperature tar at higher than fuel oil value.

The author had mentioned that with non-fusible coals it is apparently possible to drive off the gases and oil vapours at a much faster rate than with fusible coking coals. This might be of interest when treating the poor coking bituminous coals and also the fines or slack of non-coking coals for use as powdered fuel as he suggested, but it had already been shown that where the moisture content is not excessive, the higher grades of these non-coking coals can be used directly as powdered fuel, which powdered fuel would have to be used locally for steam raising purposes. The briquetting of these fines without preliminary carbonization for shipment to outside points to be used either for steam raising or household use was a problem seemingly worth investigation.

As to the yield of methanol, the figure of 350 gallons per ton of coke was used. The authority for this yield was not given, and it would seem that the authors quoting Fischer's work are responsible rather than Fischer himself. Exact information as to the details of processes and the commercial quantities of coke and water gas used and also the commercial conversion efficiencies and yields of refined methanol, was not readily available. Assuming 13,000,000 B.t.u. as the heat in the water gas per ton of coke gasified, as used on page 96 by Mr. Landt in "Coke as a Household Fuel in Central Canada", and also assuming an 18 per cent loss in heat in the reaction $2H_2 + CO = CH_3OH$, as given by Fischer in his article "Liquid Fuels from Water Gas",* (page 574, June 1923), it was interesting to note the maximum yield of methanol possible, as follows:

Heat in water gas per one ton of coke gasified...	13,000,000 B.t.u.
Heat in methanol, allowing 18 per cent loss......	10,660,000 "
Calorific value per gallon methyl alcohol (8×9600)	76,800 "
Yield of pure alcohol (methanol) per ton of coke $\frac{10,660,000}{76,800}$ =............................	139 Imp. gals.

On these assumptions, the highest possible yield from a ton of (high temperature) coke would not exceed 140 (Imp.) gallons, equal to less than 100 gallons per ton of coal carbonized. No allowance for the coal or coke used in producing the steam to make the water gas had been made here, nor was the expense of carrying out a catalytic reaction under comparatively high temperatures and pressures taken into account.

Mr. Lesslie R. Thomson, M.E.I.C.

Mr. Thomson remarked that the author had stated in passing that German methods for the treatment of German coals were not necessarily a success on this continent, and he believed that that statement was eminently true. He would not subscribe to the idea that no German method is applicable to our coals, but knew, from many years investigation, that our sub-bituminous and lignite coals are of a different structure, and German methods can not be transposed wholesale for the successful treatment of them.

He agreed with Mr. Gilmore that 550° C. was not a fair figure to allow for low temperature carbonization, for a number of very clear low temperature results were obtained at from 600° to 650° C.

He desired to ask Mr. Landt if he had heard correctly when he stated that the very low volatile char would be suitable for pulverized fuel, especially in the cement industry.

He did not think, also, that Mr. Landt had given sufficient prominence to some very recent work that had been done on this continent. Might he recall the tremendous amount of money that had been invested in low temperature carbonization processes, and some of the troubles that that industry went through. He was permitted, by one of his correspondents in New York, to state publicly that they had been successful in the development of their retorts, one of which had operated almost continuously for 19 months with the original parts, shaft, etc., still in good condition, and at reasonable expense for power, repairs and fuel. Over half a million gallons of tar had been produced and sold. Coke produced prior to October 1925 had been sold as such; after that date it had been converted into briquettes and found a ready market. A simple, inexpensive system had been perfected for carbonizing briquettes, and completely eliminated the smoke forming properties of the pitch binder.

He thought that presaged a very important development in North America of low temperature work.

Professor A. G. Christie

Professor Christie remarked that Mr. Thomson had questioned whether low volatile coal could be burned in powdered form. He would mention that the Holtwood Steam Station of the Pennsylvania Water and Power Company is located at their hydro-electric plant on the Susquehanna river, which flows through the hard coal region of Pennsylvania and washes down large amounts of fine anthracite from the culm piles and from the washeries, so that quantities of this coal have accumulated in the back water above the dam at Holtwood. The steam station was designed to burn this recovered coal along with bituminous, and its powdered coal furnaces had successfully operated with as much as 100 per cent of such anthracite coal.

Mr. Landt's Reply

The Author, in reply to Mr. Thomson's question as to the applicability of the low temperature char after carbonization to pulverized fuel on account of its low volatile content and, therefore, short flame, remarked that he did not know exactly how far he was permitted to go in saying what the success of that application had been. There were one or two coals on this continent that he knew were really non-coking. When he said non-coking coals he meant coals from which a fuel is made which is unsuitable for use without further processing. The scheme to-day of a very successful installation was to grind the fuel to the fineness required before carbonization, and this was being done on quite a large basis, and on a practical scale. It was planned to leave between 8 and 10 per cent of the volatile matter in the coal.

*Industrial and Engineering Chemistry

Discussion on the Influence of the Modern Highway

Discussion of paper presented by W. A. McLean, M.E.I.C., Consulting Engineer, Toronto, Ont., before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 29th, 1926.

Mr. Geo. Hogarth, M.E.I.C.

Mr. Hogarth remarked that while Ontario had today a network of highways second to none, the motoring public and trucking interests were not confined to their own highways but passed freely over the splendid roads of adjoining provinces and states. The day of the mud road and difficult travel was drawing to a close and with it went the isolation so much felt in some sections. The resident of rural Ontario today thought nothing of driving 20 or 25 miles to the nearest town or city in order to enjoy an evening's entertainment and the main streets of our towns and cities were crowded with the cars of people from the surrounding country. Good roads everywhere encouraged our Canadian automotive industries, which had an investment of almost $61,000,000 and about 110,000 people directly or indirectly employed. The pay-lists of motor vehicle manufacturing concerns amounted to almost $15,000,000 per annum.

The large expenditures on road improvement had caused those responsible for the work to give the closest study to every phase of highway activity. The fact that certain methods and types of road construction were satisfactory yesterday was not accepted at all today. The contractor in buying new equipment did not buy the same model as the machinery he purchased only a few years ago. Rapid changes were continually occurring in methods and equipment. Buses almost over night had developed from a combination of the old bus body set on a discarded truck into a palatial, electric lighted, heated, cushion seated affair as comfortable as a Pullman car. The time honoured method of dragging a gravel road, by pulling over it a timber frame hitched to a team of horses, had been replaced by a motorized grader that could do almost three times the work of a team at a fraction of the cost.

Intensive study of the motor vehicle was now proceeding in an effort to improve it so as to reduce the damage done to the roads, and great advances in that direction were expected.

One feature of the modern highway called for the deepest concern, namely the terrible daily toll of fatal accidents. The careless, thoughtless and reckless driver was abroad on the highways and his shortcomings would seem seldom fatal to himself. Vigilance was demanded of every driver of a moving vehicle, and excessive speed and lack of caution should not be tolerated He urged all to work towards safer practices that will reduce this record of carelessness.

On good roads the motor truck could undertake the distribution of package freight to distances of over a hundred miles in a day. This convenient motor truck service had been attacked by the railway companies as unfair competition, which was causing branch line railways to be abandoned and was seriously curtailing the earnings on some main lines. In a recent investigation of the causes of abandonment of railway lines, it had been shown that less than 5 per cent of the abandoned mileage could be attributed to motor vehicle competition. The main reasons given for the abandonment of many miles of railway were the exhaustion of the natural resources that originally caused the railway to be built, competition from other railways, and miscellaneous causes.

It would seem however that the competition of the motor vehicle had proved such an incentive to the railroads, that to meet it they had developed the oil electric car, and while this type of vehicle was still in its infancy it had possibilities that may revolutionize motive power on railways.

Professor R. deL. French, M.E.I.C.

Professor French remarked that in his paper, the author had discussed the influence of the "machine" — motor vehicle and improved highway — as a factor in modern life, and was to be congratulated on the success of his efforts to make interesting what might very well be a dry subject. He believed that the author had omitted to mention one of the most important functions of the "machine" in any country, and one which was of particular importance in Canada at this juncture. He referred to the sociological effect of cheap motor vehicles and good roads upon the rural population.

It seemed to be thoroughly admitted that this Dominion needed an increase in population of a relatively high type, and this increase would have to come largely from immigration from the older and more highly developed countries of Europe. It was also generally admitted that immigrants should be of the agricultural class as far as practicable. We did not need industrial labour, nor had we any great demand for additional merchants and professional men, but we did need, and must have, if we are to progress, those who would settle in areas at present sparsely populated, till the soil, and be prosperous and happy doing it.

The farmer's lot fifty years ago was not a particularly happy one, but he accepted it with fewer murmurings than one would hear to-day, for two reasons,—there was no great industrial demand for workers in the cities to draw him to them, and the attractions of city life were not so alluring then as now. It was a matter of record that the drift to the cities had become of increasing economic importance, and that it caused much heart-searching and worry to-day. Rural life had certain advantages and attractions. The way to a prosperous and contented rural population lay in extending to it every possible advantage as regards education, amusement and opportunity for social intercourse, as well as assuring it reasonable income for its labour.

In the author's "machine" we had the best possible agency for doing just these things. Automobiles and good roads had made practicable the consolidated school, surely a great educational improvement. They had added immensely to the farmer's material well-being by making it possible for him to market his products so that his share of the price they bring would be larger than hitherto, and by extending his buying area. They had, in effect, brought him miles nearer his neighbours, and had made it easy for him to enjoy some city pleasures, without sacrificing his rural independence. They had lightened his labours, and thus given him more time to himself for recreation or what you will. Next to the general introduction of labour-saving machinery on the farm, motor vehicles and good roads had probably been the most potent influence in ameliorating the farmer's lot.

If Canada advertised its attractions in this respect, it would go far toward dispelling the natural reluctance of possible immigrants to abandoning familiar living conditions — unattractive from our viewpoint perhaps — for those which they feared would isolate them from human intercourse in a strange country. Give these prospective settlers to understand that farm life in Canada did not necessarily mean being thrown upon their own resources for relaxation and social intercourse now, and that conditions in this respect were improving every year, thanks to motor vehicles and good roads, and one of the greatest deterrents to immigration would be removed.

The sociological effect of cheap and easy transportation upon the rural population might be impossible of evaluation in dollars and cents, but it had a very real value nevertheless, and one which should not be neglected nor underestimated in any discussion of our highway problems as a whole.

Turning to the author's remarks on bus traffic, he desired to point out that recent investigations * in eight of the United States indicated that the competition between bus lines and the railways was not as keen as might be expected. In these eight states there were 626 routes comprising 16,574 miles over which buses operated, and which might be divided as follows:—

	Routes	Miles
Directly competitive........	37%	41%
Indirectly competitive.......	25	28
Non-competitive............	38	31

Directly competitive routes paralleled the railways; indirectly competitive routes connected points between which there is railway service, but more directly, as their name implies; and non-competitive routes connected points having no railway service. As an extreme example of an indirectly-competitive route, he would take that from Bantam to Torrington, Conn., in the territory of the New York, New Haven & Hartford R.R., to which the author had referred. The bus trip was 10 miles long and the fare $0.60. By railway, the distance between these two towns was 73 miles, and the fare was $2.63, with two train changes. Indirectly competitive and non-competitive routes in these eight states accounted for about two-thirds of both routes and mileage.

Proper governmental regulation of bus traffic should do much to eliminate harmful competition between buses and railways, but in the end that form of transportation would survive which best met public demands. It was the age-old struggle between the old and the new, and duplicated very nearly the competition which had resulted in the disappearance of coaches and the great reduction of canal traffic in England when the railways were young. The public demanded service and was willing to pay for it. Some form of close co-operation between the railways and the buses seemed inevitable, if both were to reach their highest pitch of efficiency.

Mr. R. A. C. Henry, M.E.I.C.

Mr. Henry remarked that the development of the motor vehicle during the last few years had attracted the very serious attention of the public, students of economics and those interested in the problem of transportation in general.

The subject was one of great interest to society at large and particularly to members of the engineering profession, and as the author had so aptly put it, the engineers "should be to the municipal unit and to the field of transportation, what the architect is to the house".

If we reviewed the historical development of the past for the purpose of studying the influence of trade upon history, we should find that the older civilizations were built up to a great extent upon transportation. Probably the most striking feature in the whole Roman economic system was the network of roads radiating throughout the Roman Empire, which had so greatly facilitated her commerce and perhaps rendered the existence of that Empire possible. It had been said, and perhaps rightly so, that "from the Golden Milestone in the Forum at Rome, roads spread in all directions and were conspicuous and abiding evidence of Rome's greatness".

He agreed with the author that the value of the common road, or for that matter of any other facility, was in proportion to the use which might be made of it. There was no doubt that the motor vehicle had rendered available a potential carrying capacity many times that of the horse drawn vehicle, and to the extent to which this increased capacity could be economically utilized, to that extent was the community at large benefitted.

The influence of the motor vehicle and the improved highway upon the distribution of population had been great and there had been a marked tendency towards a wider distribution of city population in the urban districts. It was interesting in this connection to note a very natural, but at the same time, stimulating effect of the motor vehicle upon the building industry, because of the fact that the rapid development of the motor vehicle as a transportation facility, had suddenly extended the residential limits around large centres, with the result that a large area between the industrial sections of these centres and the outlying residential areas had developed into what had been termed the twilight zone, to such an extent that in a great many cases, both land values and building values in these areas had declined temporarily.

The author had referred briefly to the influence of the modern highway and with it, the motor vehicle, upon the steam and electric railways, which had resulted in a decline in the use, and the abandonment in some cases, of electric lines, and a marked decrease in certain classes of traffic upon steam lines. This was a question which was now receiving the very serious attention of all concerned, because it was obviously in the public interest that our various transportation facilities should be so co-ordinated as to permit of the establishment of a general system which would fully meet our public requirements.

Professor A. T. Laing

Professor Laing remarked that one of the most important features in the paper which had been emphasized, to some extent by previous speakers, was the economic question. He was not sure that we were altogether seized of the attitude of the country as a whole to the problems that had arisen. We were in the peculiar position of having granted to certain transportation companies, the railways' franchises, on the understanding that ruinous competition would be eliminated. Subsequent developments however had brought in this incongruous situation, viz:—while we had granted these protec-

* "The Motor Bus as a Common Carrier", H. R. Trumbower, U. S. Bur. Pub. Rds., "Public Roads", Dec., 1925, VI-p. 213.

tive franchises we had, on the other hand, subsidized a competitive industry, by placing at the disposal of modern transportation companies high grade highways at practically no cost to the operators except that of maintenance. This applied both to bus transportation as well as to that of the truck.

This had developed at an enormous rate, and he would ask: What degree of fairness was there in this recent development in which we had practically subsidized a competitive industry against the companies to whom we granted franchises. This situation was not only felt in this country but was affecting conditions in England; some of the tramway companies there had been obliged to abandon routes which they had been operating, and the reasons given were, "unregulated competition of motor omnibus companies under conditions quite unfair to the tramways."

He found a very similar situation in Canada. In 1924, out of 64 operating radial railway companies, forty were in financial difficulties of a very serious character, and were considering the question of abandonment. A survey made of some 37 railway companies operating in Canada and the United States in 1924 had revealed these conditions; five seeking abandonment, five total abandonment, six partial abandonment; seven with serious deficits and none of them meeting operating expenses; all due to the unregulated competition of the motor vehicle. This seemed to him a very serious question, and it concerned the whole country. What we were concerned about, especially in industrial centres, was that there should be good transportation facilities and that these should be conducted on sound economic bases.

The eight States to which Professor French had referred had 705 bus routes operating over a mileage of 18,200 miles, or 68 per cent of the State highway systems. Within these States there were only 23,000 miles of steam and electric railway in operation. Thus it could be seen how seriously the question was being pressed home in these States. In a great number of instances they had been compelled to abandon trackage.

It was not altogether a question of cheapness of handling our transportation problems. It was largely a question of convenience. Take for example L.C.L. freight between Toronto and Hamilton. He understood that, by the ordinary routine the materials had to go through, after the order was placed, it took six days to make delivery in Hamilton, whereas the goods might be placed on a truck and delivered in six hours, a much more satisfactory service. Time was often the factor which determined the method to be employed. In the eight states referred to above passenger traffic on the bus lines was continually increasing even though fares were considerably in advance of those offered by this railways. The fact that the bus provided a very much more elastic service than the steam and electric roads commended it to the travelling public, and passengers were willing to pay the difference. Fares within these eight States ranged anywhere from 2.7 to 18 cents a mile, while the railroads offered a rate from 2 to 3 cents per mile.

The feature that demanded special attention was that of devising some method by which transportation problems could be handled, not by ruinous competition but by the correlation of all the various interests. The steam road and the electric road could do the long-distance business much more economically than could the motor bus or truck. That was clearly established. We had an analogy in the wholesale and retail business. The steam and electric roads could do the wholesale transportation, but the motor bus and truck must in future be relied upon to do the retail business in these lines. The railways had their handicaps in their terminal facilities which were difficult to overcome. At these points the bus and truck could much more expeditiously handle the problems. These features clearly pointed to the necessity of so co-relating these systems that our transportation problems might be handled with dispatch and at the same time on an economic basis. Essentially the two systems were supplementary. Actually we had not yet made them so.

Major Geo. A. Walkem, M.E.I.C.

Major Walkem remarked that in discussing the competition between motor buses and railways it was often forgotten that this is confined to comparatively short hauls, and it seemed likely that the success of motor buses on such routes is largely due to the fact that they only hauled approximately six hundred pounds of equipment and vehicle for each passenger, whereas a steam railway has to haul nine or ten tons.

The Diesel-engine driven car, which was being developed and applied by the Canadian National Railways would seem to be a very promising solution of the difficulty, but even with this development the railways could not give such convenient service as that of a bus, from which the passenger is delivered practically at his door.

In British Columbia concrete roads were largely favoured on account of their durability and non-skidding qualities. Next in order came the road with a concrete base and black top, next, — asphaltic concrete, and last — the water bound macadam road with oil treatment. The latter type of road was not now being constructed in British Columbia, because motor traffic ruined them in from three to five years. They could be treated with hot asphalt to save the tops, but this had not been found very satisfactory.

He wished to compliment the author upon his timely and excellent paper.

Discussion on Differentiation of the Action of Acids, Alkali Waters and Frost on Normal Portland Cement Concrete

Discussion of paper presented by Messrs. C. J. Mackenzie, M.E.I.C., Dean of Engineering, University of Saskatchewan, Saskatoon, Sask., and Dr. T. T. Thorvaldson, Professor of Chemistry, University of Saskatchewan, Saskatoon, Sask., before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

Mr. W. G. Chace, M.E.I.C.

Mr. Chace remarked that when a few Winnipeg engineers, who had identified the source of the decay of concrete noted throughout the prairie provinces during the middle of the last decade, were bold enough to announce their opinions, they had been scornfully met by architects, contractors and by a few of the engineering profession with the statement that good concrete would not decay and that all concrete which had deteriorated was originally poor in quality and had either been frozen or washed out, or even lacking in cement. Such opinions had now been proven unsound and without warrant of fact, although certain "hardshells" still refused to believe the evidence accumulated.

He pointed out that students of the phenomenon which appeared at various points in the clay deposits of Western Canada soon identified the source of trouble as the sulphate salts in the soil and in the soil waters, occurring as Epsom and Glauber salts. It had been observed that the injury occurred to good concrete rich in cement and to poorer concrete lean in cement; that the injury to dense or impervious concrete was progressive from the surface of the structure; that the destruction of porous concrete whether rich or lean in cement took place throughout the body of the mass as well as upon the surface. It was observed also that soil waters carrying less than 1/10 of one per cent of the SO_3 molecule seemed immune unless also subject to frost action or to the concentration due to alternate wetting and drying. Other conclusions since verified by the committee were also arrived at with respect to the "free lime" or to the "released lime" following the setting of the concrete.

The authors had shown concisely and definitely how injuries of the three sorts might be differentiated. Happily injury due to concentrated acid discharges as into sewers from industrial plants were local and could easily be stopped and the cause corrected. Injuries due to frost could seldom occur if the concrete were made impervious, which could be done by experienced and skilled engineers and constructors. Injuries due to soil conditions of sulphate concentration must be fought by efficient drainage, and by the use of porous backfilling against the exterior surface planes, and underdrained in such manner as to prevent the soil solutions from coming into contact with the structure. These methods must be applied to footings as well as to walls and conduits.

As indicated by the authors the injury to concrete structures would be accelerated by alternate wetting and drying thereof by even weak solutions of sulphate salts. He had observed such instances where the interior surface of a basement wall was being injured by reason of the concentration of these waters due to the evaporation from within the basement. Such injury was not confined to concrete alone but could appear on limestone walls and on brick and tile.

He confessed to some disappointment in that the Committee of *The Institute* had not yet reached that point in their studies which would enable them to indicate to us how we should be able to construct safely caissons and other elements difficult to drain. They had not indicated whether it would be necessary to devise a new specification for cement for this purpose, the market for which would be partly throughout the Northern and Western States of the Union and in Western Canada as also in certain isolated spots elsewhere in America, to say nothing of the structures to be built in sea water. Judging from the very complete summary prepared by Messrs. Attwood and Johnson published during 1925 in the Transactions of the American Society of Civil Engineers, it seemed possible that the answer lay in the adaptation of European practice, utilizing trass or pozzuolanic materials in the cement or in the concrete. This idea had been utilized by the engineers of the Los Angeles aqueduct but not for the purpose in our view. It seemed to have met with considerable success in Europe for sea-walls. It was desirable that this idea should be sifted thoroughly and tested. For certain portions of the aqueduct of the Greater Winnipeg Water District, which portions were incapable of drainage because of their low elevation, concrete had been built of Portland cement and of an aggregate entirely silicious and in proportions such that the resultant body was impervious. It was hoped by this means to assure a long life to this portion of the structure. It would be interesting to inspect the condition from time to time to discover the efficacy of this precaution. For the pipe lines an underdrainage of gravel backfill had been provided; since completion of the structure certain of the horseshoe section which lies in sulphate bearing soil had been underdrained and so backfilled. For a very large building now in process of construction in Winnipeg the architects had taken the precaution of thorough underdrainage and had combined it with a complete backfill of gravel surrounding the basement walls.

He considered that the subject was of intense interest to investors, whether public bodies or private owners, as also to the architects and engineers in Western Canada, and hoped that practical answers to the problems he had mentioned would be developed by the Committee, whose efforts so far seemed to have been concentrated on the investigation of causes and characteristics of the phenomena observed, and on preliminary studies necessary for an understanding upon which practical results might be based.

Mr. E. Viens, M.E.I.C.

Mr. Viens wished to express his appreciation of the very fine piece of original work carried out by Professors Mackenzie and Thorvaldson. To his mind this was a great step in the advancement of our knowledge of the causes and the possible solutions of the factors of concrete disintegration. Heretofore, we had had no basis of comparison and it was fortunate that examples of the different causes of disintegration had fallen into the hands of men who were so well prepared, through their investigations of the effects of alkali waters on concrete, to grasp the full significance of the results of their chemical analyses. He believed that we now had a true basis on which to draw conclusions from the study of other failures from these causes.

He desired to speak more particularly on the Eastern phases of the problem. He had made a trip through the Eastern provinces during the month of October last, and had visited some forty odd concrete works, a large number of which were along the Atlantic sea-board, but would confine his remarks to observations on three of the larger ones. First, a breakwater on the South shore of Nova Scotia which was built in 1912-13, was a demonstration of the fact that concrete can be made to withstand the double action of sea-water and frost for a reasonable time, for it was still in good condition with the exception of some spalling at the joints. This structure was apparently as good, and even better, than many a concrete structure of equal age in fresh water. He understood that the proportions used were fairly rich in cement and that the work was performed with considerable care.

Another concrete work which had been constructed about the same time as the above, on the North shore of Nova Scotia, was badly disintegrated, especially immediately above the water line, in places to a depth of 45 inches. The failure of this work was, at least, attributable to the following factors: — porous concrete containing fine and dirty sand; inferior crushed sandstone, fifty per cent of which composed the coarse aggregate; an excess of water; and lack of control of proportions. From the reasoning given in the paper under discussion it was evident that this porous concrete had absorbed much sea-water which had ascended above the water level by capillarity and thus caused failure both by concentration of the salts and by freezing.

A third example of the deterioration of concrete was that of structures in St. John Harbour, N.B., where at least one pier had disintegrated to such an extent that repairs were impossible. The concrete in this pier was poor, due to the use of too lean a mixture and excess of water, and was at present in a soft and mushy condition. The causes for the failure in this case were, he believed, the same as in the previous case mentioned and pointed towards the need of better concrete to withstand these actions.

At the present time the concrete investigator was struck by the fact that notwithstanding the present day knowledge of the need for high class aggregates there are yet so much of the poor grades in use. It would be well to remember that even though nature may have deposited large quantities of sand and gravel, that she did not make these, as a rule, any more fit for concrete purposes without treatment than she has done for any other raw material used in industry.

If concrete, one of the most useful and flexible engineering building materials, were ever to be truly considered as permanent structurally, more consideration would have to be given to the quality of the aggregate. The trouble with many natural deposits of sand and gravel was that they are composed of a variety of rocks, some durable and others not so durable. Consequently, every deposit, before being used, should be thoroughly examined and tested, having in mind the conditions to which the proposed concrete was to be subjected. When field stone or boulders were used for crushed aggregate, the same precaution should be exercised as in the choosing of gravel, for there again one was liable to get stone from a great variety of formations having a different state of preservation and therefore some having a much lower resistance than others to weathering. The same applied to crushed stone from quarries.

Heretofore our difficulty in the art of making good, permanent concrete under our Eastern conditions had been the lack of knowledge of the quality of the aggregate, and lack of proper control of the proportions of the components: the water-cement ratio, the fine and coarse aggregate ratio; the effect of the time of mixing and the proper methods of placing had in many cases also been overlooked.

He had mentioned two cases where concrete had failed in sea-water and one where it was apparently standing fairly well. To what extent the cement was responsible for these failures was not known, and we had no means of knowing, for the problem was complicated with too many other factors. We did know, however, that the cement that would produce the most impervious concrete would be the least affected. We knew also that one brand of cement will produce much higher strength than another at 28 days or even at longer periods, but we did not know whether the stronger brand of the two would be less affected than the other by sea-water or frost action. It was even possible that the same brand might vary in these respects from time to time owing to slight variation in its chemical composition, in the degree of fineness of the raw materials before being burned, in the temperature at which it was burned, and in the fineness of the finished cement. Comparative tests along these lines were lacking, and more complete records of the chemical analysis and the physical properties of the cement should be kept when used in large works in sea-water.

One aspect of concrete in sea-water, as well as in fresh water, which had been fairly well established was that for a given cement and aggregate, the more impermeable the concrete is made the longer it will last. Porous concrete contained in itself the elements of failure, because the salts dissolved in sea-water attacked hydraulic cements with energy if the water were able to permeate or wash through the mass continuously, for it was a well known fact that the aluminate and ferrate of calcium are not only decomposed and rapidly softened by sea-water, but they also give rise to the formation of double compounds which in their turn destroy the cohesion of the mass by producing cracks, fissures and bulges.

He would therefore say in conclusion, that while the means of carrying out a post mortem examination of disintegrated concrete that has been developed by Professors Mackenzie and Thorvaldson was of great interest and value, yet the fact should be clearly appreciated that we could at present rely on but one method of combatting disintegration, whether it be from the attack of sulphate waters, acid or frost, and that method lay in the direction of the development of impermeable concrete.

To make impermeable concrete under practical working conditions we must exercise caution in the selection of materials and in our use of them.

Primarily we should look to the quality of the cement, and we would do well in this connection to ask the manufacturers to seek diligently all means in their power to produce as uniform a product as possible and that would also make a more impermeable concrete. Modern cement was a product of wonderful utility but improvement in that direction might not be impossible.

In our selection of aggregates we must then ensure that they are composed of structurally sound, dense and durable rock, well graded to minimize the tendency to segregation in handling.

Sufficient cement must be used to fill the total voids of the aggregate and to give a workable consistency without the use of too high a water-cement ratio.

The concrete must be mixed for an adequate period (1½-2 minutes) and must be properly rodded after placing to bring any entrapped air and excess water to the top, where the latter may be removed.

Finally the concrete must be given ample time to cure under moist conditions and without danger of freezing, for otherwise it would have neither the strength nor the endurance that it is capable of developing.

Mr. R. B. Young, M.E.I.C.

Mr. Young remarked that the authors had offered us another method by which we can examine the causes of defective concrete. Any engineer who had had anything to do with concrete structures which have become in bad condition would welcome any means whereby he could settle some points, positively, that are in dispute.

He thought that chemical tests of concrete must be used with a good deal of caution, for the reason that an interpretation of a chemical analysis might prove to be misleading unless it presented a very positive means of identification with respect to the trouble which was being investigated.

He believed the method outlined by the authors answered the requirements of the proper chemical method to be adopted. There were quite positive defects which caused disintegration. Alkali attack was ordinarily considered to be a peculiarly Western problem, but the same causes were met with in the East. One of such causes had come to his attention several years ago, in the case of a tunnel where the work was subject to a drip from the roof, and the concrete had disintegrated in a manner which is typical of alkali action, to a depth of from four inches to six inches. On examination it was found that the water carried about 300 parts to the million of calcium sulphate solution, and an almost unlimited supply came in contact with the concrete. The concrete had disintegrated where this solution ran down over the surface. A chemical analysis showed that this alkali action, mentioned as taking place in the West, had taken place here. The SO_3 test of the concrete was as high as six or seven per cent, which was a figure impossible to account for by any other theory.

Frost action would only take place in concrete in which there was moisture present. If the concrete were dry the frost would have no other effect on it than surface changes of volume. The moisture in the concrete must have some space which it occupies, and that meant that the concrete, in order to contain moisture, must have pore space in order to hold the moisture. All concrete had a certain amount of pore space, but lean concrete and wet-mix concrete was far more susceptible to frost action than where the quantity of cement was higher. We could obviate the defect in lean concrete to a certain extent by supplying filling material, but it would be dangerous practice to carry that remedy too far.

Probably the most serious trouble was due to excess of water. He had examined a great many concrete structures and believed that 90 per cent of the porosity trouble was due to excess of water.

If there were water in excess of that actually required to hydrate the cement, that water occupied space in the concrete, and when the water finally dissipated it left that space open to permit other water to penetrate at a later time.

Wet concrete was extremely liable to segregation, which was the arch enemy of concrete. Even where the concrete had been faced with plaster or mortar, and the plaster or mortar had separated from the mass of concrete, such places were liable to start disintegration; in fact he believed that where segregation had occurred on the surface of the work signs of disintegration would be evident in a few years.

Discussion on the Water Supply of the Border Cities

Discussion of paper presented by William Gore, M.E.I.C., Consulting Engineer, Toronto, Ont., and J. Clark Keith, A.M.E.I.C., Chief Engineer, Essex Border Utilities Commission, Windsor, Ont., before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

Mr. R. O. Wynne-Roberts, M.E.I.C.

Mr. Wynne-Roberts remarked that he had been much impressed by the spirit of co-operation among the municipalities concerned in the water supply system of the Border Cities, for no less than eight municipalities in the locality had joined hands to carry out the undertaking. This was an example worthy of emulation.

There had been a remarkable increase in the population and activities of the border cities, and while the consumption of water was exceedingly high, namely 170 gallons per head in Windsor, and 186 in Walkerville, he understood that half of the Walkerville consumption was used industrially.

The low rate at which Walkerville supplies water (10 cents per thousand gallons) was unusual, and it would be useful to know how this low rate was maintained.

The capacity of the filters was higher than normally adopted, although not as high as that proposed by the late Winthrop Pratt.

With regard to the screens, he had himself used similar screens in 1918, and he considered them superior to the old fashioned fixed screens which had to be hoisted up to be cleaned.

Would the authors explain how the output of the pumps is automatically controlled by the level of the water in the coagulation basin, and how the generator is operated by the flow into this basin?

He would ask the authors to state what quantity of alum is proposed to be used, and what is the estimated cost to operate the filter per thousand gallons delivered.

Mr. A. U. Sanderson, A.M.E.I.C.

Mr. Sanderson remarked that great thought and care had evidently been taken both with design and construction to produce a plant of the best class in water works engineering practice.

In this connection he would draw attention to the provision to reverse the flow in the intake to discharge frazil ice, the travelling screens in separate compartments, the capacities of the three main supply pumps in order to economize in electric power, the terrazzo and marble floors and stair treads, the brick and stone facings to cover exposed concrete walls, the copper covered roof, the duplicate lighting set, the duplicate hydraulic pipe line to operate all valves, the accessible pipe gallery, the skylight over the filter operators' gallery, the control of the backwash pumps from the operating gallery by push button, the cast iron pipe laterals in the underdrain system, and the cast iron overflow troughs in the filters.

Two novel features at this plant were the operators' tables in the filter house and the cemented gravel in the underdrain system. The former provided an economical arrangement that should be quite satisfactory, and the latter had been used in Toronto with excellent results.

In the formation of floc, prior to sedimentation, agitation was an important matter, and this would be produced at the Border Cities by the action of the centrifugal pump and mixing chambers. To illustrate what took place in lake Ontario water, which is somewhat similar in character, two grains of alum were added to a sample and left quiescent and floc was visible after 30 minutes, but was very fine. Another sample of the same water was subjected to 5 minutes agitation, which caused a precipitating floc after 15 minutes. At the end of 30 minutes, the water, which had been subjected to the agitation, produced a heavier floc than that which occurred in the other sample after four hours sedimentation.

In lake Ontario water, containing Humber Valley flood water, colloidal colouring matter and turbidity were present up to 110 p.p.m. This water with two grains of alum took over one hour to show visible floc, and three hours before any sign of precipitation occurred. After three hours the turbidity was reduced to approximately 50. The effect of agitation had been demonstrated very clearly at Cleveland. It was interesting to point out that, in passing through the Toronto mechanical plant, there is considerable agitation in the water. The turbidities mentioned above were completely removed in a 30-minute period when using only 1 grain per gallon.

The absence of standby power at the purification works of the Border Cities might cause considerable inconvenience in the future. When interruptions in electric power occurred, it was generally due to meteorological conditions, and the raw water supply at the different cities might be badly polluted and high in turbidity or colour at this particular time. There might be difficulties in starting up from the old sources of supply, due to the gates becoming fixed, or it might be impossible to overload the chlorine machines sufficiently to provide the large quantities of chlorine that are necessary at such times. In his experience, any deviation from normal operation by a failure from one source, might cause other links in the system to give way at the same time.

In plants where it is possible to use small quantities of alum for a long period, considerable economy might be effected by pre-chlorination with alum treatment. This was a phase of purification in which medical officers of health and engineers should co-operate with the same end in view, viz:—the most economical treatment consistent with a sterile effluent.

Pre-chlorination was being used in many plants besides Toronto, such as Louisville, Ky., Baltimore County Water Co., at Avalon, Newport News, Davenport, Virginia Beach, part of the supply of the river Thames in London, England, and many others. Robert Spurr Weston of Boston, had recommended its adoption in many waters in conjunction with alum for some time, and N. J. Howard and he himself had advocated its use at Toronto. Besides the economies effected, a purer water was often obtained.

Mr. R. L. Dobbin, M.E.I.C.

Mr. Dobbin observed that the authors had given in concise form a very comprehensive description of the filter plant now under construction at Ford City and also of the water supply situation in the Border Cities.

The plant followed standard practice in general, but there were several novel features. He noted the provision of only one operating table and rate-of-flow controller for each pair of filters. There was no doubt considerable saving, but an accident to table or controller would tie up two filters instead of one, in which case 20 per cent of the capacity of the plant would be out of business.

The storage capacity appeared small, being two million gallons. This was only 10 per cent of the capacity of the plant. In Peterborough the same size of reservoir was employed for a six million-gallon plant or 33-1/3 per cent.

At the average daily rate of use in the district in 1924, viz: 14 million gallons, this storage would last only three hours. The peak rate would be nearly twice the average, so that the storage could only be counted on for at the most, one and one-half hours, which was a very short time to repair breakdowns.

The underdrain system was similar to the Peterborough plant, in that three-inch cast iron pipe laterals were used. At Peterborough however 7/32-inch holes with 3-inch spacing were drilled in the laterals, as against 5/16-inch holes with 7-inch spacing in the plant under discussion. It would be interesting to see which scheme gave the least pumping head for the wash water pump to work against.

Examination of the strainer system at Peterborough showed no measurable change in the size of the holes after four years operation.

He remarked that the total gravel layer at Windsor was 16 inches in depth, which included six inches of cemented gravel. This was a departure from standard practice and it would be interesting to have the cost compared to loose gravel.

The depth of sand used was 28 inches, which made a total depth of bed of 34 inches as against 42 inches at Peterborough, a much shallower bed than had been used hitherto.

The authors had not given the rate of wash, but figuring from the capacity of the wash-water pumps it appeared to be about 19 inches vertical rise per minute. At Peterborough 22 inches and 24 inches had been used without any perceptible disturbance of the gravel layers.

The sand at Windsor was coarser than that used at Peterborough, which would be expected, as the plant had been designed for a rate of 127.5 million Imperial gallons per day as against 103.5.

The period of sedimentation was 2 hours, as compared with 2.5 hours; this seemed well advised and in accordance with recent practice as most filter plants had been designed with too long a period of sedimentation.

He had mentioned these points, not in a spirit of criticism, but in order to point out the differences between two plants constructed five years apart.

Mr. Gore's Reply

Mr. Gore in reply observed that Mr. Wynne-Roberts had referred to the considerable consumption of water in the Border Cities. That was a matter quite outside the function of the Essex Border Utilities Commission which supplied water to the two distributing authorities, but was not responsible in any way for the manner in which that water was used.

The Walkerville Water Company has a complete metering system throughout its district, but the Windsor district is only partially metered. A policy of complete metering to reduce the consumption was started but has now been halted because of the considerable expense involved due to the fact that few of the houses were provided with cellars in which to place the meters; boxes had to be provided. Also, a number of the services were in a very unsatisfactory condition and had to be replaced when installing the meter. It was this incidental work that brought up the cost. In this case the reduction in the use of water would in part be due to the improvement in the service pipes.

The travelling screens were a very desirable feature in modern waterworks practice, for the removal of ice and weeds coming through the intake.

These screens were similar to those in use at Toronto Island and Belleville. As the screen panels travelled the jets impinged upon them on the reverse side, fish or fragments of ice and weeds were washed away into a catch pit containing a basket which can be lifted out by the travelling crane and removed from the building. Screens were not placed on the intake mouth because of its inaccessibility. It was thought better to let anything caught in the intake current pass quite through to a place where it could be more easily dealt with.

Regarding the rate of filtration at the Essex Border Cities plant as compared with that at Detroit, he would say that at Detroit the maximum rate is 140 Imperial gallons per acre per day, the corresponding figure at Windsor being 127.5. If the hydro power failed there was no power to drive the pumps or auxiliary machinery. It was not thought advisable to saddle the Essex Border Utilities Commission with the increased cost of standby power, particularly as the Ontario Hydro-Electric Power Commission had proposed a steam generating plant in the vicinity. If considerable disturbances did take place through lack of power an auxiliary generator would be introduced.

Generally speaking, however, power failures were of short duration, and in any case the supply, if recourse had to be had to the river, would be no worse than it had been for many years. The record of failures during the past two years did not show any greater period than half an hour. That half hour might occur during the night, and therefore a small turbine generator had been provided taking water from the coagulating basins and supplying current to an independent series of lights which are distributed about the whole works. On starting this generator, the plant was lighted sufficiently for the operations of switching and the closing of gates to be carried on.

They did not use electricity for auxiliary power to close or open the gate valves, etc., which was done hydraulically by the Walkerville Water Supply Company's service pressure. That company's system had full steam standby.

The cemented gravel, as anticipated by Mr. Dobbin, did reduce the depth of the filter and consequently the amount of concrete that entered into the construction of the work. The author's experience with the filter-bed washing back was that if a square tank were subjected to high rate back wash then loose gravel tended to creep up into the corners and the bed ultimately fractured. They felt that cemented gravel was an entire success, as it gave a firm and stable bottom on which one could absolutely rely. Examinations had been made in Toronto, and no clogging had been found. They calculated the rate of wash-back required as 16 inches vertical rise per minute, but this could be increased to 24 inches if necessary.

He believed that the amount of alum per gallon required would not be greatly different from that at Detroit, which in the past had averaged about one grain per gallon.

As regards agitation, to which Mr. Sanderson had referred, he agreed that rapid mixing of alum with the water was the first essential, also that a short period of more or less gentle agitation was a condition which produced the best results with most waters.

He had always felt that the water storage should be located where it could be supplied direct to the citizens in case of failure of any part of the works. No doubt Windsor would be better off with large elevated tanks.

Discussion on Reduction of Flexural Stresses in Fixed Concrete Arches

Discussion of paper presented by J. F. Brett, A.M.E.I.C., Designing Engineer, Montreal Water Board, before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January, 28th 1926.

Mr. W. Chase Thomson, M.E.I.C.

Mr. Thomson congratulated the author on his paper, which should do much to promote better designing of concrete arches in this country. It was considered by many people that any engineer could design a concrete arch, and there were numerous cases where the design of an important structure of this type had been entrusted to a man of insufficient knowledge and experience, with most unsatisfactory results, particularly from artistic and economical standpoints. But such structures usually stood up and showed no signs of failure, no matter how badly proportioned, which sometimes led one to doubt the magnitude of the flexural stresses from rib-shortening and variations of temperature, as computed by the usual methods. Some years ago, he had been required to investigate and to report upon the design of a certain bridge which had recently been constructed. This bridge included flat arches having a span of about 114 feet with a rise of about 9 feet. The thickness of the ribs at the crown was 2.5 feet and at the skewbacks, 5 feet. The temperature and rib-shortening stresses, particularly at the skewbacks, were found to be enormous; but he had repeatedly searched for cracks at these points, without finding any.

The author's analytical method for determining the equilibrium curve for an arch appeared to him rather formidable. It was his own practice to assume for the first approximation a circular curve, and to make the necessary corrections by the graphical method described in the paper. Moreover, many years ago he had adopted the practice of designing the arch-axis so as to produce a positive moment at the skewbacks, from dead-load alone, approximately equal to the negative moment at these points due to rib-shortening from the full dead-load, together with live-load over one-half of the span. The literature in English on this subject might not be voluminous, but it was sufficient. The subject was treated quite fully in several text-books by United States engineers.

Although the practice of reducing the flexural stresses due to rib-shortening might not be general on the American Continent, there was at least one example in Canada where temporary hinges had been employed, viz., in the main span of the Ashburnham bridge at Peterborough, designed by Mr. Frank Barber, M.E.I.C., of Toronto. In most United States and Canadian bridges of importance, compensation for the shrinkage of concrete had been partially made by the voussoir method of construction; and the arch centres were usually cambered so that, when removed, the elevation of the crown would coincide as nearly as practicable with its geometrical position. In arches of moderate span, the volume of concrete in the ribs was usually small compared to that in the abutment or piers; and it was doubtful whether the saving in concrete would be sufficient to compensate for the additional labour incident to temporary hinges, especially in cases where reinforcement might be required to resist the flexural stresses due to live-load and variations in temperature. In long spans, temporary hinges would be very desirable, not only in reducing the quantity of concrete in the ribs but in the additional security due to the elimination of such stresses, which can only be roughly approximated at best.

He considered that the part of the paper dealing with rib compensation was particularly interesting and could be studied with much profit by any engineer who may be contemplating the design of a long-span arch.

Mr. E. H. Darling, M.E.I.C.

Mr. Darling remarked that the author had given a very lucid description of the problems of arch design and construction, and the paper contained much of interest and value to anyone designing concrete structures.

He believed, however, that there were few Canadian or American engineers having to do with arch construction, who would not be conversant with the methods of design and construction described in the paper. There was at least one instance in Canada where temporary hinges had been used: the bridge at Peterborough, Ont. He could not recall an instance on this continent of the use of jacks for adjusting the stresses at the crown of a concrete arch, though this had been standard practice in the erection of steel arches since the building of the G. T. R. arch at Niagara Falls, twenty-nine years ago.

In a brief description of the St. Pierre du Vouvray bridge in the Engineering News-Record of March 20th, 1924, the use of jacks at the crown to take the weight of the arch off the centering was described, and deserved as careful consideration as the design of the arched rib itself. This probably indicated the American attitude regarding the relative cost of steel and concrete designs for this bridge, although he believed that the great difference in cost was due not only to the arch rib but also to the hangers supporting the floor system and other details whose design would not appeal to engineers in this country.

While recognizing the splendid work done by French and European engineers in concrete arch construction, he would point out that economic conditions here were quite different for we had keener competition from structural steel, we wanted rapid completion, we had a severe winter season and a different scale of labour costs. We preferred to put additional concrete into the work, rather than an equivalent value into the special equipment required to save that concrete; this policy resulted in an apparent relative waste in the finished structure. He doubted whether the question discussed in the paper ever was the deciding factor against a concrete design.

He was strongly in sympathy with the author's attitude towards design, and had met many engineers, especially those associated with contracting, who, on account of the spirit of impatience mentioned, deprecate mathematical analysis that goes beyond their idea of the practical. The paper indeed pointed out a case where extra concrete placed in the arch ring "to be on the safe side" actually reduced the factor of safety.

In an article published in the Canadian Engineer, September 7th, 1916, Mr. C. B. McCullough, the assistant highway engineer, Iowa Highway Commission, had compared two reinforced concrete arches submitted to the commission for approval. They were of the same general dimensions and were found to be correctly designed for dead and live load stresses, temperature, and rib shortening, and yet one had 21 per cent more concrete than the other. He pointed out, as did the author, that these last two stresses are the limiting factor in design and that "in many cases an increase in material in the arch ring actually operates to raise the unit fiber stress —".

According to the elastic theory, these stresses in an arch rib varied directly as the moment of inertia of the rib section or, what is the same thing, the cube of the depth, while the resistance moment of the rib varied as the square of the depth. So the effects of these stresses varied directly as the depth. For a steel arch where unit stresses might be twenty or thirty times those for concrete, the depth of the rib was so much smaller that the stresses due to temporary and rib shortening might reasonably be called secondary.

He would point out to those not familiar with the mathematics of arch design that the method of the paper might be looked on as an adaptation of the theory of the three-hinged arch to a fixed concrete arch.

All structural steel designers in the habit of designing structures having a live-load comparable in magnitude with the dead load, knew that the two-hinged arch was, in theory, more economical than the three-hinged arch, the continuous member giving lower bending moments for unsymmetric positions of the live-load. By the same line of reasoning the fixed arch was more economical than the two-hinged. The point brought out in the paper, which should be of general interest, was, that for concrete arches, on account of the relative insignificance of the live-load on the one hand and the greater depth of the rib on the other, the so called secondary stresses became the limiting stresses in design. To reduce these to a minimum one must go back to the three-hinged type for the greatest economy.

If permitted to broaden this discussion he would like to state that in his opinion many examples which had come to his notice of defective concrete water tanks, silos, grain bins, reservoirs and similar structures, were due to this neglect of elastic and shrinking stresses.

Mr. William Gore, M.E.I.C.

Mr. Gore remarked that his own experience with fixed concrete arches related to the long and heavy horizontal arches of masonry dams, and that experience had drawn his attention to the movements that take place in concrete due to changes in moisture contents.

Generally in estimating the movements in concrete arches the designer took account of the effect of initial contraction of the concrete in setting, the expansion and contraction due to changes in temperature, and stresses, but little or no consideration was given to the effect of changes in moisture contents.

He had witnessed experiments on a prism of concrete over 100 feet long and of 1 foot square cross-section. It was laid on rollers in the open, provided with gauge points, and a careful record was kept of its changes in length and of the meteorological conditions. As a result it was found that the temperature effects were almost entirely masked by the effects of moisture, which caused the prism to expand, and it contracted again when the moisture had evaporated, showing that this effect was of considerable importance in exposed structures.

Professor C. R. Young, M.E.I.C.

Professor Young remarked that while the design of reinforced concrete arches had progressed considerably along traditional lines in recent years, it was probable that in the 400-ft. Cappelen Memorial Arch at Minneapolis, engineers had about reached the economic limits of structures so designed. Such an achievement was not very remarkable in view of the fact that the great plain masonry arch at Plauen, Saxony, has a span of 295 feet.

Since the use of permanent and temporary hinges in concrete arch construction had been a matter of course for a considerable number of years, the most important part of Mr. Brett's paper dealt with the comparatively recent device of rib compensation.

Whatever merits arches with permanent hinges might have, it must be admitted that they are relatively flexible, heavy in fact and in appearance, uneconomical and troublesome to construct. The use of temporary hinges, so common in Europe, if not in America, could not give anything like the advantages of the device of rib compensation. As M. Freyssinet had pointed out in his notable paper in Le Génie Civil, construction with temporary hinges cannot make provision for more than a fraction of the secondary stresses, and that fraction a very indefinite one. Of course one might deliberately set the arch forms high in order to make provision for the crown settlement resulting from rib shortening, shrinkage, time yield, abutment shifting, and non-conformity of the temperature of placing with the mean temperature, but a great many things had to be guessed at if this were done. The estimate so made might be, in certain items, as for example, yield of abutments, very wide of the mark. By adopting M. Freyssinet's method of rib compensation, it was possible to put the rib in any desired final position and so make it conform as accurately as may be with the dead load line of pressures. Then, by leaving the crown gap open for a year or more, as was done in the Vouvray Bridge, the various deformations could be followed up with accuracy as they occur. Consequently the greater part of the secondary stresses could with definiteness, be eliminated by rib compensation.

He considered it rather remarkable that neither in the author's paper nor in that of M. Freyssinet, was any reference made to the matter of progressive or time yield of concrete under stress. The author had estimated the rib shortening effect for an average pressure stress of 350 lb. per sq. in. as 0.00014 per unit of length. Observations made by Franklin R. McMillan, A. C. Janni, and others, had indicated a yield of from 0.0002 to 0.0004 per unit of length in a period of about two years, Such a yield would produce a shortening of a rib 100 ft. in length of from ¼ to ½ inch, obviously a very important item. Otherwise put, it had been found that altogether exclusive of shrinkage effects, concrete yields in 50 days under a fixed load, about 2.4 times as much as it yields on the initial imposition of this load, and in 950 days 4.4 times as much.

In view of the well established phenomenon of time yield, he believed that the author would have done well to include such an effect in the development of his equations (26) and (27).

In making available in compact form in English, the results of the newer work of the great exponents of reinforced concrete in France, Mr. Brett deserved the thanks of the profession.

Mr. Brett's Reply

The Author in reply, remarked that he had now learned that the designer of the 235 foot arch at Peterborough, Ont., Mr. Frank Barber, M.E.I.C., had made use of a type of semi-hinge there. In this case, the Peterborough arch would be the first structure of this kind on the North American continent.

Since his paper had been published, Mr. Henry Quimby had drawn his attention to the Walnut Lane bridge, Philadelphia, where some form of flexible connection had been used at the skewbacks and at the crown.

He would point out, however, that in order to reduce deformation stresses to a minimum, the semi-hinge must be designed to take up the whole dead-load thrust of the bridge complete. Further, it must remain open until the shrinkage effect had disappeared.

The volumetric change coefficients noted in his paper were those used upon the continent of Europe. Recent investigations in this country had confirmed these data.

In connection with the fitting of the load curve to the arch axis he had stated in the paper that several important structures in this country have been so designed. A great many structures, however were not, and he thought this was due to the fact that in the study of arch design, the elastic theory has been emphasized almost to the exclusion of any other consideration. In other words, a lot of time was spent checking stresses, but the underlying principles of the reduction of such stresses were given scant attention.

The parabolic theory and its numerous variations were being used a great deal in Europe to design concrete arch bridges up to 150 feet span. For longer spans, the integration of the load curve was usually carried out by means of series, and there usually resulted an equation of the fourth degree which is known as the fourth degree parabola.

Discussion on Some Phases of Industrial Relations

Discussion of paper presented by Homer E. Niesz, Manager of Industrial Relations, Commonwealth Edison Company, Chicago, Ill., before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 29th, 1926.

Mr. Wills MacLachlan, M.E.I.C.

Mr. MacLachlan remarked that he was not willing to accept the definition of engineering as pertaining only to the material end of the welfare of humanity.

He thought it would be well for the engineer to pay more attention to the human element in connection with his operations than he had done in the past.

In connection with any work in industrial relations, such as the author had outlined, dealing with 9,000 employees, it was not satisfactory to work the scheme out on a sentimental or on a welfare basis. The facts of the question must be faced just as in going into any other engineering problem. The scheme decided upon should be carried out after complete investigation, in an able way that would work for the good of the whole organization instead of trying to make a sentimental decision here, there or elsewhere. In dealing with the problem of pensioning the old employee, it was not a satisfactory method to wait until that old employee had reached the age of 65 and then try to work out some scheme where by he would be looked after. Such a scheme should be put into effect in the very early stages of the development of any organization, and should be applied to all members of the group.

The president of *The Institute* had pointed out that one of the important problems before engineers was the early training of graduate engineers so that they can be effective at a later time for an organization, or for the profession in general. In Toronto they had instituted a course for engineer graduates, running over two years, including work on construction, in operation, and in the engineering department, so that by coming in contact with the construction and operation work of a big utility they felt they were learning how to become engineers.

Another important question that would demand more attention in the future was the development of organizations to prevent accidents to employees, particularly on construction. He knew of some construction jobs in which the cost of accident had run to 10 per cent of the pay-roll, an item well worth while getting after. There were other cases where the accident cost had been as low as 2 per cent, showing what could be done by effective organization.

He desired to emphasize the fact that the problems of industrial relations, whether relating to the organization of any kind of service, the working out of a pension plan, or the organization of a force for the prevention of accidents, were essentially engineering problems.

Mr. L. St. J. Haskell

Mr. Haskell remarked that personnel problems were largely the same for all industries, and the way in which they are being handled by a progressive organization had been very ably described by the author.

It was however necessary to adapt the details of administration to the industry concerned. For instance, an organization such as the one outlined in this paper would not ordinarily apply to a small industry or one in which the force was considerably scattered. In the Bell Telephone Company of Canada there were 14,000 employees distributed throughout Ontario and Quebec, and it was obviously impossible for an administrative organization such as that described to function in matters of employment under these conditions. However, it was possible to set up a slightly different organization which would give similar results.

He desired to emphasize the importance of having the engineer study the fundamentals of industrial relations. For the last three or four years his company had been engaging graduates from the engineering schools and training many of them for supervisory positions, where one of the biggest problems is the handling of the working force. He considered it most desirable that some study of industrial relations should be incorporated in the training of engineers, either during their course, or as soon after graduation as possible.

His company had an Employees' Representation Plan similar to that given in the paper and found it extremely valuable. Representatives of the employees met periodically with representatives of the management, and in this way grievances and suggestions found a convenient avenue of expression. These meetings, however, were not limited to the discussion of wages and working conditions; methods of operation and changes in equipment were discussed, and many valuable suggestions were obtained. In addition, these meetings enabled the management to keep the working force informed as to company policy, and to obtain their co-operation in initiating changes. This last was particularly important because changes which are not understood by employees are frequently regarded with suspicion and may cause serious dissatisfaction.

One of the difficulties in employee representation was to avoid management domination. Consider the case of a meeting between, say, a number of telephone operators and the management, in which a certain point has been raised by an operator. It would be very easy for the superintendent to give a definite ruling without adequate explanation. This, too often, had the effect of closing the discussion, as very few operators would care to press the point further. They would leave the meeting still convinced that they were right, and the conference would have failed in its primary function, to overcome misunderstanding by free and frank discussion. As an illustration of a more satisfactory attitude towards these meetings, the experience of a district traffic superintendent might be worth relating.

All operators are scheduled to work for so many hours a day; to work a certain "trick" is the term used. Now in order to handle the load at all times during the day, certain operators are required to work tricks which are considered to be undesirable. In this particular case a new schedule issued by the traffic department was criticized by operator representatives, who thought that certain undesirable tricks could be eliminated. The district traffic superintendent replied that he would be only too pleased to have the schedule improved and suggested that the girls work out one which would be more satisfactory. He supplied them with all the necessary information regarding load conditions and said, "Now go ahead, work out your schedule and bring it to me. If it is all right I will put it into effect". The operators prepared the schedule and put it forward for approval. The district traffic superintendent pointed out to them where their proposals failed to meet conditions, and referred the schedule back to them for correction. After two or three attempts the girls began to realize the difficulties involved in preparing such a schedule and also saw the necessity for undesirable tricks. Their confidence in the management was thus strengthened and they expressed entire satisfaction with the existing schedule. Employee representation plans carried out in this way would be of value to almost any kind of industry.

Mr. H. G. Millson

Mr. Millson remarked that after watching the remarkable results of the study of industrial relations, as applied in Canada and in the United States, he had gone over to European countries during the last two or three years to see how those plans applied to European people and to get firsthand experience. He had been glad to find that the industries abroad who had taken up that work sincerely and who had followed it in a democratic way had been the only industries to weather the storms during the last five or six years there. They had neither lost financially nor had their men become less efficient by the terrible doctrines being preached to them. Take, for instance, Port Sunlight, Lever Bros., Cadbury's, Guinness' of Dublin, close to his own home, those industries stood storm-proof today. And the sole reason had been, that they had created a confidence in their employees and the employees in turn had placed the destiny of their welfare in their hands.

He believed that the man who can handle labour is as great as the man who can handle anything material or who can handle capital. A man might be a remarkable engineer with the greatest detail knowledge of his job, but he would be a greater engineer if he developed along the lines of Industrial Relations. If an engineer were in command of a great many men, then he should have a deep-seated interest in them, so that from them he could get the highest efficiency, teaching them the lesson that it is not the hours you put in that count, but what you put in the hours; getting in turn from them a confidence and close relationship, such that there would be on their part a readiness to learn. His job would then be co-ordinated very closely with industrial relations.

Mr. Niesz's reply

The Author in reply observed that his Company as a public utility, believed very strongly in the desirability of stock ownership, not only on the part of their employees, but also on the part of the general public, with the object of increasing the number of persons owning the stock. Their stock ownership was distributed over about 45,000 different owners. He believed in the acquiring of stock by employees, on a savings fund method, primarily as a means of encouraging thrift. They were able to give their employees the opportunity to acquire stock in the company at a low price, because there is a statute in the state of Illinois which permits a corporation to set aside a certain amount of its stock for sale to its employees at whatever price is determined by the board of directors of the company, and that stock could be sold to the employees at a very favourable price. Their representation plan was a joint one, participated in equally by employee representatives elected by themselves, and by management representatives appointed by the management. They did not believe in the domination of management in these councils, and there could be no domination of management under their plan of employee representation. Such employee representation, supplementing the organization channels of communication, enabled the employees to voice their desires, whether on a question of wages, hours, working conditions, or any other phase of employees' needs.

He desired to emphasize the point that it is necessary for every supervisory man who has to do with the handling of men to understand industrial relations, and to apply their principles to the organization over which he has jurisdiction.

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Students' Prizes

Association with his National engineering society should be the ambition of every young man interested in the engineering profession, and this fact is so generally recognized that the constitutions and regulations of all important technical societies rightly lay stress on the advantages of such membership to the young graduate or engineering pupil.

At the present time the Council of *The Institute* has three committees whose activities are concerned with the prospects, training, and development of the students of *The Institute*, and the time seems opportune to bring to the attention of the membership at large, and particularly the students, the facilities and opportunities that are now offered to them.

Five Students' Prizes were established in 1902, and for many years have been awarded for papers submitted by students on a great diversity of subjects. Among the recipients of the prizes will be found the names of many members who have distinguished themselves and are now occupying prominent positions in the engineering world and in the affairs of *The Institute*.

A Student sometimes hesitates to undertake the preparation of a paper as he feels that his lack of experience may prevent his accomplishing anything really worth while, but he should remember that the collection of the necessary data for his paper will lead him to consult text books, original papers, and other sources of information, and cannot fail, in this way, to benefit, not only his fellow students, but also himself. It is generally recognized that the most effective way to learn about a subject is to make adequate preparation for teaching it.

During the past years, Council has noted with regret that the papers sent in in competition for the Students' Prizes come almost entirely from the territories of one or two of our branches, and the opportunity is now taken to place the conditions regulating the award of students' prizes more prominently before the members of *The Institute*, with the hope that during the current year a more representative body of papers will be submitted. An abstract of the conditions governing the award of the students' prizes follows:—

1. An award shall be made in each of the five sections —general, mechanical, electrical, mining and chemical— if in the opinion of the examiners a paper of sufficient merit has been presented therein.
2. Prizes of twenty-five dollars each are awarded yearly for the best papers presented by Students of *The Institute*, in each of the five sections.
3. Prizes shall be awarded only to those who are in good standing as Students or Juniors of *The Institute* at the close of the year ending June first.
4. The award of prizes shall be for the year ending June first.
5. The papers eligible for competition must be the bona fide production of those contributing them and must not have been previously made public or contributed to any other society in whole or in part.
6. In the event of no award being made in one or more of the sections, it shall be permissible for the examiners to recommend the award of two prizes in one or more sections.
7. The examiners shall be the members of the Gzowski Medal Committee.

In addition to embracing the opportunity thus offered to the student for practice in the art of presenting technical matters in writing, advantage should be taken of the meetings for students organized from time to time by various branches, at which they are offered special opportunities for practice in the art of oral discussion, one of the most valuable accomplishments a young engineer can possess.

International Electrotechnical Commission Delegates Visit Canada

In connection with the forthcoming visit of delegates of the International Electrotechnical Commission to the United States and Canada, it may be interesting to recall that this important body was founded as a result of the International Electrical Congress held in St. Louis, U.S.A., in 1904, under the auspices of the American Institute of Electrical Engineers.

National committees have now been formed in all the principal industrial countries of the world, and these committees are charged with the duty of furthering international co-operation in connection with electrical industries with a view to obtaining uniformity in such matters as practice, nomenclature, and the rating of electrical machinery and equipment.

The activities of the International Electrotechnical Commission were of course greatly limited by the War, but the work has now been resumed with greater activity, relations have been established with the various national bodies dealing with engineering standardization questions in general.

The National Committees of the International Electrotechnical Commission are in most cases nominated bodies, the members being appointed by the several national engineering societies, and this arrangement obtains in Canada, where the Canadian National Committee of the International Electrotechnical Commission includes a number of members appointed by *The Engineering Institute of Canada* together with other members co-opted by the committee itself.

It is expected that over one hundred European delegates from more than twenty different countries will shortly pass through Canada, staying three days with us on their journey from Chicago to Boston via Niagara Falls, April 29th and 30th; Toronto, evening of April 30th; Ottawa, morning of May 1st; and Montreal, evening of May 1st, and all day on May 2nd. All members of *The Engineering Institute of Canada* will unite in welcoming this important delegation and will hope that their too brief stay with us will be an experience from which they will carry away the pleasantest recollections.

The Engineering Institute of Canada branches in the Niagara Peninsula, Toronto, Ottawa, and Montreal are taking an active part in welcoming the distinguished visitors.

OBITUARIES

Martin Murphy, D.Sc., M.E.I.C.

In the death of Dr. Martin Murphy, M.E.I.C., which occurred at St. Catharines, Ont., on January 9th, 1926, the engineering profession in Canada has lost one of its outstanding figures, and *The Institute* one of its past-presidents and one of its oldest and best known members. At the time of his death Dr. Murphy was in his ninety-fourth year, and while for some time past his health had been failing rapidly, he ever displayed a keen and active interest in the affairs of the profession which he loved. An instance of this may be cited when about three years ago Dr. Murphy undertook to write his reminiscences of engineering with particular reference to railway construction in Canada but due to his failing health was unable to continue the work.

The late Dr. Murphy was born in Cooleycarny, Wexford, Ireland, on November 11th, 1832, and was educated at Ballindagin National School and by private tutor in Ireland. Subsequently, he occupied many positions before emigrating to Canada to accept the appointment as city engineer of Halifax in 1868. After serving for two years in this capacity, he became engaged in railway survey work in Nova Scotia and after a further two years on this work he was employed as contractor on the construction of bridges on the Intercolonial Railway. In the year 1875 he was appointed provincial chief engineer for the Government of Nova Scotia, which position he occupied for about thirty years, and in addition to his duties as chief engineer for the province, he was active in the laying out of the gold mining districts in Nova Scotia. During this period he was honoured with the degree of Doctor of Science, by King's College, Windsor, N.S., in 1890. Subsequent to his retirement from this position, in 1905, he was engaged in constructional work in connection with the National Transcontinental Railway in the capacity of chief inspecting engineer of the western division. It was on his appointment to this work that he moved to Ottawa where he resided until only a few months ago when he took up residence at St. Catharines, Ont.

During his earlier years in Canada, Dr. Murphy was noted for his work on highway bridges and has been credited with being the first Canadian engineer to introduce the use of the concrete culvert. As an engineer, he was beloved by all members of the profession and he was especially considerate to the younger members assisting them at all times through his sympathy and understanding.

The late Dr. Murphy, while not a Charter Member of *The Institute*, was admitted to full membership on February 3rd, 1887, some months prior to the incorporation of the Canadian Society of Civil Engineers. During the years 1888-89-97, he was a member of Council of the Society. In 1895 he was elected vice-president and in 1905 president. He was also president of the Nova Scotia Institute of Science during 1882-83. In 1893 he was awarded a gold medal for his paper illustrating bridge work in Nova Scotia which was read before the Engineering Congress at the World's Fair, Chicago, Ill., that year.

MARTIN MURPHY, D.Sc., M.E.I.C.

Kenneth Stockton Pickard, M.E.I.C.

It is with sincere regret that we note the death of one of the most prominent of the younger engineers of the Maritime Provinces, Kenneth Stockton Pickard, M.E.I.C., who passed away at his home in Sackville, N.B. on March 6th, 1926, as the result of a stroke of apoplexy. The late Mr. Pickard was born in Sackville on May 9th, 1889, and received his early education in the public and high schools of that town. Upon matriculating he entered the faculty of applied science of Mount Allison University at Sackville, and received his engineering certificate in 1911. Continuing his course he graduated from McGill University in 1913 with the degree of B.Sc., in mechanical engineering. That year he was also licensed as stationary engineer in the province of New Brunswick. In the fall of 1913 he was appointed chief engineer of the Sackville Freestone Company, then engaged in building the breakwater for the Prince Edward Island Car Ferry Terminals at Cape Tormentine, N.B. This position he held until 1916 when he joined the staff of the Imperial Ministry of Munitions as superintendent of stores and shipping for the engineering department Division of Gauges and Standards. In 1917 he enlisted in the engineers and was gazetted lieutenant. Upon his discharge in 1920, he entered provincial land survey work, under Mr. C. E. Lund, deputy land surveyor. In 1921 Mr. Pickard was himself appointed deputy land surveyor, and shortly after was licensed as a provincial land surveyor, in Nova Scotia. Since that time he had been engaged in private practice and had completed several large projects in each province.

Mr. Pickard was a member of the New Brunswick Association of Professional Engineers and had served three years as councillor of that body, being also a member of it's examining board. He was admitted to The Engineering Institute of Canada as Associate Member on April 18th, 1916, and was transferred to full membership on June 17th, 1924.

Mr. Pickard's interests were not confined entirely to the enginerring field, for at the time of his death he was in his seventh year as a member of the School Board of the town of Sackville, and for some years had been secretary-treasurer of the Eastern Electric and Development Co., of Sackville.

His loss will be keenly felt, not only by his own community, but by the entire engineering profession of the Maritime Provinces, as his sincere interest in all projects promoting the common good, and his untiring energy in furthering such projects, as well as his genial and kindly disposition, made him a favourite with all who came in contact with him, and caused him to be held in the highest respect by all who knew him.

KENNETH STOCKTON PICKARD, M.E.I.C.

Robert Hobson, M.E.I.C.

Robert Hobson, M.E.I.C., president of The Steel Company of Canada, died at his home in Hamilton, Ont., on February 25th, 1926, after an illness of only one day.

Mr. Hobson was widely known throughout Canada being an outstanding figure in Canadian industry and the news of his death came as a great shock to his many friends in the engineering profession and in public life. Born at Kitchener, Ont., on August 13th, 1861, the late Mr. Hobson received his early education at the public schools of Guelph and Hamilton. At an early age he joined his father on engineering work and for seventeen years was engaged with his father on engineering work in connection with the Great Western Railway and Grand Trunk Railway, of which the senior Mr. Hobson was at that time chief engineer.

About the year 1896, he became secretary-treasurer of a company engaged in the manufacture of pig iron in Hamilton and was continuously connected with this industry up till the time of his death. In addition to being president of the Steel Company of Canada, the late Mr. Hobson had many financial affiliations; he was president of the Landed Banking and Loan Company of Hamilton; director of the Bank of Hamilton, and subsequently of the Canadian Bank of Commerce; a director of Tucketts Tobacco Company, the Dominion Power and Transmission Company, and the Canadian Locomotive Company of Kingston. He was at one time president of the Canadian Manufacturers' Association, and was a Fellow of the Royal Colonial Institute, London, England. He was also a member of a large number of clubs in Canada.

The late Mr. Hobson was elected Member of *The Engineering Institute of Canada* on March 25th, 1919.

Walter Chamblet Adams, M.E.I.C.

The sudden death of Walter C. Adams, M.E.I.C., which occurred at Porterville, California, on February 28th, 1926, in his fifty-fourth year, as the result of a paralytic stroke, has deprived the engineering profession of Canada of a man who was pre-eminent in his special field, which, for the past ten years or more, has been particularly the study of bituminous materials and bituminous mixtures in their relation to pavement construction in Canada and elsewhere.

A few weeks before the end came, Mr. Adams accompanied by Mrs. Adams had gone to California for a rest, and there was no indication when he left Montreal that he was suffering from anything but a fatigue such as a few months vacation would remedy.

The late Mr. Adams was born in Montreal, on August 21st, 1872, and was educated at McGill University, where he received the degree of B.A.Sc., in chemistry in 1892, and in mining in 1894.

The earlier years of his professional career were spent as a mining engineer, in a consulting capacity and in charge of development work on properties in British Columbia and in Mexico; in which latter country he spent most of his time between 1905 and 1912, when he returned to Montreal following a severe attack of malarial fever.

At this period, his health was such that he was compelled to forego the active practice of his profession for a year or so; and, in fact, the effects of the fever were such that he no longer felt equal to the rugged life required of a mining engineer in the field.

In 1914, Mr. Adams became interested in the technique of asphalt paving, and first undertook some work for the towns of Maisonneuve and Verdun. In 1916, the city of Montreal engaged the firm with which he was associated, the Milton Hersey Company, Limited, to act with the city engineer, Paul E. Mercier, M.E.I.C., in connection with its asphalt street paving, and it was at this time that he became associated with Charles A. Mullen, M.E.I.C., in direction of the paving department of that firm. This arrangement continued until the time of his death, Mr. Adams and Mr. Mullen becoming close business associates and warm personal friends.

Mr. Adams still practised his profession as a consulting mining engineer, in conjunction with Captain James G. Ross, consulting mining engineer with the firm, occasionally going out to examine a property or co-operating in the preparation of a difficult report. During the last few years of his life, he became a close student of hydraulic cement concrete work, and was in charge of inspection of concrete on the substructure of the Montreal-South Shore bridge at the time of his death.

The late Mr. Adams was elected Member of *The Engineering Institute of Canada* on March 22nd, 1921.

Outside of his professional studies, the subject which seemed to interest Mr. Adams most was the rapid development of the political and economic movements of his day, which he examined, not as a partisan, but as a scholar. His oldest friend and associate in Montreal was Doctor Milton L. Hersey, the head of the firm with which his last years were spent; and his nearest relative in Montreal was Mr. Robert Job, vice-president of the same company.

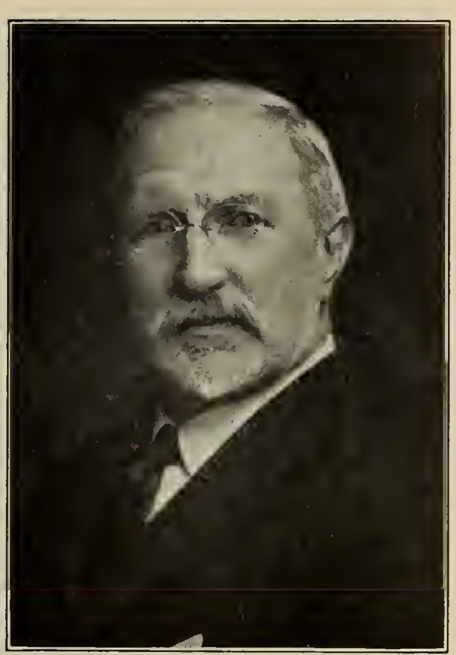
James McGown, M.E.I.C.

Regret is expressed at the death of James McGown, M.E.I.C., which occurred at his late residence, Joan Crescent, Victoria, B.C., after an illness of about two months.

The late Mr. McGown was superintendent engineer of the British Columbia Coast Steamship Service. He was born at Glasgow, Scotland on June 13th, 1863, and made an early choice of his profession or life work. He served his apprenticeship as a machinist with the Jimmie Jacks Engineering Works, Liverpool, gaining a knowledge and training that is proverbial in connection with Old Country engineering works. Having completed his apprenticeship in 1884, he joined the Cunard Line as engineer, going to sea in the Atlantic trade on different vessels, among others the Umbria, Etruria and the Oregon.

Mr. McGown joined the Canadian Pacific when that company built the first Empresses for transpacific trade and came to the British Columbia coast on the Empress of Japan, in a short time attaining the position of chief engineer of that vessel, when the company, when recognizing his thorough knowledge of marine engineering and executive ability, appointed him early in 1902 superintendent engineer jointly of the Canadian Pacific Ocean Services, Limited, and the British Columbia Coast Steamship Service, with headquarters at Vancouver. During the following years the transpacific services, as well as those of the British Columbia Coast Service lines, were gradually expanding, and in 1923 the company decided to appoint Mr. McGown as superintendent engineer for the Princess lines exclusively, with headquarters at Victoria.

Mr. McGown was held in the highest regard by all of the company's officials and by the entire staff and others serving with him. He was a recognized authority on marine engineering questions. His death will be keenly felt by a large number of friends up and down the coast and on the company's transpacific service.



JAMES McGOWN, M.E.I.C.

At the meeting of the Victoria Branch of *The Institute*, on February 17th, 1926, the following resolution was passed;

"That the Victoria Branch of *The Engineering Institute of Canada* learn with sincere regret of the passing of one of its esteemed members, Mr. J. McGown, M.E.I.C., who held such an honoured position professionally amongst his engeering confreres and associates, and that this branch place itself on record as to the loss thereby sustained by the local branch in particular, and by the engineering profession in general, and that a copy of this resolution be forwarded together with a message of condolence in their bereavement to his wife and family."

The late Mr. McGown was elected Member of *The Engineering Institute of Canada* on September 30th, 1920.

Will Reid Wellington Parsons, M.E.I.C.

It is with regret that we record the death of Will Reid Wellington Parsons, M.E.I.C., which occurred at Toronto, Ont., on January 5th, 1926.

The late Mr. Parsons was born at Orangeville, Ont., on December 24th, 1877, and received his engineering education at the School of Practical Science, University of Toronto. In February of the year 1901 he joined the staff of the Parsons Iron Works at Toronto as draughtsman and in April of the same year was appointed assistant engineer in the city engineer's office at Toronto, where he was engaged until March 1906, at which time he became city engineer of Stratford, Ont. The following year he joined his brother, J. L. R. Parsons, and subsequently moved to Regina, Sask., where he resided until 1918 when he returned to Toronto. During his stay in Regina he was engaged on construction work and many of the more important buildings throughout the province of Saskatchewan were products of the Parsons Construction Company, of which he was secretary-treasurer. Just prior to his death he joined the staff of the Massey-Harris Company, Limited.

The late Mr. Parsons was admitted to *The Institute* as Associate Member on February 7th, 1907, and was transferred to Member on August 1st, 1916.

PERSONALS

Major G. R. Evans, A.M.E.I.C., is with Messrs. Morrow and Beatty, Limited, and is located at Kapuskasing, Ont.

S. F. Ricketts, A.M.E.I.C., formerly of Winnipeg, Man., is now with Messrs. Sidney Darnbrough Limited, electrical engineers, Vancouver, B.C.

R. S. Logan, Jr., S.E.I.C., is with Messrs. Fraser, Brace Company on the construction of the International Paper Company's mill at East Templeton, Que.

O. B. Bourne, A.M.E.I.C., is with the sewer section of the Department of Works of the city of Toronto. Mr. Bourne graduated from the University of Toronto in 1907.

Mark C. Trueman, S.E.I.C., formerly of Winnipeg, Man., is located in Rio de Janeiro with the Rio de Janeiro Light and Power Company.

R. L. Dunsmore, A.M.F.I.C., formerly assistant superintendent of the Calgary refinery of the Imperial Oil Refineries Limited, is now located in South America with the International Petroleum Company, Talara, Peru.

A. H. Milne, A.M.E.I.C., has been appointed superintendent of buildings with the Protestant Board of School Commissioners of Montreal. Mr. Milne is a graduate of McGill University of the year 1917.

C. D. Sampson, Jr.E.I.C., is with the International Coal Mining Company, Limited, Westville, N.S., in charge of the surveying and draughting work for this company.

C. P. Reaper, S.E.I.C., of Montreal, is located at Port Alfred, Que., with the Foundation Company of Canada, Limited, in connection with the construction work for the Port Alfred Pulp and Paper Company.

Arthur Fraser, A.M.E.I.C., who was formerly on the staff of the Topographical Survey, Calgary, Alta., is now with the Geodetic Survey of Canada, Department of the Interior at Ottawa.

Geo. Hemmerick, A.M.E.I.C., formerly of the Ontario Department of Highways, is now representing the Dow Chemical Company in connection with their calcium chloride product for roads in the province of Ontario and has his headquarters at Toronto, Ont.

A. E. Eastman, A.M.E.I.C., is with the Central Main Power Company of Augusta, Me., and is located at Lewiston, Me. This company is installing an hydroelectric plant on the Androscoggin river at Gulf island, about five miles from Lewiston.

L. Murray Duclos, Jr.E.I.C., has been transferred from the position of transitman at Ottawa to assistant engineer with the Canadian Pacific Railway at North Bay, Ont. During 1920-21, Mr. Duclos was senior instrumentman in the office of the assistant engineer, Montreal Division of the Canadian National Railways.

H. B. Hanna, S.E.I.C., who graduated from Queen's University in civil engineering in 1924, is with the W. I. Bishop Limited of Montreal at Shawinigan Falls, Que., on the extension of the plant formerly owned by the Belgo Company but now owned by the St. Maurice Valley Corporation.

Harold E. Barnett, Jr.E.I.C., has severed his connection with the New Brunswick Electric Power Commission and has joined the staff of H. G. Acres, M.E.I.C., consulting engineer, Niagara Falls, Ont. Mr. Barnett received his degree of B.Sc. from the University of New Brunswick in 1918, and subsequently was engaged on survey work in connection with the Canadian National Railways.

Arthur Donaldson, Jr.E.I.C., is with Messrs. Burns, McDonnell Engineering Company, consulting engineers of Los Angeles, California, and is engaged as supervising engineer on the construction and design of water works and sewage projects. Mr. Donaldson is a graduate of the University of Alberta from which he received the degree of B.Sc. in civil engineering in 1922. Subsequently, he was on the staff of the Edmonton, Alberta, office of the Carter Halls Aldinger Company, Limited, of Winnipeg.

E. A. Cleveland, M.E.I.C., comptroller of water rights for the province of British Columbia has recently resigned, and has accepted the position of sole commissioner to the Greater Vancouver Water Board and chairman of the Vancouver and Districts Joint Sewerage and Drainage Board. Mr. Cleveland is a native of New Brunswick, having been born at Alma, N.B., in 1874. His engineering education was received at the University of Washington, where he was a special student during 1907. He was first engaged on railway location work in New Brunswick but since 1890 has been located in British Columbia where he has had extensive experience in engineering works.

Major J. C. MacDonald, M.C., M.E.I.C., has been appointed comptroller of water rights for the province of British Columbia succeeding E. A. Cleveland, M.E.I.C. Major MacDonald was born in Nova Scotia in1880, and graduated from Dalhousie University with the degree of Bachelor of Arts in 1904 and Bachelor of Science in 1906. After four years engineering work in eastern Canada he moved to British Columbia, where as a member of the firm of Cleveland and Cameron of Vancouver, he was engaged on various works principally in connection with the design and installation of municipal water systems, including the system at Richmond and that at Burnaby. Major MacDonald served with distinction overseas with the Canadian Engineers, having risen from lieutenant to major during service. Since 1919, he has been in charge of the reorganization and reconstruction of irrigation systems in the interior of the province of British Columbia for the provincial Department of Lands.

EMPLOYMENT BUREAU

Situations Vacant

An unmarried engineering graduate of one or two years' standing is wanted on the administrative staff of a large institution. He must be of especially good address, have an aptitude for business and be willing to start at the bottom. Apply Box No. 152-V.

CHEMICAL ENGINEER

Chemical Engineer. For particulars communicate with N. J. Gareau, Room 503, Jackson Building, Ottawa, Ont.

Situations Wanted

CIVIL ENGINEER

Shortly disengaged, age 39, married, experience on design and construction of highway and railway bridges, steam and electric railways, including street railway work, roads, sewers, main drainage, harbour work and city surveys. Apply Box No. 207-W.

COMMERCIAL ENGINEER

Young graduate wishes opening in commercial organizing and financial work for a company. Both business and technical experience. Will locate anywhere in Canada, and available early in May. Apply box No. 208-W.

ELECTIONS AND TRANSFERS

At the meeting of Council held on March 23rd, 1926, the following elections and transfers were effected:

Members

COULTIS, Samuel George, Ph.C. (Univ. of Mich.) supt. design'g and erect'g. absorption, compression and desulphurizing plant and operation with Royalite Oil Co., Black Diamond, Alta.

EDDY, Harrison Prescott, B.S. in Chem. (Worcester Polytechnique Inst.) partner Metcalfe & Eddy, Boston, Mass.

KIRCHNER, Paul, B.A., B.Sc., C.E., (Univ. of Ill.) res. mgr Union Switch & Signal Co. and engrg. advisor to pres. Massey Concrete Products Corp.

Associate Members

BENNETT, Stewart Gordon, B.A.Sc. (Univ. of Toronto), lecturer and secretary, Univ. of Toronto, Toronto, Ont.

BERRY, Edward Wilson, surveys engr. grade 3, Geodetic Survey of Canada, Ottawa, Ont.

BURKET, Leslie Howard, i/c city designing office, superintending design of all building structures, Dominion Bridge Co. Ltd., Montreal, Que.

CAREY, Edward George, elect'l. supt., town dept., Newfoundland Power & Paper Co. Ltd., Cornerbrook, Nfld.

COOTE, James Alexander, B.Sc. (McGill Univ.) Asst. professor McGill University, Montreal Que.

CRAIG, Stephen E., B.A.Sc. (Univ. of Toronto), asst. laboratory engr., i/c of inspectn. of all materials of constrn. except concrete, H.E.P.C of Ontario, Toronto, Ont.

HAWTHORNE, George, asst. engr. H.E.P.C. of Ontario, Cambellford, Ont.

HIBBERSON, Robert William, pres., Ryan McIntosh, Hibberson, Blair Timber Co. Ltd., Victoria, B.C.

JAMES, David Harries, dftsman, i/c boiler and plate work, Canadian Vickers Ltd., Montreal, Que.

KALBHENN, Josef, M.E. (Aachen Univ.) asst. ventilation engr. Dominion Coal Co. Ltd., Glace Bay, N.S.

MacCRIMMON, Duncan Daniel, Quebec Development Co., Isle Maligne, Que.

THOMAS, Arthur Stanley, B.Sc. (Queens Univ.), asst. engr., under O. S. Finnie D.L.S., director of N.W.T. & Yukon Branch., Ottawa, Ont.

WAKE, Harold Robert, B.Sc. in C.E. (Univ. of Nebraska), acting in executive capacity with Aluminum Co. of Can. Ltd., Arvida, Que.

Juniors

GUTHRIE, Kenneth MacGregor, flying officer, pilot and administrative officer, Royal Canadian Air Force, Ottawa, Ont.

KIRSCH, Harry, B.Sc. (McGill Univ.) dftsman, St. Maurice Paper Co., Cap Madeleine, Que.

McILQUHAM, Walter Scott, B.Sc. (Queens Univ.), Dominion Engineering Co. Ltd., Montreal, Que.

WOLSEY, Maunsell, B.A.Sc. (Univ. of Toronto), in engrg. cost office of Goodyear Tire & Rubber Co., New Toronto, Ont.

WOOLLCOMBE, Edward Mickle, B.Sc. (McGill Univ.) woods engrg. dept., Riordon Pulp Corpn. Ltd., Montreal, Que.

Transferred from Class of Associate Member to that of Member

BOOTH, Mark Westaway, steam engr., British Empire Steel Corp., Sydney, N.S.

COCHRANE, Morton Farrer, hydro-electric engr., Dominion Water Power & Reclamation Service, Dept. of the Interior, Ottawa, Ont.

JAMES, Edward Henry, partner with A. D. Swan, M.E.I.C., constlg. engr. Montreal, Que.

LEFEBVRE, Joseph Alexis, head of district, Roads Dept. Province of Quebec.

LUMSDEN, James Freeman, B.Sc., E.E., (N. S. Tech. Coll.); electrical engr., i/c elec'l. dept., N.S. Power Commn., Halifax, N.S.

MILLS, Thomas Stanley, B.A., B.Sc. (C.E.) (Queens Univ.), asst. chief engr., Dominion Parks Branch, Dept. of the Interior, Ottawa, Ont.

STERNS, Frank Ernest, M.Sc., (McGill Univ.) designing engr., design structures and equipment, Welland Ship Canal, St. Catharines, Ont.

Transferred from Class of Junior to that of Associate Member

DUCLOS, Lewis Murray, transitman, C.P.R., Ottawa, Ont.

GRADY, John Earle, asst. supt., By-Product Coke Plant of Steel Co. of Canada, at Hamilton Works, Hamilton, Ont.

PRIEUR, Henri, asst. engr., sewers branch, City of Montreal, Montreal, Que.

SHEPHERD, Hugh Wallis Robertson, res. engr., highway dept., Prov. of Alberta, Edmonton, Alta.

TURNBULL, Aubrey Arnold, B.Sc. (N.S. Tech. Coll.), plant engr., The New Brunswick Telephone Co., St. John, N.B.

WALTON, Frederick Stanley, instrman. on Smithers Divn. of C.N.R., Prince Rupert, B.C.

Transferred from Class of Student to that of Associate Member

AHERN, Arthur Weston, B.Sc. (McGill Univ.), vice-pres., James Ruddick Constrn. Co., Quebec, Que.

BENNETT, George Clifford, B.A.Sc. (Univ. of Toronto), vice-pres. and mgr., Burk Investments Ltd., Gen. Contractors, Real Estate & Insurance, Toronto, Ont.

CARTWRIGHT, George Herbert, B.Sc. (McGill Univ.), asst. engr., mtce. of way, Quebec Railway Light & Power Co., Quebec. Que.

DORIAN, Robert, divn, engr., i/c St. Hyacinthe Bagot Drummond and Yamaska counties, for Quebec Road Dept., St. Hyacinthe, Que.

LeBARON, Karl Shurtleff, B.Sc. (McGill Univ.), chief engr., Dryden Paper Co., Dryden, Ont.

McLELLAND, William James, B.A.Sc. (Univ. of Toronto), W. J. Westaway Co. Ltd., Hamilton, Ont.

MITCHELL, Gordon, B.A.Sc. (Univ. of Toronto), supt., i/c constrn., Virgin Falls Dam, Thunder Bay System, for H.E.P.C. of Ontario.

MOTT, Harold Edgar, B.Sc., E.E. (McGill Univ.), i/c test depts., drafting office, and factory designs, Can. Marconi Co., Montreal, Que.

PARKER, John Bruce, B.Sc. (McGill Univ.), asst. to head of engrg. dept., Sastatchewan Govt. Telephones, Regina, Sask.

WAIT, Eric Holloway, B.Sc., Met. (McGill Univ.), engr., divn. of Mineral Resources, Mines Branch, Dept. of Mines, Ottawa, Ont.

Transferred from Class of Student to that of Junior

BURTON, Harry Robert, B.A.Sc. (Univ. of Toronto), retort foreman, i/c treating at Edmonton Plant, Canada Creosoting Co. Ltd., Edmonton, Alta.

EADIE, Thomas W., B.Sc. (McGill Univ.), engrg., practices section, outside plant divn., supervisory work, Bell Telephone Co. of Canada, Montreal, Que.

ELLIOT, Gerald Burton, B.Sc. (McGill Univ.), sales engr., mech. refrigeration engrg., Montreal Office, Refrigerating Engineers Ltd., Montreal, Que.

HICKS, Alva, B.Sc. (Queens Univ.), tech. engrg., tech. dept., Northern Electric Co., Montreal, Que.

HOLMAN, John Longmaid, B.Sc. in E. E. (Univ. of N.B.), traffic engrg., traffic dept., New Brunswick Telephone Co. Ltd., St. John, N.B.

HOLT, Ernest William, B.Sc. (McGill Univ.), Canadian Mead Morrison Co. Ltd., Welland, Ont.

MILLER, Wilfred Laverne, B.A.Sc. (Univ. of Toronto), transformer designing engr., Can. Westinghouse Co. Ltd., Hamilton, Ont.

MOORE, Reginald Arthur, B.Sc. (McGill Univ.), demonstrator, dept. electrical engrg., McGill University, Montreal, Que.

NUTTER, Jack C., B.Sc., (McGill Univ.), electrical engr. and asst. to chief engr., Groveton Paper Co. Inc., Groveton, N.H.

PATTERSON, Thomas Bilton, res. engr. on prelim. survey and constrn. with dept. of Highways, Saskatchewan.

SCHERMERHORN, Henry Lewis, instrman, with Ontario Dept. of Highways, Napanee, Ont.

SCOTT, William Orville Craig, B.A.Sc., M.A.Sc., (Univ. of B.C.) smoke inspr., City of Vancouver, Vancouver, B.C.

SOMMERVILLE, Archibald Laurence Harold, B.A.Sc., (Univ. of B.C.), dftsman, reinforced concrete, Sydney E. Junkins Co. Ltd., Vancouver, B.C.

YOUNG, Dudley Stewart, B.Sc., C.E., (Univ. of Man.), field engr., Winnipeg Hydro-Electric System, at Point du Bois, sluiceway constrn.

The following students were admitted:

ADAMSON, Francis Stanley, 122 Arlington St., Winnipeg, Man.

ALLAN, John Charles, 300 Pearl Ave., Peterborough, Ont.

BRYANT, James Sanborn, 1991a De La Roche St., Montreal, Que.

CARTER, Francis Tracey, 882 George St., Fredericton, N.B.

GOUGH, Robin William, 63 Shore St., Fredericton, N.B.

GREGORY, Hurd Anthony Forbes, 149 Drummond Street, Montreal, Que.

MacPHAIL, Gordon Miller, 239 Smythe St., Fredericton, N.B.

SALTER, Frederick Cumberland Jr., 51 Vendome Ave., Montreal, Que.

SEELY, Harold Chipman, 651 Union St., Fredericton, N.B.

STOREY, Thomas Edwards, 255 Glenwood Crescent, Winnipeg, Man.

BRANCH NEWS

Border Cities Branch

W. H. Baltzell, M.E.I.C., Secretary-Treasurer.

The Border Cities Branch, *Engineering Institute of Canada,* held its regular monthly meeting on February 12th, 1926, in the Prince Edward hotel, Windsor, Ont. Twenty-eight members and friends sat down to dinner.

During the course of the meeting the chairman announced that a free post graduate course in concrete was about to be conducted in Detroit under the auspices of the Detroit Engineering Society. The following asked to be enrolled for this course: J. E. Porter, A.M.E.I.C., J. Clark Keith, A.M.E.I.C., E. S. Carlyle, Harvey Thorne, M.E.I.C., Thos. H. Jenkins, Jr. E.I.C., Harold J. A. Chambers, S.E.I.C., and Sidney Hogg, and the secretary was instructed to advise the Detroit Engineering Society asking that their names be placed on the roll for the entire course. J. Clark Keith, A.M.E.I.C., past-chairman, was the speaker of the evening. Having been solicited by the membership committee to do so Mr. Keith gave the branch the benefit of his paper on "The Border Cities Water Supply" presented in Toronto at the annual general meeting of *The Institute.* He illustrated his talk with stereoptican views, in a most entertaining and instructive way. The paper has been printed in full in the February issue of *The Journal of The Institute.*

The paper was enthusiastically received by those present, as was evidenced by the subsequent interrogations and discussion, and a hearty and sincere vote of thanks was given to Mr. Keith by those assembled.

As this closed the business of the evening, a short social period was indulged in and the meeting adjourned at 9.45 p.m.

Executive Meeting

A meeting of the Executive of the Border Cities Branch was held on Thursday, February 10th, 1926, in the office of J. Clark Keith, A.M.E.I.C., afforded the members an opportunity of meeting Major George Alexander Walkem, M.E.I.C., president of *The Institute,* but prior to convening a message was received, from Major Walkem indefinitely postponing his visit.

The following were appointed members of the standing committee of the branch for 1926.

Membership Committee:— A. E. West, A.M.E.I.C., (chairman), C. G. R. Armstrong, A.M.E.I.C., J. E. Porter, A.M.E.I.C.

Papers and Entertainment:—R. J. Desmarais, Jr.E.I.C., (chairman), W. B. Pennock, Jr.E.I.C., E. G. Riley.

It was decided to add to the duties of the Papers and Entertainment Committee by asking them to make such arrangements, with the Border Cities Star, as may be necessary to insure the meetings of this branch being given publicity.

It was suggested that a registration book, for use of those attending branch meetings, be provided in lieu of roll call but after discussing the matter it was agreed that the secretary should place slips or cards before each attendant upon which he could register.

The matter of papers for future meetings was discussed. It was suggested that we have one meeting at which papers of five or ten minutes length be read by several members, the chairman to nominate at a previous meeting, from amongst those present, the ones to present these. It was thought this would be particularly helpful to the younger members who might be hesitant about presenting more extended papers.

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch-News Editor.

Visit of President Geo. A. Walkem, M.E.I.C.

On March 1st, a welcome was tendered to President Geo. A. Walkem, M.E.I.C., which took the form of a luncheon. The chair was taken by R. S. Trowsdale, M.E.I.C., in the unavoidable absence of chairman A. L. Ford, M.E.I.C.

Major Walkem gave a talk on *Institute* affairs which was of very great interest, and was most enthusiastically received. We in the west are forced to miss a good deal of knowledge concerning the bigger business activities of *The Institute* as transacted by our chief executive council, and the speaker gave us an insight into these matters, linking us up, as it were, with such affairs. The west is honoured this year in having one of its members elected to the highest position attainable, that of president of *The Institute.*

Our guest referred to the possibility of the publication of the transactions of *The Institute* being resumed, which proved a matter of much interest to those present. Considerable care, however, had to be exercised, he said, in the expenditure of monies especially when the budget prepared for the year exceeded the anticipated income. He was emphatic on the principle of keeping up a high standard of admission for new members, pointing out how essential it was that this should be at least equal to that obtaining for admission to professional institutes in the provinces.

His reference to his visits to eastern Canadian branches was most interesting. He strongly recommended a closer touch being kept with student activities, and related how in British Columbia every student in communication with *The Institute* branch had been successfully placed in a position. He emphasized the probability of such students or young engineers being lost to Canada in many cases, if such action is not taken, and this was a responsibility that any branch might well foster.

He announced that Rudyard Kipling was very interested in the E.I.C. and had specially written a ritual for engineers, and also that there was a possibility of his coming out in July of this year to open that portion of new road forming the closing link of the main highway through British Columbia.

Major Walkem's conclusion was followed by a very hearty round of applause.

A. S. Dawson, M.E.I.C., expressed a high appreciation of Major Walkem's presence, his words, his message of goodwill from the east, and the information given, and congratulated him on the high honour bestowed on him by his election to the presidency. He stated that only on two previous occasions had western members been elected, namely J. G. Sullivan, M.E.I.C., and Colonel J. S. Dennis, M.E.I.C.

The Sugar Beet Industry

An instructive and exceptionally interesting lecture was given on March 2nd, by C. R. Wing, the superintendent of the Canadian Sugar Refineries at Raymond, Alberta. Mr. Wing addressed a big gathering of members and visitors and outlined the process of growing sugar beets, marketing, and handling them in the factory.

He explained that sugar cane and maple sugar were chemically identical, and that there was no difference whatsoever between the chemical analysis of cane sugar and beet sugar. Dealing with the history of the industry he went back to the days of Queen Elizabeth, who was the first to introduce sugar into the household, probably because it was a very expensive luxury, about $275 a hundred pounds. The first commercial extraction of sugar from the sugar beet was in 1797 when a Frenchman named Karl Achard was successful with its production. The industry did not become profitable until the Napoleonic wars. In 1830 sugar beet was first grown in the United States, near Philadelphia. There are now one hundred sugar beet factories in the States from which twenty-two million 100-pound bags of sugar were produced last year, forming only 20 per cent of the sugar consumption. The per capita sugar consumption in the States for 1925 was 107.5 pounds, an increase of 13.5 per cent over the year 1924. Relative to the growing of sugar beets, he stated that they must be properly cultivated, also that the southern Alberta climate was practically ideal for their growth and full maturity. He claimed that the growing of beets will solve to a large extent the problems of the irrigation farmers. A minimum price is guaranteed by the operating company. Besides the value of the crop in sugar product there are the by-products of pulp, beet tops, and molasses, all returning large values and of great assistance to the dairy industry.

The speaker pointed out that in the case of wheat the value of the soil fertility is also being exported, whereas with sugar it is only the air and water that acutally leaves the field in addition to the sugar, for sugar is a hydro-compound holding not a single particle of mineral matter from the soil. The tops and by-products are returned to the soil by feeding to sheep, hogs, and cattle. In the extensive cultivation necessary, weeds are destroyed, and by crop rotation the value of the land increased.

His reference to the factory was no less interesting, and with a complete set of bottles containing samples he was able to illustrate clearly the process of manufacture from the ribbon like "cossettes" or slices of beets to the finished table product. A million and a half dollars have been expended on the plant and he went into the multifarious treatments and extraction processes in considerable detail, at the same time pointing out that not a particle of the produce is manhandled and that the final product is 99.9 per cent pure sugar as determined by the provincial analyst.

His detailed explanation of the various mechanical features of the factory proved conclusively that his company are down to the minute in respect to modern equipment. It was interesting to note that sugar cannot be manufactured chemically or in any other way, but humanity is solely dependent on nature to produce this all-essential commodity in the raw state.

W. H. Snelson, A.M.E.I.C., gave a very opportune short talk on the retentiveness of soil for moisture and applied water, pointing out with the assistance of diagrams, the crop growth of beets with varying applications of water both natural and artificial. It was readily observed that there was a "just right" condition that should and could be maintained by the farmer, given the opportunity and ability to study in a more or less scientific manner the problem of the application of water to the land.

S. G. Porter, M.E.I.C., was eloquent in his remarks on the stabilizing effect that such an industry was bound to have on the province, dependent as we are to so large an extent on the products of the soil. He considered this new industry would be of lasting benefit and should open up a new era of prosperity to farming communities.

UNDERGROUND MAPPING OF OIL, GAS AND WATER HORIZONS

On February 18th, S. J. Davies, A.M.E.I.C., delivered an address to the branch on "Underground mapping of oil, gas, and water horizons encountered in drilling operations". This address created particular interest at this time especially, as considerable activity is evident in the Turner Valley oil field adjacent to the Calgary area. Mr. Davies spoke to a crowded house, in fact it was with difficulty that late visitors were able to find standing room. Engineers, operators, promoters, drillers, and brokers were in evidence on all sides, and all listened with keen attention. Many questions were asked and were very ably answered by the speaker.

At the conclusion of the lecture the geological samples displayed were closely examined by many of those present. Mr. Davies is to be congratulated on his presentation of a paper that showed careful study and accurate knowledge of the subject selected, and which was much appreciated by all who were fortunate enough to be able to attend.

LIGHT RAILWAYS IN FRANCE DURING THE WAR

On January 25th, F. K. Beach, A.M.E.I.C., gave the branch a talk on light railways in France during the great war. Mr. Beach, at very short notice, kindly filled the gap caused by the unavoidable absence of one of the scheduled speakers.

It proved an excellent discourse on methods adopted to overcome difficulties in track-laying at the scene of warfare and was followed closely by all present. The speaker displayed the somewhat rare gift of making things quite clear in a few well chosen words, and with the aid of several charts illustrated his points in a very interesting manner. Considerable discussion followed on the question of steel versus wooden ties and on the stability of light railway wagons on narrow gauges, etc.

Edmonton Branch

W. R. Mount, A.M.E.I.C., Secretary-Treasurer.

The regular monthly meeting of the branch was held in the Macdonald hotel on February 23rd. The chairman, A. G. Stewart, A.M.E.I.C., briefly introduced Mr. Bache Wiig who had come to address the branch concerning the possibilities of making paper from Alberta straws.

The paper was listened to with the greatest interest by a large meeting and much discussion was entered into. The samples of papers and boards which were shown were of large variety and interest. It is hoped that at a later date Mr. Bache Wiig's paper will be printed in full, as it was felt by all present that it would be of far wider interest than to this branch alone.

A very hearty vote of thanks was accorded Mr. Bache Wiig.

Lethbridge Branch

N. H. Bradley, A.M.E.I.C., Secretary-Treasurer.

The Lethbridge Branch met on February 21st, for its usual bi-monthly dinner. The guest of the evening was Prof. Edgar Stansfield, M.E.I.C., honorary secretary of the Research Council of Alberta.

Mr. Stansfield gave a most interesting and instructive address on the work being done by the Research Council and showed the results obtained by the experiments of Professor Clark of the Alberta University in developing a process for extracting the bitumen from the McMurray tar sands. Professor Stansfield stated that the process was now available for commercial purposes, but he pointed out that so far the experiments in the use of bitumen were all to the end of developing an all-weather service for dirt roads. The bitumen was mixed into the clay and produced a waterproof layer that so far has made the roads treated adaptable to traffic throughout the year.

Professor Stansfield also entered into the work being done with coals and elaborated somewhat on the briquette. He referred to the fact that briquettes were now being manufactured on a commercial scale at Canmore and that the Research Board was finding there a proving ground for their laboratory experiments.

Professor Stansfield showed a number of slides and charts of coal areas and systems of analyses for coal. The meeting was enlivened as usual by community singing and by solos from Messrs. Parsons and Meldrum. The Rainbow Orchestra, which is always a feature of the Lethbridge Branch, was again in evidence and played throughout the dinner.

There were about forty members and affiliates present and these entered earnestly into the general discussion following Professor Stansfield's able address.

London Branch

E. A. Gray, A.M.E.I.C., Secretary-Treasurer.

The regular February meeting of the London Branch was held in the Board Room of the Public Utilities Commission on Thursday, February 18th, at 8.15 p.m.

The branch was most fortunate in having as the speaker of the evening President Geo. A. Walkem, M.L.A., M.E.I.C. President Walkem discussed several phases of engineering as obtaining in British Columbia, especially pointing out the work which is being accomplished there in the way of providing employment for students graduating from the university, and assisting them in every way possible in their chosen profession.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.
V. C. Blackett, A.M.E.I.C., Branch News Editor.

MANUFACTURE OF PORTLAND CEMENT

The "Manufacture of Portland Cement" was the subject of a very interesting illustrated address delivered by H. S. Van Scoyoc, M.E.I.C., in the City Hall, Moncton, N.B., on March 4th. Mr. Van Scoyoc is consulting engineer for the Canada Cement Company and is widely known for his work in connection with concrete highways. Because of the importance of the subject the meeting was open to the public, and in addition to a large attendance of branch members, a number of persons, prominent in building work, were present.

C. S. G. Rogers, A.M.E.I.C., chairman of the branch presided.

Mr. Van Scoyoc stated that although the patents on Portland cement were taken out over a century ago, it is only within recent years that concrete, of which Portland cement is the principal ingredient, has come into general use. In 1880, the annual output of cement, on this continent was only 40,000 barrels; at the present time the output is 150,000,000 barrels per annum.

Hydraulic cements were not unknown to the Ancients. They were, however, mostly used in mixing mortar. It is interesting to note that the cement made by the Romans from volcanic dust was almost exactly the same as the slag cement manufactured at Sydney, C.B.

Briefly, the manufacture of Portland cement consists in passing a mixture of pulverized limestone and clay, to which a small quantity of gypsum is added, through a rotary kiln. This kiln is about 9 feet in diameter and 150 feet long and is set on a slight slope. The ingredients are fed in at the upper end of the kiln, either in the dry state, (dry method), or else mixed with water to form "slurry", (wet method). The slope and rotary action of the kiln causes the mixture to move slowly from the upper to lower end, during which time it is subjected to a temperature of upwards of 3,000° F. After passing through the kiln, the cement is again pulverized, and then stored for shipment. To maintain the intense heat in the kilns, large quantities of coal are required. The manufacture of one cubic foot of cement calls for an equal volume of coal. In the central province plants alone about one million tons of coal is required annually. Mr. Van Scoyoc, on being questioned, was unable to state what percentage of coal used, was mined in Canada.

The address was followed by a very interesting discussion. Mr Rogers described methods of calculating stresses in rotary kilns, and Prof. H. W. McKiel, M.E.I.C., told of his experiences while chemist of a cement plant.

A vote of thanks moved by Prof. McKiel, and seconded by A. S. Gunn, A.M.E.I.C., was tendered Mr. Van Scoyoc for his excellent address.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
Stanley A. Neilson, A.M.E.I.C., Branch News Editor.

Tribute Paid the late Phelps Johnson, M.E.I.C.

Prior to the regular meeting on February 25th., an expression of the feeling of loss that the profession had sustained through the death of Mr. Phelps Johnson was given by Mr. Duggan. He spoke very feelingly of their close associations on various engineering enterprises and suggested that the branch executive be instructed to word a suitable resolution of regret to be inscribed in the records of the branch. The resolution follows:—

"At the suggestion of Mr. Duggan, the Montreal Branch of the Engineering Institute of Canada wish to go on record as expressing their deep regret on the death of Mr. Phelps Johnson, past-president and past-vice-president of the Institute, and for six years a member of Council.

His admirable personality and his unassuming character gained for him a host of friends; his eminence as an engineer was acknowledged by the profession on both sides of the Atlantic; and his death leaves a vacant place which will be difficult to fill.

The branch desires to place on record its sense of loss and its appreciation of the importance of the services rendered by Mr. Johnson to The Institure, to the engineering profession and to the public welfare."

The development of the outside plant of the Bell Telephone Company

W. H. Winter, assistant to the general manager of the Bell Telephone Company of Canada, and himself one of the telephone pioneers, having seen over forty years of service in the telephone company, was the speaker for the evening on February 25th., before the Montreal Branch.

Mr. Winter's address contained much information tending to disabuse the mind of the average telephone user that the telephone instrument is all that is necessary for the carrying on of conversation over the wire. He outlined the main features of the outside plant which he defined as "all the structures, apparatus and appurtenances required to connect the central offices to the subscribers' stations and to connect the various central offices with each other."

His treatment of the subject was for the most part historical, beginning with the first telephone system, if it may be so called, which Professor Alexander Graham Bell erected on a fence in Brantford, Ontario, in 1876. Limited development took place until 1880, when the Bell Company was organized and absorbed a number of small exchanges in Quebec and Ontario.

At the start the outside plant work followed the methods that had been laid down by the telegraph companies, but as the service expanded and the number of lines increased the poles and numbers of cross-arms became so numerous that the development of a suitable cable was made necessary, and a system of underground conduits was considered. The first underground cable was laid in Toronto in 1889, Mr. Winter gave some very interesting figures as to the miles of cables in Toronto and Montreal, as to the numbers of poles, etc., in use, and then dealt with the company's work of planning for the future, through commercial surveys, fundamental plans and construction programmes, on which plant development is based.

Dealing with the matter of expenditures, the speaker stated that in 1925 over five million dollars had been spent in outside plant and that for the period 1926-1930, thee stimated expense was placed at nearly twenty-eight millions, with an average per year for Montreal and Toronto of about one million each.

In conclusion, he said that the tradition of the company has been to use the best of equipment, to be ever seeking something better, to improve the service and to find new means of meeting the steadily-increasing requirements, which policy has brought about a development, beginning with a few small isolated telephone exchanges, with 2,100 stations, in 1880, to an up-to-date telephone system, second to none, of 592,000 exchange stations and long distance facilities to interconnect with 17,000,000 telephones throughout Canada and the United States, an achievement of which any builder may justly be proud.

J. A. McCrory, A.M.E.I.C., occupied the chair and tendered to the speaker the vote of thanks that was proposed by C. K. McLeod, A.M.E.I.C.

The Chicago Drainage Canal

So completely was this subject covered, and exhaustive elucidation given to every aspect of the question by J. L. Busfield, M.E.I.C., at the Montreal Branch meeting on March 4th., that not one query was put by any member of the large audience or exception taken to any of his observations. when the meeting was thrown open for discussion.

In the expressed opinion of J. W. Hayward, A.M.E.I.C., who was called on by the chairman, C. J. Desbaillets, M.E.I.C., to propose a vote of thanks to the speaker, no other paper to which he had ever listened at the Institute had proved of such interest or been so completely comprehensive in character, treating in detail every phase of a very broad subject in the short space of two hours.

Vancouver Narrow's Bridge

An engrossing description of the recent construction of the Vancouver Narrow's Bridge was given to the members of the Montreal branch by E. H. James, A.M.E.I.C., on March 11th.

In his address Mr. James, who was resident engineer during the building operations, told of the method of construction and the many difficulties that had to be overcome before the link between Vancouver and North Vancouver was completed. The paper was illustrated by a large number of lantern slides showing the bridge at all stages, as well as many details of the fabrication of the concrete piers on which the superstructure was placed.

The project was mooted before the war, said the speaker, but was not taken up again in real earnest until the beginning of this decade. The bridge consisted of a trestle span, fixed span, bascule span, tower span, and two other spans terminating in a trestle span on the north shore. It was designed to carry a single railroad track and two highways 10 feet wide on either side, and one sidewalk, and its need was proved in the month after the opening on November 7, 1925, when 5,000 automobiles and 125,000 people crossed the bridge.

The work of trestle driving began in January, 1924, and the construction of the concrete cylinders for the piers soon followed.

The designers were faced with a difficulty in that no solid rock foundation could be found for the main caisson of the bridge although a depth of nearly 100 feet under water was reached at high tide, and it, was this fact that occasioned the most difficult problem that arose during building operations.

After the caisson for pier No. 2 had been constructed and floated out to position in mid-stream, not without difficulty as a seven-mile an hour current necessitated the work being done during the slack water, they found that after the caisson had been sunk to a depth of 90 feet at high water it rested on a ledge rock, apparently on the edge of a vertical cliff. Dynamite did not reveal any great amount of rock bottom at a lower depth and only damaged to some extent the walls of the working chamber.

Consequently the engineers were forced to add to the base the caisson where it did not rest upon solid rock and as the work had to be done at a considerable depth below water the task was none too easy.

The men working on the pier had to work in short shifts of 50 minutes and so great was the pressure at that depth that many of them suffered from the "bends."

Following an agitation on the part of shipping companies and lumber companies who claimed that the bridge as designed would greatly interfere with their operations, the suprestructure of the bridge was set at a height of five feet more above the water than was called for in the original design, and part of the trestle span was replaced by two steel spans.

During the summer of last year the steel spans were built and placed in position, the last 150-foot span being finished in August.

The bascule, which is raised by two 100-horse-power electric motors may be fully opened in 75 seconds, it having a counterweight concrete block weighing 1,000 tons.

A short discussion followed the paper and a hearty vote of thanks was tendered the speaker.

History of the Locomotive, its development and Future possibilities

The history of the locomotive, its development and future possibilities was the subject of the lecture delivered by W. A. Newman before the Montreal Branch on March 18th, 1926.

From very early times it was customary to convey coal first by panniers on horses, then by horse-drawn carts and by barges to a considerable distance from the mines themselves. The carts were first used on dirt roads, then flagstones were laid as cartways, next the carts became four wheel wagons and early in the 17th century the collieries commenced to haul their waggons on wooden rails which very greatly increased the hauling capacity of horses. These roads of rails or railroads, as they were soon called, first consisted of long wooden rails with a flange built on the inside but which were later abandoned in favour of a plain rail with a flange on the wheel. Cast iron rails were used as early as 1738 and the flanged wheel made its appearance about the year 1789.

The speaker gave a description of the progress of the steam locomotive. The Cornwall man, Richard Trevithic constructed what was really the first successful steam locomotive, some years elapsed before any further developments occurred with locomotives during which period the combined use of horses and fixed winding engines was considerably extended. In 1811 Blenkinsop constructed for the Middleton colliery a locomotive which cost £380. The engine performed satisfactorily and a few others were built of the same type which worked for a considerable number of years. In 1814 George Stephenson, who with his son, was destined to become the most outstanding figure in the development of the locomotive, produced one for the Killingworth colliery.

All the railways in operation at this time, the speaker said, were intended for the haulage of coal and merchandise and passengers were not even considered. One writer of eminence at that time went so far as to declare that he would as soon think of being fired off on a ricochet rocket as to travel on a railway at twice the speed of the old stage coaches.

Shortly after the opening of the Liverpool and Manchester railway a passenger train was run as an experiment and greatly to every one's surprise more passengers presented themselves than could be carried. From this time passenger traffic grew to such an extent that it became a big proportion of the business and in fact called for the entire remodelling of the railways. The locomotive at this time was, of course, intended as a substitute for the horse. With continued improvements, it soon demonstrated that its capacities were away beyond those of horse haulage and heavier and more powerful locomotives succeeded each one after the other. The speed of the trains also increased which improvements called for still heavier rails which in turn became obsolete with further increases in locomotives weights and speeds and this succession of heavier locomotives and rails has not only continued up to the present but will undoubtedly continue into the future.

As for the American continent the locomotive only really started in 1828 with the importation of two English locomotives. The first locomotives to be built in America was not constructed until after 1830. The speaker also dealt with the electric locomotive and the internal combustion locomotive. The lecture was illustrated with lantern slides depicting the different types.

The chairman was A. R. Ketterson, A.M.E.I.C.

Visit of Sir Sefton Brancker

On the occasion of the visit of Sir Sefton Brancker, director of civil aviation of Great Britain, to Montreal on March 19th, 1926, the executive of the Montreal Branch and the resident members of Council entertained him to an informal luncheon at the University Club.

Following the luncheon, Sir Sefton told those present of the progress that is being made in Britain in the field of civil aviation. He complimented Canada on the aerial survey work that was being done here, saying that in this particular line Canada leads the world.

C. J. Desbaillets, M.E.I.C., acted as chairman, and J. M. R. Fairbairn, M.E.I.C., thanked the speaker for his interesting talk.

Papers and Meetings Committee

The following have been appointed to the above committee:— R. E. MacAfee, A.M.E.I.C., chairman, A. Duperron, A.M.E.I.C., vice-chairman.

Civil Section;—A. Plamondon, A.M.E.I.C., chairman.

Electrical Section:—G. A. Wallace, A.M.E.I.C., chairman.

Mechanical Section:—J. W. McCammon, A.M.E.I.C., chairman, F. S. B. Heward, A.M.E.I.C., vice-chairman.

Municipal Section:—J. G. Caron, A.M.E.I.C., chairman, J. F. Brett, A.M.E.I.C., vice-chairman.

Railway Section:—D. Hillman, M.E.I.C., chairman, J. A. Ellis, A.M.E.I.C., vice-chairman.

Student Section:—G. Gingras, S.E.I.C., chairman, H. L. Johnston, S.E.I.C., vice-chairman.

International Electrotechnical Commission

On April 30th and May 1st., Montreal will be visited by members of the above mentioned body. Prior to this date a meeting is to be held in the United States, the members then coming through Canada visiting Niagara, Toronto, Ottawa and Montreal. It has been proposed that the Montreal Branch entertain them and the details of this are to be announced later.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

The motion pictures taken during the 1925 Canadian Arctic expedition were screened for the first time before a large audience in the Victoria Memorial Museum hall last night. The screening and lecture by George P. Mackenzie, officer in charge of the 1925 expedition, was under the auspices of the Ottawa Branch, and was open to the public.

There were a great many good reasons to justify the expenditure of time and money on such expeditions, Mr. Mackenzie stated. Canada's root of title to the Canadian Arctic Archipelago is an Imperial order-in-council passed in 1880, a good holding title but to be made indefeasible must be followed by occupation and government.

It would be a dangerous thing for Canada to say that her northern possessions were not worth while. Mr. Mackenzie recalled that at one time Alaska had been considered useless and that Canada had lost untold wealth by failing to take it over.

The motion pictures formed a most complete story of the whole trip of 102 days. Pictures were taken at the farthest north post of the R.C.M.P. and at all points visited. From a scenic standpoint the pictures of icebergs in the polar seas were exceptionally fine. J. D. Craig, M.E.I.C., director general of surveys, Department of Interior, and chairman of the Ottawa Branch, was in the chair.

Some Great Men of Science and Their Books

An eloquent and erudite address was delivered before the Ottawa Branch when Dr. Leo E. Pariseau, of the Hotel Dieu, Montreal, who has achieved distinction both as scientist and bibliophile, lectured on "Some Great Men of Science and Their Books."

Dr. Pariseau in an interesting manner traced the trend of scientific thought and progress from the time of the Greeks down to comparatively recent times and he pointed out what the world owed to the countries bordering on the eastern section of the Mediterranean for here not only occurred the founding of Christianity, but from this comparatively small area also came the foundations of modern arts and sciences from the Greeks, Egyptians, Phœnicians and Romans.

The lecturer referred to the notable achievements of the Greeks in the study of astronomy, metaphysics, biology, anatomy and kindred sciences and stated that in this respect they excelled the Romans, who though capable soldiers and administrators, were more given to moralising and copying the Greeks than to looking into the basic cause of things. The library at Alexandra founded by Ptolemy contained 700,000 books and the speaker referred to the loss sustained to learning when this collection was destroyed by the Arabs in the 7th century.

Dr. Pariseau said that the Middle Ages could be called the Dark Ages so far as advance in science was concerned, with some notable exceptions, and in illustration of this he stated that many of the learned Greeks and Roman savants held that the world was spherical, for which belief Columbus and Gallileo were persecuted so many years later.

References were made to the great scientists of the 15th and following centuries and particularly to their contributions made to anatomical and physiological science in the invention of the microscope and the discovery of the circulation of the blood. A valuable collection of scientific books dating from the 16th century were placed on view and created particular interest.

J. D. Craig, M.E.I.C., chairman of the branch, who occupied the chair, expressed the thanks of the meeting to Dr. Pariseau for his valuable address and this was ably seconded by Noulan Cauchon, A.M.E.I.C.

Major Walkem's Visit

The part played by engineers in the making of Canadian history, and particularly the history of British Columbia, was outlined by Major George A. Walkem, M.L.A., M.E.I.C., of Vancouver, B.C., in an address at the luncheon of the Ottawa Branch, at the Chateau Laurier. J. D. Craig, M.E.I.C., chairman of the branch was in the chair.

Major Walkem first paid high tribute to the Ottawa Branch, and then gave a very interesting and graphic summary of the history of Victoria, B.C., pointing out that the first white man to explore the coast was Captain Vancouver. He also made reference to the epic-making journey of Sir Alexander Mackenzie, the first white man to reach tidal waters at the Bellacoola river.

Major Walkem also spoke of the railway engineering feats of British Columbia, and of water power developments.

At the conclusion of the address Mr. Craig thanked the speaker on behalf of the Ottawa Branch, and invited the new president to address the Ottawa engineers on subsequent visits to the capital. The president exemplified in his person the type of engineer which was his ideal—a man versed in commerce and public affairs, the chairman said.

Peterborough Branch

P. Manning, A.M.E.I.C., Secretary-Treasurer.
W. E. Ross, A.M.E.I.C., Branch News Editor.

Trees

On the evening of January 14th, a very interesting meeting was held at which Mr. H. J. Moore, of the provincial department of agriculture presented a most interesting and enlightening talk on "Trees."

A. L. Killaly, A.M.E.I.C., chairman of the branch, introduced the speaker and made brief reference to the long experience that Mr. Moore had had in this particular work, which experience includes ten years at Queen Victoria Park, Niagara Falls; the planting of the trees along the highway between Niagara Falls and Fort Erie and other service with the provincial department of highways.

Mr. Moore in his address covered the various uses of trees, for parks, shade purposes and the preservation of wild flowers and wild birds, and he also discussed reforestation and the effect of this on the economic life of the country. Reference was also made to the effect of trees on waterflow, and the influence on climate and rainfalls. He made a particular appeal for action to offset the great loss occasioned, due to the improper pruning of trees by inexperienced people, and stated, that, in his opinion, in all towns or cities a by-law should be introduced for the protection of trees, giving the parks commissioner the sole authority to prune, remove or otherwise attend to all trees.

The address was illustrated with excellent lantern slides, some of which depicted some very interesting examples of tree surgery.

Power Factor Correction

On February 4th, B. L. Barns, M.E.I.C., gave an interesting and instructive paper on "Power Factor Correction" before a goodly attendance of members and friends.

Mr. Barns, for the benefit of those of the audience not familiar with electrical matters first briefly explained power factor, the causes of low power factor and the general effects, both from the consumers' and the supply company's point of view.

The speaker then elaborated his remarks regarding the objectionable features and disadvantages of low power factor, explaining in detail the effect as regards size of transmission lines, capacity of machines, cables, transformers and switching apparatus and the detrimental effect on voltage regulation.

Passing to the question of power factor correction, Mr. Barns stressed the point that there is no general solution of the problem of power factor correction and each case must be treated according to its merits. He stated, however, that it is generally accepted that the greatest benefit is to be derived by correcting the power factor on the premises of power users where it is possible to obtain the same results with less investment and maintenance cost and contingent losses by the use of synchronous motors operating at leading power factor, and at the same time bring about a corresponding improvement in the power factor conditions of the secondary distribution system. The use of synchronous condensers, static condensers and induction motors for power factor correction was then discussed and the advantages and disadvantages of each pointed out, after which Mr. Barns cited several concrete examples, quoting actual figures.

R. L. Dobbin, M.E.I.C., was in the chair at this meeting and on motion of Mr. Wells Fraser, president of the Chamber of Commerce, tendered to Mr. Barns a hearty vote of thanks.

Aviation and Modern Engineering Practice

A regular meeting was held on the evening of February 11th, at which Commander E. W. Stedman O.B.E., M.E.I.C., gave a paper on "Aviation and Modern Engineering Practice."

This lecture has already been given by Commander Stedman before the Montreal Branch, and was described in these columns in the January issue, therefore, we do not propose to describe it in detail.

The description to above had prepared us for a pleasant evening, and it is no exaggeration to state that the lecture, and the lecturer, fully lived up to the advance notices, with the result that a thoroughly enjoyable evening was afforded the goodly number of members and friends present at this meeting.

The lantern slides used by Commander Stedman as illustrations for this lecture include some of the most remarkable and beautiful photographs ever shown before this branch.

At the conclusion of the paper a fair amount of discussion followed and several questions were asked of the speaker, after which R. C. Flitton, A.M.E.I.C., proposed a vote of thanks, which was approved by all present and tendered to Commander Stedman by the chairman, A. L. Killaly, A.M.E.I.C.

The branch had the pleasure of the company of G. E. Bell, M.E.I.C., of Ottawa at this meeting.

Saint John Branch

J. W. Johnston, A.M.E.I.C., Secretary-Treasurer.

Interconnection of High and Low Pressure Turbines

On February 19th, 1926, the members of the Saint John Branch were addressed by J. D. Garey, A.M.E.I.C., chief engineer, New Brunswick Power Company, Saint John, on "The Interconnection of High and Low Pressure Turbines." The meeting was held in the New Brunswick Telephone Company's building with W. R. Pearce, M.E.I.C., presiding.

In introducing his subject the speaker briefly traced the growth of the steam turbine in America during the past thirty years. The several types of turbine were clearly shown by slides, and other features of the address were also explained by slides.

The speaker described an actual problem met with in the operation of the power house of the New Brunswick Power Company at Saint John, where electricity is generated for domestic and public utility uses. In 1918 there developed such an overload on the company's system that it became imperative that something be done to obtain more power, and this at a time when new equipment was expensive, hard to obtain, and time of delivery uncertain. This was overcome by operating a high pressure condensing turbine as an extraction unit to supply steam to a low pressure turbine operated as a bleeder unit. By this means equipment on hand was utilized whereas otherwise expensive machinery would have had to be installed.

The power house of the Saint John Drydock and Shipbuilding Company was also described. The excess power generated here is used as required during peak loads on the system of the New Brunswick Power Company under an arrangement between the two companies. The first-named is supplied with oil-burning equipment, and at the second coal is used as fuel.

A discussion by those present disclosed many interesting points. A hearty vote of thanks on behalf of those present was moved by S. R. Weston, M.E.I.C., and G. G. Murdoch, M.E.I.C. After the meeting the members visited the power house of the New Brunswick Power Company and saw in operation the machines described in Mr. Garey's paper.

The Manufacture of Cement

A meeting of the Saint John Branch was held on March 5th, 1926, in the New Brunswick Telephone Company's building with W. R. Pearce M.E.I.C., as chairman. H. S. Van Scoyoc, M.E.I.C., of Canada Cement Company, Montreal, addressed the branch on "The Manufacture of Cement". The various processes of manufacture from the quarrying of the limestone to the storing and shipping of the finished product were shown by a moving picture film, and were also described by the speaker. More than eighty operations are required during the manufacture of cement, and the description of the care taken in making samples through out the process to ensure a proper finished product was very interesting.

The speaker also described the advances made in the use of cement whereby better concrete was now being obtained by controlling the proportions of the aggregate and using proper quantities of water. The use of a small proportion of calcium chloride and heating the aggregate were described as means employed for hastening the setting of the concrete.

The discussion at the close of the address proved a very interesting part of the meeting. Many questions were asked Mr. Van Scoyoc and great interest was shown. A vote of thanks was moved by Geoffrey Stead, M.E.I.C., and G. G. Murdoch, M.E.I.C.

Sault Ste. Marie Branch

A. H. Russell, Jr.E.I.C., Secretary-Treasurer.

A special meeting of the Sault Ste. Marie Branch was held on Monday February 22nd, at Y.W.C.A. rooms. The guest of honour at the dinner was Major Geo. A. Walkem, M.E.I.C., president of *The Institute.*

C. H. Speer, M.E.I.C., chairman, called the meeting to order and introduced Major Walkem by outlining his civic, political, military and engineering activities. He gave a brief history of the local branch, showing the growth and the prospects ahead of it.

Major Walkem expressed his pleasure in being able to meet the members of the Sault Branch again as he still carried pleasant memories of his last visit to the Sault, in 1924, when he had presented the charter to the branch. He briefly outlined the activities at headquarters and stressed the point of getting the young engineers into *The Institute* and the encouragement of giving prizes for the Student members while attending university. The average engineer, he said, is too modest and should serve the public more, as taking part in public life, (politics), broadens and strengthens the engineer. In the Vancouver Board of Trade, the engineering section is one of the most important and every city having a Board of Trade should have an engineering section.

Then, by special request of the chairman, Major Walkem gave a most vivid description of his work with the Royal Engineers in the Suez canal area and Palestine on railroad construction and maintenance. He had charge of the construction of 500 miles of road, the excavation of which was all done by native labour without the use of mechanical devices such as steam shovels, etc. In the whole distance of 500 miles one standard frog, a No. 7, was used throughout. The flies, heat and sandstorms caused the most trouble to the men and the white men worked in the morning and evenings only, as they couldn't stand the heat in mid-day. He said that the 75-pound rails used were carried on the backs of twelve natives and laid in place. These rails weighed about 900 pounds each. Modern shops and roundhouses were built and equipped with the latest machinery. A chlorination plant was installed and water trains were run to carry water to the front line trenches. He said that the pipe line used to carry the water pumped from Suez to Palestine was constructed from lap welded pipe and as this pipe line was being constantly bombed, considerable work was required at night repairing it. The track suffered from bombing also and the maintenance crew were kept constantly at work repairing and as the track went within three miles of the front line trenches, it was extremely dangerous work. The rolling stock consisted mostly of old engines dug out of scrap at Cairo and repaired. The fire boxes of these engines were made of copper and their efficiency was very low as most of the $75.00 per ton coal went out through the smoke stack.

The new road connected with the old Jaffa railway built in 1892, and Major Walkem said that they standardized the old road from where they cut into it to Jerusalem. His description of this old railroad was most interesting. All culverts were built of stonework and no steel was used and around all cliffs and bluffs, no cuts were made but embankments of stonework were built to support the tracks. In describing general conditions in Palestine, he said that the conditions were very much the same as in Bible days. The beasts of burden were, camels, donkeys and women, and that the men supervised. The farming is done in January, as from May to November the rains are very heavy.

A lively discussion followed and Major Walkem had to answer numerous questions as several members desired more detailed information as to his methods used in overcoming some of the many difficulties with which he had to meet.

A most hearty vote of thanks was moved by C. H. E. Rounthwaite, A.M.E.I.C., and J. H. Jenkinson, A.M.E.I.C., to Major Walkem for his interesting talk and they extended to him a cordial invitation to visit the Sault Branch whenever it was possible for him to do so.

A regular meeting of the Sault Ste. Marie Branch was held at the Y. W. C. A., on March 5th, 1926.

THE MANUFACTURE OF ARTIFICIAL SILK

C. H. Speer, M.E.I.C., chairman, called the meeting to order and the business was first disposed of. Then Mr. Speer introduced the speaker A. D. Hone, principal of the Technical School, who gave a splendid paper on "The Manufacture of Artificial Silk," an abstract of which appears on another page of this Journal.

This subject is of both local and general interest—local because the chief raw material is wood pulp, which is manufactured in the local plant of the Spanish River Pulp and Paper Company, and general because it has to do with clothing, one of the fundamental necessities of life.

Toronto Branch

C. B. Ferris, A.M.E.I.C., Secretary-Treasurer.
J. W. Falkner, A.M.E.I.C., Branch News Editor.

THE ECONOMIC AND ENGINEERING SITUATION IN CANADA

Brig. Gen. C. H. Mitchell, C.B., C.M.G., C.E., M.E.I.C., addressed the Toronto Branch on Thursday evening, February 18th, on the above subject, and the relation of the engineering profession as a definite factor in the economic and industrial fabric of the country was ably indicated.

A brief resumé of the above paper will be given in the next issue.

After discussion, which was led by J. A. Knight, A.M.E.I.C., the chairman, Professor T. R. Loudon, M.E.I.C., extended a hearty vote of thanks to the speaker for his interesting and instructive paper.

CONSERVATION OF RAINFALL IN SOUTHERN INDIA

It was a great pleasure to be addressed on February 25th by one of our own branch members whose professional life has been largely spent in a climate and under labour conditions very different to those prevailing in Canada today.

The speaker, G. W. Winckler, M.E.I.C., unfolded the story of a paternal British government, that, faced with the administration of the Native State of Mysore, Southern India, during the minority of the child Maharaja, and the necessity, in the interest of the native cultivators, of rehabilitating the badly run down water storage and irrigation systems, placed him about 1872 in charge of a large rainfall conservation district, thousands of miles from the world's markets, and from such everyday commodities as iron bolts and nails, and where he was directly dependent on native labour and workmanship, and local materials.

Fortunately, there are found throughout the Deccan nodules of pure limestone from which the natives make most excellent lime, and they are also adept in brick making. These, together with earth, rock, teak, and bamboo were structural materials ready to hand. Mr Winckler described in detail the excellent work done to conserve rainfall, the method of constructing dams, etc., illustrating his address with diagrams. Excellent lime concrete had been made, using 4 or 5 parts of stone to one part of lime mortar.

An interesting discussion followed after which R.O. Wynne-Roberts, M.E.I.C., moved a vote of thanks to the speaker. The discussion disclosed the interesting fact that two or three of our branch members present had spent time in Southern India, and were very familiar with the conditions depicted by Mr. Winckler.

CIVIC FINANCE

At the monthly luncheon meeting held at the King Edward hotel on March 4th, we welcomed as our guest and speaker Geo. H. Ross, finance commissioner for the city of Toronto.

We suppose there are some to whom the term "Civic Finance" means little more than frequently recurring tax demand notes. Mr. Ross, in a witty and — as also befits a finance commissioner — a partly statistical speech, showed that engineers, at any rate should have more interest than that, because *they* are the men who keep the finance commissionners busy. "*Debt charges* are the sons of *capital expenditure;* the *engineer* is the father of capital works" and however much capital works may be apprecia ed by the public, their progeny, (our *GRANDCHILDREN*, if Mr. Ross be correct!), certainly are not.

Mr. Ross explained in a very lucid manner the high mysteries of civic finance, the functions of the various departments that collect monies from the public, and the percentage requirements of our annual civic budget. With regard to debt flotation, Mr. Ross sounded a note of warning. It was, however, cheering to know that debt charges, which have steadily risen from $1,600,000. in 1912 to $6,400,000. per annum in 1925, will for the first time in 1926 show a diminution.

Mr. Ross urged the members present to assume responsibility in the affairs of the city. They were shareholders in a billion dollar corporation, and those who were directing the affairs of the city would welcome expressions of public opinion to aid them in their work. "Every man owed more than his taxes".

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

CANADA'S NEW PACIFIC PORT

On January 20th, J. P. Forde, M.E.I.C., gave an exceedingly interesting talk on "Canada's New Pacific Port."

After outlining the historical events that deprived Canada of the coast line north of the Portland canal on the Pacific, a map was shown on which were marked the approximate positions of the ice front at different periods in Glacier bay, Icy Straits.

At the time of a visit by Capt. George Vancouver in 1794, the glacier line was only 3 miles from the mouth of the bay; between 1794 and 1912 the line retreated some 62 miles, or an average of half a mile a year; while in the last thirteen years it has receded a further 4000 feet.

At the present time, after entering Glacier bay, a distance of 44 miles is covered to a point where three inlets meet; the most westerly of these, Reid inlet, stretches for 12 miles, and then divides into two, the more westerly Tarr inlet having a length of 13 miles, with the Grand Pacific glacier at its head.

The line of vegetation was of considerable interest, as at Icy Straits the growth was similar to that on the near Alaskan coast, whereas in Glacier bay it was smaller.

Willoughby island was reported to be bare in 1869, but now had a covering of willows, and a number of spruce up to twenty feet in height. Hugh Miller islets also had some willow, and about a dozen spruce from six to eight feet high.

Composite island was bare, except for sea-grass and moss and, a few alpine flowers, while Reid inlet above its mouth was devoid of vegetation.

The change in rate of the recession of the glaciers seemed to take place after deep water was passed, and now about half of the toe of the Grand Pacific glacier is exposed at low water.

Glacier bay, as its name suggests, is touched by many glaciers, and the noise made by the tons of ice falling from the faces was almost continuous.

The speaker outlined their efforts to mark the international boundary line at its intersection with the shore of Tarr inlet, owing to the prevalent fog an approximate position was first located by comparison with the contour map of that area, and when, a little later, a fortunate opportunity enabled them to get a transit line on stations 160 and 161 they were agreeably suprised at the closeness of their first mark.

It was found that there is now some 4,000 feet of water in Canadian territory, and though the roughness of the mountain ranges, and the numerous glaciers, prevent access by land, it may prove to be of use as a harbour for industrial purposes.

A number of slides illustrating the trip up the coast, with reference to many points of interest were shown, also unique photos of the icebergs and glaciers in Tarr inlet and vicinity.

A curio of note was on exhibit, on the shores opposite Willoughby island, buried forests have become gradually uncovered, as the ice cap receded, and Mr. Forde was fortunate in obtaining a section of the trunk of a Sitka spruce released from the glacial morain, which showed a growth of some 124 years, and was estimated to be about 300,000 years old.

EARTHQUAKES

On February 10th, F. Napier Denison, director of the Dominion Meteorological Observatory on Gonzales Hill, Victoria, gave an illustrated lecture on "Earthquakes".

After dealing with the latest views as to the structure of the earth and its crust, and illustrating the scientific theory of earthquakes by sections showing the comparative height of mountains and sea depths at the critical world seismic zones, Mr. Denison sketched the improvements in seismographs, and showed a number of records made at Victoria at the time of well-known quakes, and also outlined the methods by which the location of such disturbances was fixed.

Mixed feelings of regret and pleasure mingled at a luncheon held on February 22nd, at which E. A. Cleveland, M.E.I.C., was the guest, and at which some thirty engineers met to offer their congratulations to Mr. Cleveland on his appointment as commissioner of the Greater Vancouver Water District and chairman of the Vancouver and Districts Joint Sewerage and Drainage Board.

Mr. Cleveland, who has filled the position of comptroller of water rights for the last seven years, gave a concise outline of the progress of legislation in regard to water in the province of British Columbia from the days of Sir James Douglas, emphasizing the gradual growth of a policy that insists on beneficial use being made of water and also of the granting to the crown of the rights to all unrecorded water, thus abrogating the old doctrine of riparian rights; the respective duties of the comptroller of water rights, and the board of investigation under the present Water Act were also mentioned.

After thanking the speaker for his interesting outline of the water laws of th eprovince, the chairman, J. M. Anderson, A.M.E.I.C., tendered to Mr. Cleveland the congratulations of the engineers, and their regret at his departure from Victoria. P. Philip, M.E.I.C., deputy minister of public works; E. Davis, M.E.I.C., chief engineer, Water Rights Branch; J. Umbach, surveyor-general; F. L. MacPherson, M.E.I.C., of the provincial civil service, voiced their regret at losing such an outstanding member of the engineering profession, while feeling that Vancouver was to be congratulated on its choice. Satisfaction was also expressed that the position had been filled from among the engineers of the province.

Col. A. W. R. Wilby, A.M.E.I.C., Bateman Hutchinson and G. B. Mitchell, M.E.I.C., past chairman of the branch, also spoke, after which opportunity was given for a personal word with Mr. Cleveland by many of his friends.

Mineral Industry in British Columbia

On February 17th, members of the branch and their friends enjoyed a talk by J. P. Galloway, Provincial Minerologist, who gave some interesting statistics regarding the mineral industry in British Columbia. The mineral production last year in British Columbia, said Mr. Galloway, represented $61,500,000, of which metals represented $47,000,000, coal and coke $11,500,000 and the remaining $3,000,000 included non-metallics and building material. Of the lode production 72% was treated in the Province, 15% was shipped in a crude condition, while the remaining 13% was partially treated in British Columbia. He also mentioned that 15,000 men were employed in mining in British Columbia, which represented a payroll of $25,000,000.

Mr. Galloway then referred to the difficulty in determining the profits made from mines. He quoted figures as to the investments in the industry and stated that the capita value of mining production in British Columbia was $93.00, whereas in the whole of Canada it was only $24.00. He referred to the future prosperity of the mining industry in the province and pointed out that improper transportation was greatly aiding production. In the coal industry better conditions might be expected in view of the increased cost of crude oil, Mr. Galloway then referred to the existing conditions dealing with the subject under the heading of the various districts created by the Provincial Government. In each of the six districts he showed that there was increased activity.

On the conclusion of the address a hearty vote of thanks was given the speaker for his excellent address upon one of the great industries of the province, which had proved most interesting to all present.

J. N. Anderson, A.M.E.I.C., chairman of the branch, added his thanks to that expressed in the motion, describing the address as one of the most enlightening that had been given before the body.

Preliminary Notice

of Applications for Admission and for Transfer

March, 19th, 1926

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in April, 1926.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council, shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering with special reference to the branch of engineering in which he has been engaged. This examination may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects: geography, history, (that of Canada in particular), arithmetic, geometry, euclid (books I, IV and VI), trigonometry, algebra up to and including quadratic equations.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed successfully an examination equivalent to the final examination of a high school or the matriculation of an arts or science course. He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which cash he shall pass an examination equal to that prescribed for admission to the grade of Junior in the foregoing section and he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineer in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BRANDON—HARRY ELMER, of 24 Abbott Ave., Toronto, Ont. Born at Cannington, Ont., Feb. 7th, 1884. Educ., B.A.Sc., Univ. of Toronto, 1907; 1908-11 detailing and designing structural steel, Manitoba Bridge & Iron Works, and Vulcan Steel Works; 1911-15 Vulcan Iron Works, chief engr. i/c design and fabrication; 1915-19 overseas military service; 1919 to present, station structural and mechanical engr. with Hydro-Electric Power Commn. of Ont.

References: E. T. J. Brandon T. H. Hogg, J. J. Traill, W. P. Dobson, R. B. Young.

COX—LEONARD MARTIN, of 57 Post St., San Francisco, Cal. Born at New Liberty, Ky., Mar. 21st, 1870. Educ., Renselaer Polytechnic Inst.; 1892-99, Union Iron Wks. N.Y. Louisville & Jeffersonville bridge and ry. wk.; 1899-23, in U.S. Navy; 1899-1901, Lieut. asst. to Pub. Wks. Officer, Navy Yards New York, immediate charge reconstrn. drydock No. 2; 1901-03 Pub. Wks. Officer, Isl. of Guam, constrn. of roads, design of watrworks and survey; 1903-06 i/c design and constrn. floating dock; 1906, chief engr. Louisville Henderson & St. Louis Ry.; 1907, recommissioned Lieut. U.S. Navy 1907-08, asst. to Pub. Wks. Officer, i/c constrn. drydock No. 3 Navy Yard Norfolk, Va; 1909 Commander; 1909-11 asst. ch. of Bureau Yards & Docks, Washington, 1911-14 Pub. Wks. Officer Navy Yard Norfolk, Va. i/c pub. wks. design constrn. and operation; 1912-13, member Taft Alaska Railroad Comm; 1915-17 Pub. Wks. Officer, Navy Yard, New York; 1917-18, Pub. Wks. Officer San Diego, Cal., initiating work on Naval Air Sta. and Marine expeditionary Depot; 1918-19, Asst. Mgr. div. ship yard plants, Emergency Fleet Corp. Philadelphia; 1919-23, Pub. Wks. Officer Navy Yard Mare Isl. Cal., i/c pub. wks. and constrn.; 1921, Captain; 1924 to date, consltg. in San Fransisco; economic study of ship canal, design for reconstrn. of Tampico harbour, other harbour and minor bridge projects.

References: S. J. Chapleau, E. Brydone-Jack, H. Goldmark, J. A. L. Waddell, J. W. Doty.

HUTCHINSON—ERIC CHARLES, of Chelsea Falls, Que. Born at Vevey, Switzerland, Oct. 11th, 1896. Educ., C. E. Ecole Polytechnique Federale Suisse 1920; 1920-22, Ed. Zublin & Co. designg. engr. reinf. concrete structures, and supt. constrn. office bldgs., wharf foundations and grain elevators; 1922-23 gen. supt. and res. engr. constrn. of bldgs. of Soc. Nouvelle des Charbonnages du Savant de Mons; 1923-24, gen. supt. for eastern dist. of France for Soc. Française des Pieux Faubiguant, Paris (pile driving concern); 1924-25 rodman, Duke Price Power Co.; instrument-man, rodman, and pile inspector, W. I. Bishop Ltd.; 1925-26 design. engr. Chelsea dev., Fraser Brace Engrg. Co.; at present ch. of engrg. party at Farmers dev. on Gatineau riv. for Fraser Brace Engrg. Co.

References: J. P. Chapleau, A. B. McEwen, J. B. D'Aeth, F. S. Small, G. J. Nelson C. J. Desbaillets.

KELLNER—HUGH, of Windsor, Ont. Born at Salford, Eng., Oct. 8th, 1879; Educ., Royal Tech. Col., Salford, 1898; 1894-1900, apprentice, T. Oliver & Son, engrs. Salford; 1901-02, volunteer, South African War; 1903, engine fitter, Sir W. H Bailey & Sons, Salford; 1904-05, millwright, S. Marsden & Sons, Manchester; 1906-07, eng. fitter and erector, Jas. Hawley Ltd., Liverpool; 1908-10, marine and gen. engrg., Gibson & Reynolds, Ellesmere Port, Eng., & Gellings Ltd., Isle of Man; 1911, Reid Newfoundland Ry., locomotive erection; 1912, eng. fitter and erector, John Inglis Ltd., Toronto; 1913, ch. engr. Windsor Water Works, Windsor, Ont., 1914-17, overseas, mech. transport; 1917 to date; ch. engr., Windsor Water Works; 1919-20, supervised plant improvements.

References: Wm. Gore W. Storrie W. S. Lea, C. M. Goodrich, O. M. Perry, W.H. Baltzell, C. J. Burgess.

KENNEDY—DUNCAN, Montreal, Que. Through a typographical error Mr. Kennedy's experience for the year 1924-25 was incorrectly printed in the March 1926 Journal. This should read as follows: 1924-25, with Quebec Development Co. on construction of Isle Maligne hydro-electric station, engaged on cost estimates of the work.

LOVE—LEONARD VINCENT, of 15 Beachview Cres. Toronto, Ont. Born at Atherton, Eng., Oct. 16th, 1889. Educ., 1904-09 Central Tech. School Atherton; 1909-12 asst. to ch. boiler insp. i.e. inspected boilers, condeusers, main hoisting engines, enconomizers, and safety appliances; 1912-18, supt. of erection and installn. 1250-h.p. marine triple expansion engine, Polson Shipbuilding Co. 1918-19, supt. of erection 2500-h.p. marine triple expansion engines, Can. Allis Chalmers; 1919 to present date, equipment engr. Ont. dept. of highways.

References: R. C. Muir, G. Hogarth, R. M. Smith, A. A. Smith. W. A. Maclachlan, H. T. Routly, A. E. Jupp, G. C. Parker, W. A. Mclean, C. A. Waterous.

McDONALD—JAMES ALEXANDER, of 536 Barton St. E., Hamilton, Ont. Born at Woodstock, Ont. Apl. 27th, 1898; Educ., B.Sc., Univ. of Alberta 1924; 1924-25 instrument-man on highway constrn. Alberta; 1925, mine surveyor's helper, Luscar, Alta.; rodman, Toronto Terminal Ry. Co.; at present in coke ovens dept. of Steel Co. of Can.

References: H. P. Keith, O. Inkster, R. S. L. Wilson, N. H. Bradley, W. S. McDonald.

PEARSE—LANGDON, of Winnetka, Ill. Born at Boston, Mass., Nov. 12th, 1877. Educ., A. B. Harvard College, 1899. B.Sc., 1901, and M.S., 1902, Mass. Inst. of Tech.; 1903-09, asst. engr., Commn. on Additional Water Supply. New York; asst. to G. C. Whipple on work for Augusta Water Dist. Cleveland and Jersey City; asst. engr. improved water and sewage works, Columbus, Ohio; asst. engr. greater water supply, Peoples Water Co. Oakland, Calif. 1909 to date, asst. engr., div. engr., and since 1917, sanitary engr., the Sanitary Dist. of Chicago, i/c all sanitary work involving lab. testing stations, (4), design and constrn. of certain intercepting sewers, design of certain pumping stations, sewage treatment works; i/c of tech. operat'n. of same preparation of special reports etc. Also consultant to U.S. Pub. Health Service; in priv. capacity as cons. engr. with G. W. Fuller designed and built Evanston water filters; with Pearse Greeley & Hasen designed and built Decatur, Ill. dam, Whiting Ind., and Winnetka Ill. water filters, also engrs. to Sanitary Dist. of Decatur, North Shore Sanitary Dist. etc.; at present, sanitary engr., Sanitary Dist. of Chicago, also member of firm Pearse Greeley & Hasen of Chicago Ill.

References: F. E. Field, G. R. Heckle, F. H. Fay, R. S. Weston, G. W. Fuller, J. H. Fuertes, F. A. Dallyn, W. Gore, R. O. Wynne-Roberts.

SAGAR—WILLIAM LISTER, of Toronto Ont. Born at Toronto, Ont. Jan. 2nd, 1895. Educ., B.A.Sc. Univ. of Toronto, 1918; 1914 (summer) rodman on Grand Riv. surveys with Ont. Hydro-Electric Power Commn; 1915 (summer) rodman and instrumentman on Chippawa Power Canal; 1917 (summer) Inspector for Imperial Munitions Board; 1919-20, Fellow in applied mechs. Faculty of Applied Sci. 1920, res. insp. for Can. Inspection Co. Bank of Commerce book vaults, 8 story reinf. concrete bldg. 1920-21, demonstrator in C.E. Fac. of App. Sci. Univ. of Toronto; 1921; location engr., Ont. Out of Season Growers Ltd.; 1922, inspr. for Industrial Labs. on Humber Bridge and Cayuga Bridge for Dept. Public Highways of Ont. 1923-24, demonstrator in C.E.; 1924, ch. inspr. Industrial Labs., and consultant, paving of Town of Port Hope; 1924-25, Instr. in civ. engrg.; 1925, ch. inspr. and testing engr. with Industrial Labs. Ltd.; 1925-26, engr. i/c tests (physical) for Industrial Labs.; 1926, to date, mgr. Industrial Laboratories Ltd., Torouto, also Instructor in civ. engrg. structural and municipal, Univ. of Toronto.

References: P. Gillespie, C. R. Young, W. B. Dunbar, R. B. Ferris, T. L. Crossley, H. A. Babcock.

SPROULE—JOHN EMDON, of 190 University Ave., Toronto, Ont. Born at Digby N.S., Sept. 7th, 1893. Educ., B.Sc. in civ. engrg. McGill Univ. 1916; 2 summers topographical div. of Geological Survey; 1 yr. maintenance Intercolonial Ry.; 2½ yrs. Lieut. Can. Engineers; 3 yrs. Shawinigan Engrg. Co. layout and inspection of transmission lines, etc.; 3 yrs. and at present Hydro-Electric Power Commn. of Ont. on layout and inspection of transmission lines;
References: E. T. J. Brandon, A. V. Trimble, C. S. Saunders, J. H. Cornish, C. M. Goodrich.

WOODSIDE—JAMES, of 2084 Jeanne Mance St., Montreal, Que. Born at Larne, Ireland, Dec. 18th, 1891. Educ., B.A.I. (C.E.) Dublin Univ. 1914, B.A. Dublin, 1915-18 asst. engr. Indian Public Works Dept. 1919-20; engrg. asst. civ. engrg. dept. of Harland & Wolff Ltd. Belfast: 1920-21, drftsman C.P.R. (Wpg. office); 1924, instrumentman, C.P.R. railway construction. At present employed by Can. International Paper Co. on hydro-electric dev.
References: W. E. Blue, H. G. Acres, S. S. Scovil, J. A. H. Henderson, C. G. J. Luck.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO MEMBER

DEVEY—JOHN HARDY, of Richmond Va. Born at Staindrop Eng., Feb. 12th, 1883. Educ., 1903-05 Durham Col. of Science; 1900-02 pupil with Sir Wm. Arrol & Co. Glasgow, Scotland; 1902-05 articled pupil C. F. Bengough M.I.C.E. chief engr. North Eastern Ry. Co. England; 1905-06 location and constrn. of C.N.R.; 1906-07 on staff of city engr. Toronto, Ont.; 1908, deputy city engrg. West Toronto; 1909, priv. practice, Toronto, report on Lake Superior Br. G.T.P.Ry. for Ry. Commn.; 1910, res. engrg. C.N.P.R. in B.C.; 1911-14, engr. for Howe Sound & Northern Dev. Co., B.C.; 1914, reconnaisance survey, plans, reports, etc. for rly. from Findlay Forks, B.C. to Peace River; 1915, asst. engrg. Can. Explosives, Nanaimo; 1916-17, engaged on Victoria Breakwater for Sir John Jackson & Co., 1917-18, various engrg. works; 1918-19, engr. for Moore & Silverton, Vancouver; 1919-23, member of firm Robertson & Devey, cons. engrs; drydock plans, oil tanks design of steel and concrete structures, bridge, dam, and canal works etc.; 1923, designer steel and concrete highway bridges for North Carolina State Highway Commn; 1924 to date, designer Chesapeake & Ohio Ry. Co. steel and concrete structures.
References: T. H. White, C. H. Rust, C. E. Cartwright, E. G. Matheson, J. Kilmer W. Anderson, C. M. Morssen.

KIRKPATRICK—EVERETT CHARLES, of 47 Ainslie Rd., Montreal West, Que. Born at Montreal, Feb. 3rd, 1885, Educ., B.Sc., McGill Univ. 1906; summers while at univ. surveys, and machine shopwork; since graduation employed continuously with Steel Co. of Can. & Mtl. Rolling Mills, as dtfsman, supt. of constrn., and for last 6 or 7 years as mechanical engr. i/c design of new plant and i/c operation of power depts. for the Steel Co. of Canada's plants in Montreal.
References: H. M. Jaquays, D. C. Tennant, J. T. Farmer, A. R. Roberts, C. V. Christie.

MIDGLEY—FRANK HAROLD of Galt, Ont. Born at Cambuslang, Scot., May 26th, 1884. Educ., C. E. Associate Royal Technical Col., Glasgow; 1900-1906, articled pupil to Niven & Hoddin, C. E. Glasgow; 1906, asst. engr. i/c of drainage, waterworks etc. surveys, plans, estimates, supervision of constrn. final adjustments, etc. with contractors; dftsman, Dom. Bridge Co. Lachine, Que,; 1907-12, topographer, dftsman. leveller, transitman, with C.P.R. survey parties; 1912-15, res. engr. on constrn. of double track, Lake Superior Divn. C.P.R., 1907 to date, continuous service with C.P.R. engrg. dept.; at present, engr., Lake Erie & Northern & Grand River Rlys. (subs. of C.P.R.) i/c maintenance and constrn.
References: J. M. R. Fairbairn, P. B. Motley, D. Hillman, J. Haddin, C. A. D'Abbadie.

YORATH—CHRISTOPHER JAMES, of 2211-7th St., Calgary, Alta. Born at Cardiff, Wales, 4th, Nov. 1880. Educ., A.M.I.C.E. Cardiff Wales 1905; asst. to contractors engr. Mount Stuart drydock, Cardiff, asst. to city engr. Cardiff, municipal engrg. wks, electrification of horse-drawn street rly., drainage, road, constrn., bridges, public baths, sewage disposal, town planning etc.; 1902-13 deputy engr. Acton Boroug Council, London, Eng., engaged on design and supervision of municipal engrg.; 1913-21, city commr., of Saskatoon; 1921-24 city commr., of Edmonton, in both cases responsible for all pub., wks., and munic. administration, including operation of public utilities, street rly., elec. lt. and pr., waterworks etc.; at present, pres. and mng. dir. of Can. Western National Gas Light, Heat & Power Co., pres. and mng. dir. of Northwestern Utilities Ltd., pres. and mng. dir. of the Gas Production & Transportation Co.
References: A. R. Greig, C. J. Mackenzie, R. O. Wynne-Roberts, W. R. Mount, A. W. Haddow.

FOR TRANSFER FROM JUNIOR TO HIGHER GRADE

DESMARAIS—RAYMOND JOSEPH, Walkerville, Ont. Born at Walkerville, Ont., Nov. 8th, 1894. Educ., 1 yr. Univ. of Detroit, Windsor Collegiate Inst., I.C.S. (C.E.) 1910-17, rodman, chainman, dftsman, transitman, Owen McKay, O.L.S. Walkerville, 1917-19, transitman and leveller, i/c party under Owen McKay; i/c party under R. W. Code, O.L.S., work included surveys, subdivisions, drainage, pavements, sewers, sidewalks, railways, bridges; 1920-22, designg. engr., city engr's office, Windsor Ont. 1922- to date, asst. city engr. Windsor, Ont.
References: M. E. Brian, C. R. McColl, J. C. Keith, W. J. Fletcher. J. J. Newman, H. W. Patterson.

FOR TRANSFER FROM STUDENT TO HIGHER GRADE

ELEY—FREDERICK CHARLES, of 140 Montrose Ave., Toronto, Ont. Born at London Ont., Nov. 15th, 1897. Educ., B.A.Sc., Univ. of Tor. 1921; summer 1917, machine shop operative, Benjamin Electric Co., Toronto; June 1918–Oct. 1919, switch and switchboard assembler and finishing dept.; summer 1920, stockkeeper for same firm; summer 1921, assembler; 1921-22 mfg. dept. and cost dept., lighting equipment, wiring device, switch and switchboard design, estimating work, and checking designs; 1922 to date, engr., i/c design proposals and pr. sales, Benjamin Electric Co.
References: A. S. Cook, F. R. Ewart, D. M. Fraser, R. W. Angus, G. W. Winkler.

FARRELL—ALFRED JAMES, of 4874 Westmount Ave., Westmount Que. Born at Montreal, Que., May 15th, 1900. Educ., B.Sc., McGill Univ. 1924; Oct. 1924 to Jan. 1925 training in the Planning Dept. of the Can. Consolidated Rubber Co.; 1925 i/c installation of rubber flooring for the Can. Consolidated Rubber Co. to present date.
References: C. M. McKergow, A. R. Roberts, A. J. Kelly, J. Weir, E. Brown.

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The Chicago Drainage Canal

A Review of the Historical, Technical, Financial and International Features

J. L. Busfield, B. Sc., M. E. I. C.
Consulting Engineer, Montreal, Que.

Paper read before the Montreal Branch, March 4th; Kingston Branch, March 17th; Toronto Branch, March 18th; Peterborough Branch, April 8th, and Niagara Peninsula Branch, April 21st, 1926.

History of the Drainage Canal

The Chicago drainage canal has the main object of providing a means of diverting water from lake Michigan westwards into the Des Plaines river and ultimately into the Illinois and Mississippi rivers, for the purpose of diluting and carrying away the sewage of the city of Chicago and surrounding municipalities in order to prevent its discharge into lake Michigan, where it would have the effect of contaminating the water supply. The drainage canal is also used for navigation and power development purposes. The history of the project on its present lines, while full of noteworthy events, is of comparatively short duration. If, however, a reference to the orginal thought of making a water connection between lake Michigan and the Illinois valley is included, it is necessary to go back to the 17th century, at which period references were made by the explorers Joliette, LaSalle and others to the possibility of reaching the gulf of Mexico from lake Erie by way of lake Michigan and the Des Plaines and Illinois rivers.

The first definite event in the life of the project was an Act of Congress on March 3rd, 1822, granting a right-of-way through public lands for the proposed canal, which lapsed through non-compliance with its conditions. It was followed by another Act dated March 3rd, 1827, granting to the state of Illinois certain lands for the construction of a canal between lake Michigan and the Illinois river. It might be noted in passing that at this date, practically one hundred years ago, Chicago did not exist. It was not until nine years after the land grants had been made, namely 1836, that construction was actually started on the Illinois and Michigan canal, but owing to various delays, particularly those due to difficulties in financing, it was not completed and put into operation until twelve years later, 1848, in which year the canal was opened from Bridgeport to LaSalle. This canal had a bottom width of 36 feet and a depth of 6 feet. The original plans had been for a deep cut canal at the level of lake Michigan, but the financial difficulties above referred to led to a modification of the plan and it was built partly at a higher level. Water was supplied from the Chicago river by a lift-wheel at Bridgeport, and while this was not of sufficient quantity to reverse the flow of the river, it nevertheless can be looked upon as the first actual diversion of water belonging to the lake Michigan watershed into the Illinois valley, and only came about as a necessity for the operation of the canal.

The first sewer system was put into operation in Chicago in 1856, when the population had become about 80,000. These sewers discharged into the Chicago river. At this time, Chicago was becoming the important railway centre of the middle west, and this was one of the principal factors leading to its subsequent phenomenal growth.

To return to the canal,—it was apparently looked upon as a success from the traffic point of view, as it was decided to improve it by lowering the summit level and carrying it through at the level of lake Michigan. This work was accomplished in the years 1866 to 1871, and at the same time the flow in the canal from the Chicago river was increased to 1,000 cubic feet per second. Pumping was still adhered to, as the natural flow through the canal was only about 700 cubic feet per second.

There is little to record during the next decade, but by the eighteen eighties the sewage problem was becoming a serious factor in the growth of the city. Apart from any question of actual construction of sewers, which in itself has always been a difficult matter owing to the extreme flatness of that part of the country, the discharging of sewage into lake Michigan was seriously contaminating the water supply, the death rate from typhoid fever reached alarming proportions, and indeed it may be noted in passing that for the period of twenty years subsequent thereto the death rate from typhoid fever was greater than that of any of Chicago's sister cities in the lake region. This state of affairs led to the appointment of a Drainage and Water Supply Commission in 1885. This commission reported in

January, 1887, in favour of a drainage canal with a capacity of 10,000 cubic feet per second, connecting the Chicago and Des Plaines rivers. This may be said to be the origin of the present undertaking. The commission concluded its labours shortly after presenting its report.

The legislature of the state of Illinois took direct action, however, by an Act which came into force on July 1st, 1889. This Act created the Sanitary District of Chicago for the purpose of disposing of the sewage of Chicago and contiguous territory and determining the method of administration and financing. The district was given rights to construct a main drainage canal, to build sewage treatment and disposal plants, and to construct docks. The drainage canal was specifically covered in the Act. It was to be at lake level, parallel to the old Illinois and Michigan canal, and to have a bottom width of 160 feet, minimum depth of 18 feet, a minimum capacity of 10,000 cubic feet per second, and carry a flow at all times of at least 3 1-3 cubic feet per second for each 1,000 population tributary to the canal. It was also provided in the Act of 1889 that that part of the canal excavated in earth could be constructed in consecutive stages, but that the rock section should be immediately excavated to the full section. The Act also provided that when the flow became 5,000 cubic feet per second the canal shall be declared a navigable stream. When the Act was put into force, the territory covered by the Sanitary District covered only a part of the area occupied by the city of Chicago and comprised 185 square miles with a population of 1,140,000. From time to time, however, there have been amendments to the Act increasing the size of the district, until to-day it covers an area of 437.39 square miles, includes 49 municipalities in addition to the city of Chicago, and serves a total population of about 3,500,000.

Three years after the passing of the Act, i.e. in 1892, work was commenced on what is the present main drainage canal, and carried on continuously, until its completion at the end of 1899. Water was turned into the canal on January 2nd, 1900, while the flow through the canal was commenced two weeks later. It might be mentioned in passing that great interest was taken by engineers throughout the world in the construction work, as new methods of rock excavation and handling had been devised without which the cost of the undertaking would have been absolutely prohibitive. It was the first occasion when channelling machines were used on a large scale, thus providing a smoother waterway, requiring a smaller section than would have been required with the older method of excavation.

The main drainage canal was constructed as far as the controlling works at Lockport, at which point it was to discharge into the Des Plaines river. It was appreciated, however, that the capacity of the Des Plaines river, between Lockport and Joliet, would be insufficient for the augmented flow, so between the years 1898 and 1901 considerable work was done in widening and improving this part of the river. It must also be noted that at this period no provision was made for navigation through the drainage canal.

While this work was going on, the Sanitary District of Chicago applied to the United States secretary of war for permission to alter various structures in order to permit the passage of 5,000 cubic feet per second through the Chicago river. This permission was granted by the acting-secretary on July 3rd, 1896.

Prior to the completion of the canal, an Act was passed by the United States Congress on March 3rd, 1899, giving the secretary of war jurisdiction over all navigable waters, subsequent to which a new permit was issued by the secretary of war on May 8th, 1899, covering the provisions for the protection of navigation in the Chicago river.

On April 9th, 1901, the secretary of war reduced the permissible flow through the Chicago river to 3,333 cubic feet per second. However, on December 5th of the same year, he permitted the Sanitary District to increase the foregoing amount to 5,000 cubic feet per second between the hours of 4 p.m., and 12 midnight, daily. In the meantime the district commenced the work of improving the river by the removal of bridge piers and by widening, in order to reduce the velocity. On January 17th, 1903, the secretary of war granted a permit for the diversion of 5,833 cubic feet per second continuously until March 31st of that year, subsequent to which the flow was not to exceed 4,167 cubic feet per second. This permit remained in force until 1925.

During this period, and, indeed, until quite a few years later, it is not apparent that there was any direct opposition to the principle of diversion of water from lake Michigan by the Sanitary District of Chicago, but, nevertheless, there were many watchful eyes, as indicated by the fact that from the very early days of the undertaking, reports and investigations were being made by many interested parties, and in particular, some years before the completion of the canal, the Canadian government retained J. L. P. O'Hanley, C.E., to report on the probable effect of the diversion at Chicago on the levels of the Great Lakes. O'Hanley's report was dated February 29th, 1896, and amounted to a confirmation of the opinion of the United States chief of engineers, to the effect that there was insufficient data available for a determination sufficiently accurate to serve any useful purpose.

On May 14th, 1903, the Illinois State legislature passed an Act amending the original Act of 1899 by which they added the North Shore and Calumet regions to the original district and at the same time authorized the development of such water powers as might be incidental to the drainage canal scheme. The work of extending the main drainage canal from the Lockport controlling works, four miles further downstream, was forthwith commenced. At the same time, the present power house and navigation lock were built at the new end of the canal. The power house was put into operation on November 26th, 1907, and has been continuously operated ever since.

In order to provide sufficient water to flush out the South Fork of the South Branch of the Chicago river, (into which the stock yards empty their sewage), a conduit was built at 39th street, connecting the pumping station on lake Michigan with the South Fork. This was put into permanent operation on December 28th, 1905. Similarly it was found that with the growth of the population on the north side, there was insufficient natural flow in the North Branch, and this was partially remedied by the construction of a conduit at Lawrence avenue, connected with a pumping station near the lake. This conduit was put into operation on May 28th, 1909. At the same time a new channel was being cut, (the North Shore channel), making a direct connection from the lake at Wilmette, (13 miles north of the mouth of the Chicago river), to the North Branch. This was put into operation on November 29th, 1910.

While the development of the work on the north side was being undertaken the district was also looking to ways and means of preventing pollution of lake Michigan water by the discharge of the Little Calumet river on the south side of the city. Studies were commenced in 1907 for reversing the flow of this river, and diverting lake Michigan water through the Calumet river and a new channel connecting with the drainage canal at Sag. In 1908 the Sanitary District applied to the secretary of war for permission to withdraw 4,000 cubic feet per second through this channel in addition to the flow through the Chicago river. This was refused, but the Sanitary District ignored the refusal and action was taken against it in the United States courts. The district again applied for a permit for the Calumet-Sag channel, and on June 30th, 1910, this was obtained but it was specifically provided that the total withdrawal from lake Michigan should not exceed the 4,167 cubic feet per second originally allowed. It is therefore of interest to note at this point that this is the first of the permits which gives any indication that the problem was being dealt with from the view-point of the effect of the diversion on lake navigation, as heretofore it seems to have been effects in the Chicago river which were of prime consideration.

The Calumet-Sag channel was started on September 18th, 1911, and was put into operation on August 26th, 1922, but this project cannot be said to be completed as the Calumet river section still has to have considerable improvement work carried out.

To return to the legislative history, during all this period, while construction of many parts of the undertaking was going on, there were investigations and reports being made almost continuously, and indeed have continued up to the present date. The history of all these investigations and reports would fill a volume in itself; it must here suffice to refer to the principal bodies, which were the International Waterways Commission, boards of engineers appointed by the Canadian government, and by the United States government, and by the Sanitary District itself. The United States Lakes Survey, the United States Corps of Engineers, numerous consulting engineers, many of them of world-wide fame, have studied and reported on the problem, and lent their quota to the information and opinions at hand.

At the same time it must not be forgotten that the legal fraternity have had a finger in the pie as well as engineers. Applications to Congress, to the secretary of war, suits in various courts, numerous hearings, actions of one kind or another, interpretations of acts and treaties, have all lent a hand in providing bases for lengthy legal battles and conferences. Out of the chaos of all this examination and cross-examination, one event of supreme importance stands out and must be noted in order to give a proper conception of later events and present-day arguments. Subsequent to a long study and reports in 1906 and 1907 by the International Waterways Commission, (appointed in 1905), the boundary waters treaty between Great Britain and the United States was concluded on January 11th, 1909. This treaty, which is still in effect, covers all the terms agreed to by the two countries for the use and control of the Great Lakes, St. Lawrence river and boundary waters.

On February 28th, 1912, the secretary of war opened the hearing of an application from the Sanitary District of Chicago for permission to divert a quantity of water not to exceed 10,000 cubic feet per second. The Canadian government and shipping interests opposed to the application were heard on March 27th, 1912, and on January 8th, 1913, the secretary of war refused the application.

When it was found that, notwithstanding the refusal of the secretary of war to grant a permit for more than the original amount of 4,167 cubic feet per second, the Sanitary District was withdrawing considerably larger quantities, the United States government instituted legal proceedings by taking out an injunction against the district. This was fought out in the United States district court at Chicago, and it was only after a long-drawn-out legal battle with many delays that a final decision was rendered by Judge Carpenter on June 18th, 1923, finding against the Sanitary District. The case was appealed to the United States Supreme Court, which again upheld the federal government in a judgment rendered on January 5th, 1925. The decision rendered was on the question of jurisdiction of the secretary of war and judgment was to the effect that the Sanitary District had no authority to exceed the quantity permitted by the secretary of war.

The Sanitary District forthwith applied to the secretary of war for a permit to divert an annual average of 10,000 cubic feet per second, and on March 3rd, 1925, a permit was issued authorizing the Sanitary District to—

> "divert from lake Michigan, through its main drainage canal and auxiliary channels, an amount of water not to exceed an annual average of 8,500 cubic feet per second, the instantaneous maximum not to exceed 11,000 cubic feet per second....."

The principal conditions* are that sewage treatment must be carried out to the extent of 100 per cent treatment for 1,200,000 people by the end of 1929; the deposit of $1,000,000 towards the cost of remedial works on Great Lakes; installation of controlling works for Chicago river; metering of Chicago's water supply. It is understood that the sewage outflow amounting to about 1,200 cubic feet per second is not included in the foregoing amount of 8,500 cubic feet per second.

In the meantime, it must not be overlooked that while all these legal battles were proceeding, history was being made on other lines. It is stated that as early as the year 1908, immediately following the recommendations of the International Waterways Commission, studies were being made by the engineering department of the Sanitary District of ways and means for treating their sewage wastes. Laboratories and experimental stations were established and have been continuously in operation ever since. Special investigations were made on domestic sewage from 1908 to 1911; on the trade wastes from the stock yards 1912 to 1918; on the tannery wastes 1919 to 1922; and on the corn products wastes from 1920 to date. A small treatment plant was first built for the municipality of Morton Grove, largely as an experiment. This was followed by the construction of an activated sludge plant at Maywood, (Des Plaines River plant), which was commenced in 1920 and put into operation on August 1st, 1922. Similarly the Calumet sewage treatment plant, of the Imhoff tank and trickling filter type, was commenced in 1920, and put into operation on September 11th, 1922. A very large plant for the north side was commenced in the year 1923, and will be put into operation in 1927 or at the latest 1928.

The Engineering Board of Review

On September 23rd, 1924, the Sanitary District of Chicago retained a board of engineers to review the past procedure and the proposed future programme of the Sanitary District and their effects upon all interests involved. This board consisted of twenty-eight engineers selected from among the prominent engineers throughout the United States. A number of meetings were held and the board divided into committees, each handling a specialized subject and making an intensive study thereof. The board then held its private sessions in New York and presented its first report and recommendations on December 20th, 1924. This was followed by a more elaborate document dated January 23rd, 1925, which consists of the technical basis for the recommendations. Still later the reports of the various committees have been and are still being published as appendices to the main report. These appendices in themselves constitute authoritative scientific documents on the respective subjects treated upon. The recommendations of the board have been widely published.

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*For full text of permit, see Eng. News-Record—March 12th, 1925, p. 448.

Summary of Present Status

The present status may be summed up as follows:

1. A flow of from 8,000 to 10,000 cubic feet per second is being maintained through the drainage canal, the quantity depending on the stage of lake Michigan. This quantity includes about 1.200 cubic feet per second discharge from the sewers.
2. The secretary of war of the United States, acting with authority established by the United States supreme court, has authorized the diversion of 8,500 cubic feet per second from lake Michigan, with 11,000 cubic feet per second instantaneous maximum demand, until December 31st, 1929. This quantity is exclusive of the sewage flow.
3. The Sanitary District has two important sewage disposal plants in operation, namely Des Plaines River and Calumet, a third on the road to completion, namely North Side, and is embarked on a programme of increasing the treatment of sewage at the rate of 100 per cent treatment for 1,200.000 people by 1930, with continual expansion thereafter.
4. The city of Chicago has undertaken the metering of its water supply to the end that consumption be reduced. This work is to be effected at the rate of 10 per cent per annum for 90 per cent of the population.
5. Plans are being prepared for controlling works on the Chicago river to prevent reversals of flow.
6. The United States chief of engineers and the United States district engineer make periodical inspections to insure that the above programmes are being carried out.

Position of Canada

Whatever the effects of the diversion at Chicago, the position of Canada in regard thereto is fixed by the boundary waters treaty of January 11th, 1909, between Great Britain and the United States. In order to completely understand the position, however, it is necessary to go back further than that. Prior to the completion of the drainage canal, Canada wanted to know what effect it would have on lake navigation, and retained Mr. O'Hanley to report thereon, without any definite result, except that the impression was given that there might be a general lowering of the lakes by as much as 6 inches. In their 1906 report, the Canadian section of the International Waterways Commission recommends that "the diversions by the Chicago drainage canal should be limited to the use of not more than 10,000 cubic feet per second," and makes allowance for this quantity in reaching their conclusion as to the permissible diversion at Niagara Falls for power purposes. Subsequently, in 1907, the International Waterways Commission as a body reported on the drainage canal with particular reference as to whether there should be a limit placed on the amount of the withdrawal at Chicago. Their report concludes with the recommendation that the Chicago drainage canal be limited to 10,000 cubic feet per second. It is very definite, however, that the subject was discussed always from the point of view of sanitary necessity and that navigation and power were secondary considerations.

The International Waterways Commission was a purely advisory board and did not bind either country. The definite binding agreement was made in the form of the Boundary Waters Treaty, 1909, which makes no specific mention of the diversion at Chicago, but uses approximately the same ratio for the diversions at Niagara as recommended by the International Waterways Commission.

Different interpretations have been put on the meaning and intent of this treaty, especially as to whether it really included the Chicago diversion or not in its reference to existing uses of boundary waters, and also as to whether the primary use of boundary waters, namely, "Uses for sanitary and domestic purposes," includes such a use as the present instance.

When the Sanitary District applied for 10,000 cubic feet per second in 1912, Canada strenuously opposed the application, and has consistently adopted the same attitude ever since.

However, it must not be overlooked that for many years after the drainage canal had been put into operation, representatives of Canada tacitly acquiesced in the proposition for sanitary reasons. Certainly there were many investigations as to the effect on lake levels, and so forth, but apparently there was no official action of protest taken, and indeed, the indications are that in the years prior to 1910 the diversion was not looked upon with any great degree of apprehension except by a very few people who were possibly a little more foresighted than others.

Physical Description of the Drainage Canal, Pumping Stations, Treatment Plants and Water Supply System

The Drainage Canal

Prior to the construction of any of the parts of the navigation or drainage canal projects, there was a small village situated at the mouth of the Chicago river. This river had two distinct branches, one flowing in a southerly direction, known as the North Branch, and the other flowing in a northerly direction, generally parallel to the lake shore and known as the South Branch. The latter in turn was fed by a West Fork and South Fork. The North and South Branches met at a point about a mile west of the lake, and from there flowed in an easterly direction into the lake through the common outlet.

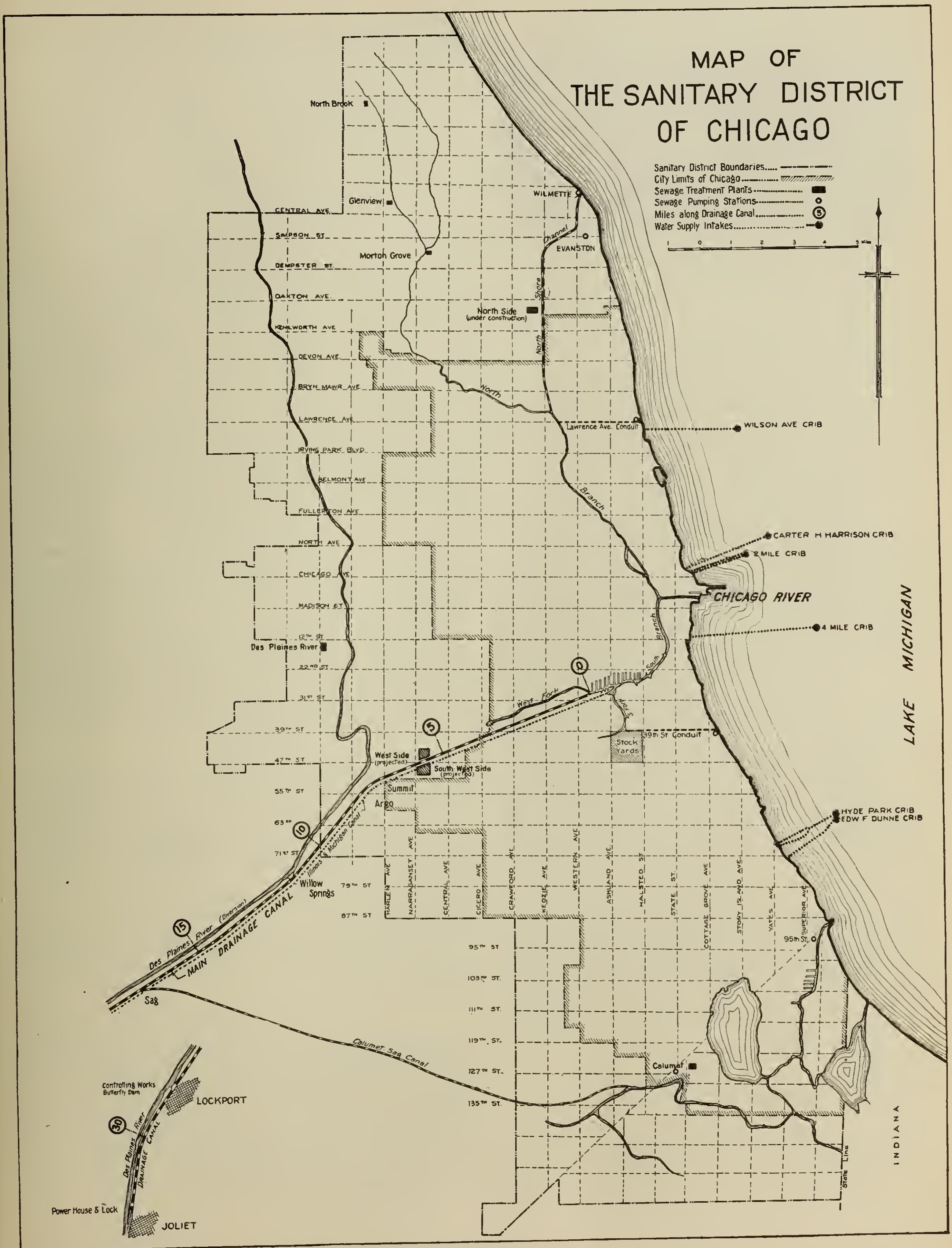
About 10 miles west from the lake and parallel thereto, the Des Plaines river flowed in a southerly direction until opposite the West Fork of the South Branch of the Chicago river, from which point it followed a westerly and south-westerly direction, joining the Kankakee river at about 50 miles from Chicago, the two rivers then forming the Illinois river, which in turn flowed into the Mississippi river at Grafton, Illinois.

Main Drainage Canal

The main drainage canal connects the Chicago river with the Des Plaines river and provides the means of withdrawing water from lake Michigan, reversing the natural flow of the Chicago river and of the South Branch, carrying this water through an artificial canal and discharging it into the Des Plaines river between Lockport and Joliet.

The canal leaves the Chicago river at Robey street in the city of Chicago, and extends from there in a westerly and south-westerly direction through the valley of the Des Plaines river, a distance of 32.3 miles, to a power house at its downstream end, in the village of Lockport. The canal passes through the villages of Summit, Argo, Willow Springs, Sag, Lemont, Romeo and Lockport, and was constructed to the north of and parallel with the Old Illinois and Michigan navigation canal. At various places along the route, the drainage canal was built along the bed of the Des Plaines river, the latter being diverted at these places to the north.

For the purpose of a physical description the canal must be divided into four sections. The earth section extends from Robey street to Summit, and is 7.8 miles long. It has a bottom slope of 1 in 40,000, bottom width of 162 feet, side slopes 1 to 1 on the north and 2 to 1 on the south side. The earth and rock section extends from Summit to Willow Springs, 5.3 miles, has a bottom slope of 1 in 40,000, bottom width 202 feet and side slopes of 2 to 1. The rock section



MAP OF THE SANITARY DISTRICT OF CHICAGO
Sanitary District Boundaries
City Limits of Chicago
Sewage Treatment Plants
Sewage Pumping Stations
Miles along Drainage Canal
Water Supply Intakes
North Brook
Glenview
Morton Grove
WILMETTE
EVANSTON
North Shore Channel
North Side (under construction)
CENTRAL AVE.
SIMPSON ST.
DEMPSTER ST.
OAKTON AVE.
KENILWORTH AVE
DEVON AVE.
BRYN MAWR AVE
LAWRENCE AVE.
IRVING PARK BLVD.
BELMONT AVE
FULLERTON AVE
NORTH AVE
CHICAGO AVE
MADISON ST
12TH ST
Des Plaines River
22ND ST
31ST ST
39TH ST
47TH ST
55TH ST
63RD
71ST ST
79TH ST
87TH ST
95TH ST
103RD ST.
111TH ST.
119TH ST.
127TH ST.
135TH ST.
North Branch
Lawrence Ave. Conduit
WILSON AVE CRIB
CARTER H HARRISON CRIB
2 MILE CRIB
CHICAGO RIVER
4 MILE CRIB
South Branch
West Fork
S. Fork
Stock Yards
39th St Conduit
LAKE MICHIGAN
West Side (projected)
South West Side (projected)
Summit
Argo
Illinois & Michigan Canal
Willow Springs
Des Plaines River (Diversion)
MAIN DRAINAGE CANAL
Sag
HYDE PARK CRIB
EDW F DUNNE CRIB
HARLEM AVE
NARRAGANSETT AVE
CENTRAL AVE
CICERO AVE
CRAWFORD AVE
KEDZIE AVE
WESTERN AVE
ASHLAND AVE.
HALSTED ST
STATE ST
COTTAGE GROVE AVE
STONY ISLAND AVE.
YATES AVE
SUPERIOR AVE
95th St.
Calumet Sag Canal
Calumet
State Line
INDIANA
Controlling Works Butterfly Dam
LOCKPORT
Des Plaines River
DRAINAGE CANAL
Power House & Lock
JOLIET

Figure No. 1.

extends from Willow Springs to the Lockport controlling works, a distance of 14.95 miles, has a bottom gradient of 1 to 20,000, a bottom width of 160 feet, with vertical masonry or channelled rock sides. The fourth and last section, from the controlling works to the power house, is 5.25 miles long and is constructed with a clay and rock levee on the right bank, and a concrete wall with rock back-filling on the left bank, with a distance of 160 feet between. The depth throughout the channel for normal conditions of lake Michigan level is 24 feet, but this of course varies with the flow.

At Willow Springs, on the north side of the canal, a spillway was built in order to permit the Des Plaines river to discharge into the canal at flood stages, as the canal had greater carrying capacity than the river between this point and Lockport. This spillway is 397 feet long and its crest is about 20 feet above the water level in the canal.

The controlling works at Lockport were built on the west side of the canal and consist of seven Stoney sluices, 30 feet wide, 20 feet vertical travel, and one Bear-trap dam, 160 feet wide with 15 feet of travel.

With the extension of the canal to the Lockport power house a butterfly dam was built across the canal. This dam is 184 feet long and 30 feet high, and ordinarily is kept parallel to the flow of the canal. On each wing there are six small butterfly valves, each 4 by 6 feet, by means of which the dam can be used either to entirely shut off the flow or for controlling purposes.

The main drainage canal is crossed by eight highway bridges and seven railway bridges, all of the swing type, with the exception of the 8-track railway bridge in Chicago, which is of the rolling type. They have a clearance of 16½ feet minimum. Four highway and three railway bridges were also built over the diversions of the Des Plaines river. When the canal was first constructed as far as the controlling works there was no provision for through navigation into the Des Plaines river, but with the extension to the power house, a lock was built adjacent thereto, 22 feet wide, 130 feet long and with 12 feet over the mitre sills. This lock provides for a lift of 40 feet and was the highest ever built at the time of its construction. In this way the drainage canal was first made available for through navigation in the year 1907, but has only been very sparsely used for that purpose, in fact the swing bridges have not had the motors for operation installed.

At the present time a new lock is under construction by the state of Illinois on the east side of the old lock, having a length of 600 feet, a width of 110 feet and 14 feet over the sills.

In order to take care of the discharge of the canal in the Des Plaines river and to augment the head available for power development a large amount of excavation work was done in the river between the Lockport power house and Joliet.

The drop in water level through the canal under present conditions varies with a great many factors, such as the level of lake Michigan, the quantity of flow, the relative proportions through the main channel and through Calumet-Sag channel, and a number of factors of minor effect. In order, however, to give an idea of the actual slope obtained, the following data for a specific instance may be of interest:—

Elevation of lake Michigan....	2.50 feet below Chicago City datum
Elevation at Lockport..........	11.00 " " " " "
Flow in main channel..........	7,600 cubic feet per second
Flow in Calumet-Sag channel...	900 " " " "
Total flow....................	8,500 " " " "

Flow Through the Canal

The flow through the canal represents the sum of the flow from the Chicago river, the North Shore channel, the North Branch and 39th street conduit and the Calumet-Sag channel together with the discharge from the sewers. The distribution is about as follows:—

1. Main river..................	6,200	cubic feet per second.
2. North Shore channel.........	800	" " " "
3. North Branch................	100	" " " "
4. 39th Street conduit.........	500	" " " "
5. Calumet-Sag channel.........	900	" " " "
6. Sewage......................	1,200	" " " "
Total.........................	9,700	" " " "

The quantity under item "1" will be about 5,000 cubic feet per second when the total flow at Lockport is 8,500 cubic feet per second. The following table gives the average flow through the canal yearly since 1901.*

Year	Mean for Yr.	Year	Mean for Yr.	Year	Mean for Yr.
1900	2,990 c.f.s.	1909	6,495 c.f.s.	1917	8,726 c.f.s
1901	4,046 "	1910	6,833 "	1918	8,826 "
1902	4,302 "	1911	6,896 "	1919	8,595 "
1903	4,371 "	1912	6,938 "	1920	8,346 "
1904	4,793 "	1913	7,839 "	1921	8,355 "
1905	4,479 "	1914	7,815 "	1922	8,858 "
1906	4,473 "	1915	7,738 "	1923	8,348 "
1907	5,116 "	1916	8,200 "	1924	9,465 "
1908	6,443 "				

In a recent report to the United States chief of engineers, Major Putnam, United States district engineer, excludes sewage from the amount of diversion. It must be remembered, however, that the total flow through the drainage canal represents "diversion," regardless of whether it is the original water of the Chicago river, sewage, or lake Michigan water, because if the canal did not exist all these waters would flow into lake Michigan. It might also be noted that in a report dated November 1st, 1923, Major Putnam gives average yearly flows through the canal, and his figures, subsequent to the year 1907, are considerably less than those quoted above.

The whole question of flow, slopes, values of "n" in the Kutter formula, and the hydraulic characteristics of the canal have been the object of many studies by the engineers of the Sanitary District, and of the United States government, and it is anticipated that some very interesting and valuable data will be published in the near future.

Chicago River

In order to provide sufficient waterway and also to maintain velocities low enough to permit navigation, considerable work was done in the improving of the channel of the Chicago river and its South Branch. The channels have been excavated to a width of 200 feet with an average depth of 26 feet, although in the South Branch the depth is reduced to 16 feet at the dock lines. Similarly, the North Branch was improved by widening, straightening and deepening; the dimensions of new cuts being 90 feet wide by about 12 feet deep.

On the South Branch, fourteen centre-pier bridges were replaced by Bascule bridges with a clear span of 120 feet and clearance of 16½ feet.

Lockport Power House

The power house, which is built normal to the main canal, is a concrete and steel building with tile roof, 385 feet long, 70 feet wide, and 47 feet high. At the east end of the building, two sluiceways for control purposes, one 12 feet wide, leading from the forebay, and the other, 48 feet wide, direct from the main canal. They are both controlled by gates of the sector type, with a vertical range of 14 feet.

The power house equipment consists of seven 6,000-

*See Engineering Board of Review—Part II, page 12.

horsepower horizontal turbines, each having six runners mounted on one shaft, with wicket gates operated by Lombard governors. They are direct-connected to seven 4,000-kilowatt generators, operating at a speed of 163.6 revolutions per minute and delivering 60-cycle alternating current at 6,600 volts. Three small turbines drive exciters of 350 kilowatts capacity each. Current is stepped up by oil- and water-cooled transformers (21 of 1,333 kilowatts) to 44,000 volts for transmission to the terminal station at 39th street, and Western avenue, Chicago, a distance of 30 miles. The transmission line carries three 3-phase circuits on two cross-arms on galvanized steel towers 60 feet high, spaced 350 feet apart.

The electrical system is tied in with that of the Commonwealth Edison Company and a load factor of practically 100 per cent is obtained at the plant. Peak loads are helped out by the steam plant at 39th Street pumping station. The output of the plant is divided between the city of Chicago for municipal lighting purposes, the Sanitary District, (engineering department), for pumping purposes, some small municipalities and a small commercial load which is being abandoned as rapidly as contracts will permit. With the completion of plants for the treatment of sewage, the total output of the Lockport plant will be insufficient to take care of the Sanitary District's own load.

The plant operates under a varying head depending on the level of lake Michigan and the flow permitted through the canal. When the lake was at an elevation about 1.5 feet below Chicago city datum, there was a head at the plant of 31.5 feet, and an output of 12,000 kilowatts.

North Shore Channel

It was found that the North Branch of the Chicago river had insufficient flow to carry off the sewage of the district feeding into it. To remedy this condition and also to provide an outlet for sewers in the northeasterly part of the district, a new canal, known as the North Shore channel, was built from Wilmette on lake Michigan, 13 miles north of the Chicago river, to a point on the North Branch at Lawrence avenue. This channel has a bottom width varying from 26 to 30 feet, with side slopes of 2 to 1, and 3 to 5, a bottom gradient of 1 in 20,000, and depth of 13.5 feet. Its capacity is 1,000 cubic feet per second.

In order to provide this flow the water has to be lifted 3 feet above the lake Michigan level at Wilmette, which is accomplished by four screw pumps, 9 feet in diameter. Each pump is driven by a 150-horsepower motor.

A lock, 130 feet long by 32 feet wide by 11 feet deep, is provided for navigation purposes. The channel is crossed by twenty highway and three railway bridges.

Calumet-Sag Channel

As the population of Chicago spread to the south and also with the development of the northern part of Indiana, the condition of the discharge of the Calumet river became a menace to the health of the people of Chicago, and steps were therefore taken to reverse the flow of this river by the construction of the Calumet-Sag channel, leaving the little Calumet river at Blue island, and connecting with the main drainage canal at Sag. This drainage canal has a length of 16.2 miles and a capacity of 2,000 cubic feet per second. The earth sections, comprising a total length of 10.8 miles, have bottom widths of 36 feet, with side slopes of 2 to 1, or 50 feet width, and 1 to 1 slopes. The depth is 20 feet and bottom gradient 1 in 37,000. The rock sections, comprising 5.4 miles, have the same depth and gradient, but are 60 feet wide with vertical channelled rock or concrete sides. Owing to the restricted capacity of the Calumet river, this channel has only been used for a flow of 700 to 900 cubic feet per second.

Figure No. 2—Main Drainage Canal at Romeo, Ill., looking upstream.

Controlling works combined with a navigation lock are built at the entrance to the channel, and passing places for vessels are provided every three miles in the canal. The channel is crossed by seventeen highway and seven railway bridges, all of the fixed span type with a clearance of 16½ feet.

Pumping Stations

The Sanitary District has constructed and in operation a series of pumping stations for various purposes.

Thirty-Ninth Street Pumping Station

This station serves to pump sewage from the south side between 31st and 87th streets, west from lake Michigan through a 20-foot conduit below 39th street to the South Fork of the South Branch of the Chicago river. The station is also used for intermittent pumping of fresh water from the lake through the conduit, for flushing purposes. It serves a district about 22 square miles in area, and pumps sewage varying in volume from 45 to 1,000 million gallons per day.

The equipment of this station consists of eight boilers with a total capacity of 2,600 horse power; two low-head pumps, 14 feet 9 inches diameter, driven by triple expansion steam engines for flushing purposes with a capacity of 1,000 cubic feet per second each, four vertical shaft centrifugal pumps, with a total capacity of 650 cubic feet per second, also driven by triple expansion steam engines of the horizontal type, and a 4,000-kilowatt turbo-generator set, which is used for peak load purposes at such times as the steam capacity of the plant is required for pumping sewage.

Lawrence Avenue Pumping Station

The Lawrence Avenue pumping station is located on Lawrence avenue, east of Broadway, and pumps the sewage of the North Side, comprising an area of six square miles, through a conduit 16 feet in diameter, which discharges into the North Branch of the Chicago river. It also pumps lake water through the conduit for flushing and dilution purposes. The pumpage of sewage varies from 25 to 190 million gallons per day.

Evanston Pumping Station

The Evanston pumping station is located just north of the city of Chicago in the municipality of Evanston, and pumps sewage from this district through a 10-foot conduit discharging into the North Shore channel. It serves an area of about 600 acres. The equipment consists of six centrifugal pumps driven by 25-horsepower electric motors, with a total capacity of 135 cubic feet per second.

Figure No. 3—Entrance to North Shore Channel, showing Pumping Station and Lock at Wilmette.

Ninety-Fifth Street Pumping Station

The 95th Street pumping station was built by the city of Chicago, but is operated by the Sanitary District. It serves a district to the south of 95th street and is electrically operated with power from Lockport or from the Calumet power station.

Calumet Pumping Station

The Calumet pumping station is located at 125th street and Indiana avenue and pumps sewage from the Calumet intercepting sewer into the Calumet sewage treatment plant through two large conduits. When the flow exceeds the capacity of the treatment plant, namely, 56,000,000 gallons per day, the sewage is turned into the Calumet-Sag channel, and if the flow still exceeds the capacity of the two, the excess is turned directly into the Calumet river.

The equipment consists of six pumps, three driven by 250-horsepower electric motors, and three by 1,000-horsepower motors, with a total capacity of 950 cubic feet per second. Two additional motors of 375 horse power each are provided for use in place of the large motors when conditions are such as to require pumping direct to the river.

Adjacent to the pumping station is a power house equipped with four full-Diesel-type engines of 750 brake horsepower each, direct connected to 500-kilowatt, 3-phase, 60-cycle, 2,300-volt generators operating at 180 revolutions per minute.

In addition to the foregoing there are some small pumping stations built by the city of Chicago operated by the Sanitary District.

Intercepting Sewers

In order to divert the discharge of the many sewer outlets from the Chicago river or its branches to the treatment plants, over 50 miles of intercepting sewers had to be built. These sewers vary from small tile to large reinforced concrete structures, the largest being 24 feet by 27 feet high.

Sewage Treatment Plants

Morton Grove, Glen View and Northbrook Plants

These three treatment plants are all of the Imhoff type, with trickling filters, and serve small suburban municipalities outside the city limits in the north-western section of the Sanitary District. The effluent is discharged into the North Branch, and while these treatment plants undoubtedly cause a great improvement in the condition of the North Branch, they do not have much effect on the sewage disposal problem of the district as a whole.

Des Plaines River Plant

The Des Plaines river sewage treatment plant, located just west of the Des Plaines river and south of Roosevelt road, serves an estimated population of about 40,000 and 50,000 people residing in Melrose Park, River Forest, Forest Park, Maywood, and part of Oak Park and the Speedway hospital. This is an activated sludge plant. The sewage arriving at the treatment works is pumped through a lift of about 28 feet by three vertical pumps, each of a capacity of $6\frac{1}{2}$ cubic feet per second, driven by a 50-horsepower induction motor. The ordinary dry weather flow is about 5 million gallons per day, and the total capacity of the plant as at present installed is about $6\frac{3}{4}$ million gallons per day. In the same building with the pumping station are blowers to compress the air for the activated sludge process. These are driven by induction motors: four at 150 horse power, one at 75 and one at 30 horse power. The sewage is pumped through a Venturi meter into duplicate grit chambers, which are followed by a Riensch-Wurl self-cleaning screen. The screened sewage is then aerated in four tanks with filtros plate diffusers. Two of the tanks, 10 and 15 feet deep respectively, are arranged for the ridge and furrow type of aeration, one tank, 10 feet deep, is arranged for the circulating type of aeration, and the fourth unit, 10 feet deep, is of the ridge and furrow type followed by separate re-aeration of the sludge. The aerated liquor is settled in settling tanks, one-half of which have hopper bottoms, and the other half, Dorr clarifiers. For pressing and drying the excess sludge from the tanks to form commercial fertilizer, there is provided a press and dry house. Centrifugal and stuff pumps, as well as duplicate ejectors, feed two presses of the platen type, one containing eighteen bags, each 5 by 8 feet, and the other ninety bags, each 4 by 6 feet. With these the water content is reduced from 99 per cent to about 80 per cent. The press cake is then dried in a rotary dryer of the Atlas type, 4 feet in diameter by 30 feet long, the dried sludge being passed through a screen and bagged for use. A crusher is provided for breaking up the tailings.

Calumet Plant

The Calumet sewage treatment plant, located at 125th street and Cottage Grove avenue, is handling the sewage of the territory south of 87th street, east of Western avenue and west of lake Michigan, and north of the Calumet river. Sedimentation in Imhoff tanks is used at this plant. The works consist of coarse bar screens with one-inch openings, a grit chamber with five channels in which the velocity is reduced to about one-half foot per second to drop grit, and thirty units of Imhoff tanks of the double deck type in which the sewage is settled in the upper compartments, and the sludge collected and digested in the lower chambers. The digested sludge is dried on underdrained sand beds and finally disposed of by dumping. Two activated sludge units and a trickling filter of crushed stone, 0.74 of an acre in area and approximately 6 feet deep, are also provided for comparative studies on complete treatment sewage. The trickling filter is equipped with two secondary settling tanks with hopper bottoms. The plant has a capacity of 56,000,000 gallons per day, and serves a population of 180,000. A machinery building houses the four blowers with a combined capacity of 6,500 cubic feet per minute at $8\frac{1}{2}$ pounds pressure for supplying air to the activated sludge units and the sludge lifts in the Imhoff tanks, and also the three centrifugal pump units for feeding the trickling filter, and also an Oliver vacuum filter and Atlas dryer for de-watering the excess sludge. Offices and chemical laboratory are in a separate building.

North Side Plant

The North Side treatment plant is under construction and will not be in operation until late in 1927, or early in 1928. It is stated to be the largest activated sludge plant in the world. When completed it will provide for a population of 800,000 people, and a flow of 175,000,000 gallons per day. The sewage will be pumped from the intercepting sewers through a lift of 48 feet, passed through grit and screen chambers into three batteries of aeration tanks, each approximately 420 feet square. The sludge will not be entirely settled out at this plant, but will be pumped to the projected west side plant, where it will be pressed and dried.

Cost of Works

The cost to the end of 1924 of the foregoing works is summarized in the following table*:—

Cost of Canal System and Appurtenances

Main drainage canal	$ 28,418,214.78
Des Plaines river improvement	2,333,571.72
Main channel extension	3,167,003.05
Chicago river improvement	12,903,773.66
North Shore channel	4,138,105.25
Calumet-Sag channel	14,159,215.51
Sewage pumping stations	980,622.76
Auxiliary sewers	2,229,012.08
Miscellaneous construction	1,389,238.15
North Shore sewers	2,453,996.55
Bare construction cost	$ 72,172,753.51
Administration, legal expense, clerical expense, damages, etc	5,729,813.46
Interest on bonds for construction	17,055,898.00
Expenditures by city of Chicago	6,706,804.37
Lockport power house	1,395,712.95
Total to Dec. 31st, 1924	$103,060,982.29

Cost of Sewage Treatment Projects

Sanitary improvements	$ 282,117.52
Des Plaines river project	3,357,669.23
Calumet project	17,853,719.45
North Side project	7,119,620.93
West Side project	295,164.28
Miscellaneous plants and sewers	387,484.50
Bare construction cost	$ 29,295,775.91
Administration, legal expense, clerical expense, damages, etc	2,325,799.06
Interest on bonds for construction	6,923,188.71
Total cost of sewage treatment plants to Dec. 31st, 1924	$ 38,544,763.68

The Sanitary District of Chicago

The organization which has the direction of such important works as have been described in the foregoing pages is naturally a large one. The Sanitary District of Chicago is governed by a body of nine trustees, who are elected by the people with primary and secondary elections. The trustees hold office for six years and election of three members occurs every two years.

The Sanitary District now embraces an area of 437.39 square miles, of which 205 square miles, (47 per cent), is comprised of the city of Chicago. The distribution of population, however, is more pertinent, as 91 per cent of the population served lies within the city limits and only 9 per cent in the large area outside the limits, in which there are forty-nine separate small municipalities. The total population served is about 3,500,000.

The engineering department of the district is under the direction of Edward J. Kelly, M.A.S.C.E., who has charge of the greater part of the work of the organization. The following is a summary of the budget for 1926:—

Annual Appropriation for 1926

Engineering Department	$30,107,792
Department of Maintenance and Operation	2,918,266
Illinois Valley Department	71,517
Department of Law	419,540
Department of the Clerk of the District	192,365
Department of the Treasurer	3,250
Department of Real Estate	19,625
Department of Police	164,530
Board of Trustees	90,898
General fixed charges	8,266,170
Total	$42,253,953

Water Supply of the City of Chicago

The Sanitary District has no jurisdiction or control over the water supply system of Chicago, which is entirely operated by the Department of Public Works of the city. The system consists of ten pumping stations with a total installed pump capacity of 1,349 million gallons per day. The water is obtained from intake cribs in lake Michigan, of which there are six in number, with numerous tunnels and cross-connections to the various pumping stations. The total consumption per day averages about 820 million gallons, which corresponds to 278 gallons per capita per day. In terms of flow, it might be noted that the quantity of water used is equivalent to about 1,250 cubic feet per second.

The following table* gives the location and particulars of the intakes:—

Name	Distance from shore	Distance from Chicago River	Depth of water
1. Wilson Avenue	3 miles	5.25 miles north	33.5 feet
2. Carter H. Harrison	2.6 "	2.0 " "	33.8 "
3. 2-Mile	1.75 "	1.25 " "	29.0 "
4. 4-Mile	3.4 "	1.0 " south	38.0 "
5. Hyde Park	2.0 "	7.0 " "	32.0 "
6. Edward F. Dunne	2.0 "	7.0 " "	32.0 "

It is not possible to separate the quantity of water taken in at each crib, owing to the cross connection to various pumping stations, but on broad lines it may be stated that considerably over 60 per cent of the total water supply is taken from lake by the three cribs in closest proximity to the Chicago river.

The whole of the supply is treated with chlorine and the records of consumption show that nearly 3 parts per 10,000,000 are used, which represents a dose somewhat larger than average conditions usually found.

*Engineering Board of Review—Part III, page 9.

Figure No. 4—Entrance to Calumet-Sag Channel showing Combined Controlling Works and Lock.

*From data supplied by Mr. John Ericson, city engineer of Chicago.

Plans for Future Works

Sewage Treatment Plants

In addition to the plants now under construction, the trustees of the Sanitary District passed a resolution on December 26th, 1924, adopting the recommendations of the Engineering Board of Review, providing that all sewage will be treated by the year 1945, which they consider is as early as possible with due regard to sound engineering and financing. The following is the general outline of the proposed procedure taken in the chronological order of the recommendations.

The Des Plaines river plant is to be increased from its present capacity for a population of 40,000 to provide for a population of 105,000, with a corresponding increase in flow from 4 to 10.5 million gallons per day.

The Calumet plant is to be increased from its present capacity for a population of 200,000 to provide for a population of 320,000, with a corresponding increase in flow from 56 to 72 million gallons per day. It is also proposed to install additional trickling filters for the present plant so that the degree of purification will be increased as well as the capacity.

The North Side plant when completed under the present programme will provide for a population of 800,000 and is to be increased to provide for 1,122,000, with a corresponding increase in flow from 175 to 200 million gallons per day.

The future treatment of industrial wastes has been provided for, but it is probable that the plans will undergo radical changes, owing to recent developments in the possibilities of utilizing the wastes, particularly from the corn products industry. In the future the wastes from this industry will be small in quantity and comparatively innocuous. In the case of the packing industry, the problem has not reached such a satisfactory stage, either from the point of view of utilization or from that of the responsibility of the industry itself. Plans provide for the construction of an activated sludge plant with a capacity of 40 million gallons per day, which would correspond to a population equivalent of 1,250,000. There have been negotiations and controversies between the Sanitary District and the producers for many years, but whatever the outcome as far as responsibility goes, provision is being made for the construction of this plant.

The West Side plant is to provide for an area of 57.2 square miles in the centre of the city immediately to the north of the main drainage canal, and including the Loop District, the total population of which, including transients, is estimated to be 1,915,000 by 1945. The plans for this plant provide primarily for Imhoff sedimentation tanks to take care of a flow of 414 million gallons per day, and later for the installation of trickling filters, with an ultimate capacity of 440 million gallons per day.

The South-West Side plant is to provide for an area of 59.0 square miles immediately to the south of the drainage canal, with a population of 1,322,000, and will be built in stages, with Imhoff sedimentation tanks with a capacity of 301 million gallons per day, followed by trickling filters, the whole with an ultimate capacity of 344 million gallons per day.

In addition to the foregoing it is recommended that provision should be made for treating the sewage of the outlying parts of the Sanitary District as the development of the cities and villages may make necessary.

It is estimated that the foregoing works which will serve a population of nearly 6,500,000 will cost about $100,000,000, including necessary pumping works, intercepting sewers and so forth, but exclusive of the amount already expended.

Water Supply

As far as the future plans for water supply are concerned the outstanding feature at the moment is the fact that the city has adopted a definite programme for the installation of meters. The result of this will be that the present enormous per capita consumption of 280 gallons per day will be steadily reduced and consequently for a number of years the actual total consumption will decrease, notwithstanding the rapid growth of the city. This means that no extensive programme is necessary for providing additional pumpage capacity or intakes. On the other hand, the condition of the supply, even with the use of the drainage canal, has been far from satisfactory, and the dosing with chlorine has been utilized to a degree which is even now producing unpleasant results. The chief sanitary engineer of the health department of the city of Chicago recently stated that "The water supply of Chicago is becoming more and more potentially dangerous, and the increasing quantities of chlorine required for disinfecting the same will render it quite objectionable for drinking purposes."

The city engineer of Chicago says in a report to the commissioners of public works that "The filtering of the Chicago water supply is rapidly becoming a very important question irrespective of the great plans for sewage purification works of the Sanitary District." He further states that in view of the persistent opposition in the past to metering, it has been out of the question to accomplish any results in the direction of filtering, but in view of present conditions he has made a preliminary study for filtration plants. While the plans for filtration are in an embryo state and therefore subject to radical changes, nevertheless it is of interest to note that preliminary studies have been made from which it appears that the complete filtration and water purification plants will cost about $40,000,000.

The Present Need for the Diversion

Whatever truth there may be in statements to the effect that Chicago should have done this, that, or the other, the situation as it stands to-day has to be faced. Any discussion of an immediate stoppage of the diversion or even of a large reduction in the quantity is simply a waste of breath, for the simple reason that under conditions as they now exist, the direct result of such action would be without any doubt a very serious typhoid epidemic. The present system of chlorination of the water supply would be totally inadequate to counteract the extent of the pollution which would exist under such circumstances. It must be remembered that Chicago is differently situated as compared with many other cities on the Great Lakes; firstly, it is over three times as large as any other of the Great Lakes cities and many more times larger than most of them; secondly, there is practically no perceptible current in the lower end of lake Michigan, and the sewage discharge is largely at the mercy of the wind and very apt to remain in close proximity to Chicago; thirdly, the outlet of the Chicago river is in the midst of the group of water intakes. In other words, it must be taken as axiomatic that Chicago's sewage under present-day conditions must be kept out of lake Michigan, and the problem therefore becomes one of determination of how much water is necessary to carry the sewage away. This leads to an examination of the whole system of sewage treatment and disposal now in existence.

Sewage Disposal

The method of discharging sewage into a large body of water or into a running stream is known as the dilution method. The process, however, represents something more than dilution, as, in order to prevent the sewage becoming putrescent, even though diluted, oxidization of the organic matter must take place. It is this oxidization which makes it possible for sewage to be discharged into a stream from one city, while further downstream a second city may use the same stream for its water supply with perfect safety. Any ordinary source of fresh water supply such as a lake or running stream contains a certain amount of dissolved oxygen, while on the other hand sewage contains a large amount of organic matter which requires so much oxygen to completely oxidize it. This latter quantity is known as the "oxygen demand" of the sewage. It is the relationship between the amount of dissolved oxygen and the oxygen demand (oxygen balance), which determines whether a stream will become putrescent or not. If the supply of dissolved oxygen exceeds the demand, the organic matter in the sewage will become oxidized and the water become purified; if, on the other hand, the dissolved oxygen available is less than the demand, a negative oxygen balance will ensue, and in turn the stream will become putrescent. In other words, when there is no oxygen available at all, the sewage will become septic and produce unpleasant odours. As long as oxygen is present, the stream will be in an aerobic condition.

In the case of sewage treatment plants artificial means are taken to reduce the oxygen demand of the sewage. An activated sludge plant concentrates the natural action of a running stream into a short period of time, and then provides means for the withdrawal of the solid matter in the form of sludge. In such a plant the oxygen demand may be reduced as much as 85 or 90 per cent. In the Imhoff tank system no attempt is made to oxidize the organic matter, but it is simply a means of settling out the sewage solids, and has the effect of reducing the oxygen demand about 30 to 35 per cent. It is frequently customary to provide a further stage of treatment to the effluent from the Imhoff tanks, either by the activated sludge or by the trickling filter method. In either of these cases the combined result gives a total reduction in the oxygen demand of about 85 to 90 per cent.

Characteristics of Chicago's Sewage

One of the principal characteristics of the sewage of Chicago is that owing to the abnormally high rate of water consumption, and also to the use of combined sewers, it has a large volume in proportion to the population served. This refers to the ordinary domestic sewage. The sewage from the industries, on the other hand, has a degree of concentration far greater than the domestic sewage.

The Sanitary District of Chicago has made extensive tests covering a long period, of the oxygen demand of its sewage, from which they determine an average value of 0.24 pounds per capita per day. The United States Public Health Service has made a number of investigations of the oxygen demand of the sewage of cities from which it would appear that while the Chicago figure is not abnormally high, it is nevertheless somewhat higher than the average. This applies to ordinary domestic sewage. In the case of the packing and corn-product industries, analysis was made to determine the total oxygen demand of the various wastes, and then by applying the factor 0.24 an equivalent human population was obtained.

The oxygen demand of a given volume of sewage is not satisfied immediately, but takes a number of days, and may be said generally to be normally 99 per cent satisfied in a period of twenty days at 68° F., the effect of lower temperature being to increase the time, or decrease the degree of satisfaction. The rate of satisfaction is not directly proportional to the time, as after a period of five days the demand is 68 per cent satisfied, seven days, 80 per cent, ten days, 90 per cent, and so forth.

Figure No. 5—Chicago River showing Junction of North and South Branches.

(Note line of demarkation between polluted water from North Branch and fresh water from lake Michigan.)

It will be appreciated that with constantly fluctuating sewage discharge flows and temperatures, the oxygen balance at any point is subject to daily and seasonal variations, but many records and surveys of the condition of the Des Plaines and Illinois rivers have been made, not only by the Sanitary District, but also by the United States Public Health Service. The study and analysis of the various records is a subject in itself, and is very fully covered in Part III, Appendix I, of the Report of the Engineering Board of Review, from which much of the basic data used herein has been taken. It must be understood that only the broadest principles are being discussed herein, and the author does not attempt either to substantiate or refute the statements of the Board of Review. It has been found that Chillicothe, 150 miles from lake Michigan, is the critical point, or in other words, the farthest downstream point where there would be danger of there being a negative oxygen balance. The time of passage from the lake to Chillicothe is about seven days, with a flow of 8,700 cubic feet per second. At the seven-day period, the oxygen demand is normally 80 per cent satisfied and beyond this point re-aeration takes place rapidly.

The present population of the Sanitary District is about 3,500,000, while the equivalent population of the packing and corn-products industries may be placed at 1,300,000; hence the total human and equivalent population whose sewage has to be taken care of amounts to 4,800,000. Before determining the oxygen demand, consideration has to be given to the effect of the existing treating plants. The Des Plaines river plant has the effect of reducing the oxygen demand of about 40,000 people by 85 per cent, making a net reduction therefore of 34,000 people, while at Calumet the reduction may be placed at 80 per cent for 200,000 people or a reduction of 160,000 people. The net total human and equivalent population to be served is therefore 4,600,000 in round figures. The oxygen demand, (at 0.18 pounds per capita per day for seven-day demand), therefore, averages 828,000 pounds per day. It must be borne in mind, however, that the oxygen demand varies between summer and winter. It will reach an extreme minimum of about 33 per cent less than the average in the winter and an extreme maximum of

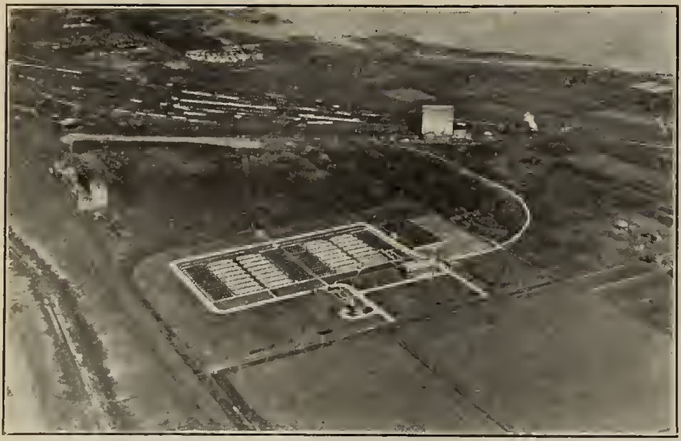


Figure No 6—Calumet Sewage Treatment Plant.

about 30 per cent more than the average in the summer. Average winter conditions therefore might be represented by an oxygen demand of 610,000 pounds per day, and average summer conditions by an oxygen demand of 995,000 pounds per day.

Owing to the fact that practically no attempt has been made to settle out the sewage solids, large accumulations of sludge occur in the bed of the canal and river which have a very large oxygen demand. The deposits of sludge occur where the velocity is low, principally in the earth and rock section of the drainage canal, in the Des Plaines river between Joliet and Ottawa and also between LaSalle and Chillicothe. It is estimated that the total oxygen demand of these sludge deposits amounts to about 1,200,000 pounds per day. This quantity varies of course with the temperature and other conditions, but may be taken as a general indication of the requirement.

The total oxygen demand under present-day conditions may therefore be taken as being about 2,000,000 pounds per day on the average for a seven-day demand, without taking into account the small additional amounts required by the sewage of some of the small towns located on the Des Plaines or Illinois rivers.

The Supply of Oxygen

There are three principal sources of supply of oxygen to meet the demand—first, lake Michigan; second, the air in contact with the canal and river surface; third, tributary rivers.

The amount of dissolved oxygen in lake Michigan has been found to vary from a minimum of about 8 parts per million in summer, to a maximum of 13 parts per million in winter, which represents a general average of about 95 per cent of saturation. These figures are the result of a series of tests made by the Sanitary District at the 39th Street pumping station. Taking the average of these figures, and assuming a diversion of fresh water of 8,500 cubic feet per second, a simple mathematical calculation gives the quantity of dissolved oxygen obtained from lake Michigan as 436,000 pounds per day.

During its contact with the air, water which is depleted of its normal amount of dissolved oxygen will absorb oxygen from the air (this is known as *re-aeration*). The rate at which this absorption takes place depends on the degree of depletion of the dissolved oxygen, the temperature, the rate of movement of the water through the air, the depth of the water and so forth. In the case of water in which the oxygen has been practically exhausted, and which is flowing with a broken surface as in a rapid, the rate of absorption may be as high or even higher than 50 pounds per 1,000 square feet per day. On the other hand, where there is some oxygen present and where the stream is flowing very slowly, the rate of absorption becomes less than one pound per 1,000 square feet per day. Applying this principle to the drainage canal, there is first of all the canal section with comparatively slow moving water where the absorption is found to be about 2 pounds per 1,000 square feet per day, which gives the possibility of absorbing a total of about 98,000 pounds of oxygen per day. Between Lockport and Joliet, the river flows swiftly and the absorption becomes very much greater in proportion and reaches a total of 100,000 pounds per day. Between Joliet and Ottawa, a rate of 4 pounds per 1,000 square feet is applied, giving 820,000 pounds, and between Ottawa and Chillicothe, 2 pounds per 1,000 square feet, giving 442,000 pounds. Of course, this absorption can only take place as the primary amount of dissolved oxygen is used up.

The tributary rivers above Chillicothe are the Des Plaines, the Kankakee, the Fox and Vermilion. The first of these is negligible as a source of oxygen supply as its flow is small, and its own oxygen demand is high. The Kankakee, on the other hand, has a flow averaging about 5,000 cubic feet per second, and has excess oxygen to the extent of about 6.5 parts per million, which therefore makes available about 175,000 pounds per day. The Fox river averages about 1,740 cubic feet per second with 5.75 parts per million, giving 54,000 pounds of oxygen per day, and finally, the Vermilion with a flow of 1,000 cubic feet per second gives 31,000 pounds per day.

The following table summarizes the sources of oxygen supply with a flow of about 9,700 cubic feet per second in the canal, which includes sewage:—

Lake Michigan	436,000	pounds per day
Drainage canal	98,000	" " "
Des Plaines river to Joliet	100,000	" " "
Des Plaines and Illinois rivers to Ottawa	820,000	" " "
Illinois river, Ottawa to Chillicothe	442,000	" " "
Kankakee river	175,000	" " "
Fox river	54,000	" " "
Vermilion river	31,000	" " "
Total	2,156,000	pounds per day

This quantity is somewhat in excess of the oxygen demand of 2,000,000 pounds, and further downstream the river continues to re-aerate and purify itself.

It must be borne in mind that in the foregoing calculations, no attempt has been made to go into the subject any more fully than is necessary to show the principles involved, and the unit quantitative values have been adopted from the studies of the Engineering Board of Review. A complete analysis of the situation involves not only seasonal fluctuations but also the introduction of a number of factors of minor importance.

Effect of Obstructions

The major obstructions which occur in the section of the rivers under discussion are the power house at Lockport, a small dam at Joliet, a dam at Marseilles, and another near Henry. The effect of the power house at Lockport is the elimination of four miles of rapids, and the dam at Marseilles also creates a long reach of slack water which would otherwise be flowing swiftly. The other dams are of minor effect. The obstructions have a detrimental effect in two ways: first, the slowing up of re-aeration, and secondly, the causing of the sludge deposits which are now creating such a large oxygen demand. In the former case, it is no exaggeration to state that the amount of oxygen which could be absorbed between lake Michigan and Chillicothe, (provided the water had not already become saturated), would exceed the present quantity by 750,000 pounds per day, if there were no obstructions. Similarly, the present demand of 1,200,000 pounds of oxygen per day by the sludge deposits, might well be reduced to one-half this amount. Of course this supposition introduces new factors into the situation, as, for example, change of areas, change in velocities and so forth, but there is no gainsaying the fact that if there were no dams or other obstructions in the way of the natural flow of the river, the quantity which would have to be withdrawn from lake Michigan in order to maintain aerobic conditions might be reduced as much as twenty-five per cent.

Reversals of the Chicago River

Prior to the construction of the drainage canal, the Chicago river had a North Branch flowing south, and a South Branch flowing north. The two branches met at the "Fork," and from there flowed about one mile easterly into lake Michigan. The reversal of the Chicago river is accomplished by providing an outlet from the South Branch with larger capacity than the flow of the river itself. This process may possibly be more clearly illustrated by figures. If, for example, the combined flow of the two branches amounted to 1,000 cubic feet per second, this would be the quantity flowing easterly through the Chicago river into lake Michigan. If, however, 300 cubic feet per second were drawn out of the South Branch, the flow in the Chicago river would be correspondingly reduced and would become 700 cubic feet per second. If the quantity withdrawn were 1,000 cubic feet per second, the Chicago river between the Forks and the lake would have no flow. Finally, when the amount taken out reaches, say 3,000 cubic feet per second, this quantity would be made up of 1,000 cubic feet per second natural flow of the river, collected from the north and south branches, and 2,000 cubic feet per second of additional water withdrawn from lake Michigan, the latter causing a current through the Chicago river in a westerly direction, which is now the condition which normally exists. Paradoxically, if the river flows in its natural direction, i.e., into lake Michigan, it is referred to as reversal of flow. It is this reversal of flow which has to be prevented as far as possible, because it means that raw sewage is discharged freely into lake Michigan quite close to the source of the water supply. A reversal will take place whenever the flow of the Chicago river exceeds the capacity of the canal at the particular elevation of lake Michigan. For example, while conditions are fairly normal on the lake, but with a low elevation, it is not out of the ordinary for a local rainstorm to cause a sudden freshet which exceeds in volume the capacity of the canal for that elevation; consequently the excess flow discharges into lake Michigan. Another cause of a reversal is the sudden dropping in elevation of the surface of the lake which sometimes occurs through atmospheric disturbances. In this case, a reversal naturally takes place for a short time, but is not likely to be of long duration as a readjustment of levels in the river and canal corresponding to the lowered level of the lake soon takes place.

The frequency with which reversals are apt to take place depends on the quantity normally being passed through the drainage canal, and the number of times the discharge of the Chicago river is likely to exceed this quantity.

According to a report* on the diversion of water from lake Michigan by the district engineer of the United States Engineer Office, it is estimated that rates of storm run-off of the Chicago river have the following frequency:—

3,000 cubic feet per second,	10 to 12 times per year.
4,167 " " " "	7 to 8 " " "
5,000 " " " "	5 to 6 " " "
7,500 " " " "	3 to 4 " " "
9,500 " " " "	2 times in 3 years.

*Report on the Diversion of Water from Lake Michigan, November 1st, 1923.

He then sums up the situation with the statement that "Positive insurance against discharge of the river into the lake under present conditions would require a flow in the neighbourhood of 10,000 feet per second at the time of maximum flood."

There is no doubt that reversals could be prevented by the construction of controlling works which could have made the reversal of flow independent of the quantity of diversion. Suggestions on these lines, however, were not approved on account of placing an obstruction in the way of navigation.

Summary of Present Needs

Apart from the determination of the actual quantity of diversion necessary for present-day needs, which has been shown to average about 8,500 cubic feet per second of fresh water from lake Michigan, but to be subject to a wide seasonable variation, there are four very important conditions which enter into this determination which may be summarized as follows:—

First, the actual quantity of water necessary for dilution purposes and necessary to maintain an aerobic condition in the canal and Des Plaines-Illinois river, is largely increased owing to the dams for development of power and for improvement to navigation.

Second, the actual quantity of water is also materially increased, owing to the deposits of sludge for which these dams are largely responsible.

Third, the actual quantity of water necessary to prevent the continuance of sludge deposits is materially increased by the presence of these dams.

Fourth, the actual quantity of water necessary to prevent reversals of the Chicago river could have been very much reduced if it had not been for the fear of placing an obstruction in the way of navigation in the Chicago river.

The Future Need for the Diversion

Discussion of the future needs or necessity of the diversion naturally leads into a sphere of speculation in which many of the principal elements may be matters of opinion or, at the best, of estimation. It is possible, however, to discuss the principles involved and reach certain fairly definite conclusions without the introduction of any uncertain elements.

With regard to the word necessity, it must be understood that this word is being used herein in its strictest sense, and refers to the necessity of safeguarding the health of the community, and is not used with any idea of broadening its meaning to cover the desirability of providing a waterway or power development, as this phase is not a necessity but a fortuitous condition leading to a commercial benefit.

The question which naturally arises with regard to the future of the drainage canal is to what extent can the amount of diversion be reduced in the future. Can it be entirely eliminated, and, if not, what will be the amount of diversion absolutely necessary? If all plans for sewage treatment and water filtration, both approved and embryo, are carried out, the situation at some future date would be that the whole of the sewage of Chicago would be undergoing treatment before discharge into the Chicago river, and the whole of Chicago's water supply would be undergoing filtration and chlorination. To reach this condition will involve the expenditure of say $175,000,000 and will take anywhere from fifteen to thirty years, depending on the ability of the Sanitary District and city of Chicago to finance the projects. It is unlikely that such a programme could be completed in less than twenty years, by which time the population may have reached 5,000,000, while the packing and other industries will still possibly have a population-equivalent of

1,000,000. If all the sewage is fully treated to the greatest possible extent, the reduction in oxygen demand will average about 85 per cent, the total effluent will therefore be equivalent in oxygen demand to a population of 900,000, but there will be no solids in the effluent. That it is not desirable to discharge this amount of polluted water in the comparatively stagnant waters of lake Michigan, even if extensive filtration plants are in operation at all communities on the lake or in the vicinity, is only a statement of fact, but whether the resulting condition would seriously imperil the health of the people, is a matter of opinion; and at the same time there are what might be called partly sentimental considerations, all of which have to be weighed in the balance against the value of the diverted water. There is little doubt, however, but that the opinion on the side of preventing the dumping of sewage effluent into the water supply will win out in the end. Hence the future must be looked upon from the point of view that there will be diversion and it is therefore necessary to determine the quantity necessary for sanitary reasons.

As in the case of the present need the amount of oxygen demand has first to be determined. Taking the population, both human and equivalent, at 6,000,000, regardless of what year such population is reached, and assuming that all sewage is treated, the oxygen demand will be equivalent to that of a population of 900,000. If there is no change in the characteristics of the sewage from the present-day conditions, the twenty-day oxygen demand would therefore be 216,000 pounds per day. That is to say one day's sewage would require this amount of oxygen within a period of twenty days. With the complete treatment of sewage there will be no sludge deposits to create an extra demand for oxygen, therefore 216,000 pounds per day may be taken as the total demand to be supplied on the average throughout the year.

With the premise that aerobic conditions must be maintained in the canal, this involves the average withdrawal of fresh water from lake Michigan of about 1,200 cubic feet per second, with less in winter and more in summer. This, of course, allows for re-aeration effects during the passage of the water along the canal. The combined flow of sewage effluent and lake water reaches its minimum oxygen content about the time it reaches Lockport, (about $3\frac{1}{2}$ days), at which time the oxygen demand exerted is 55 per cent of the total. After this point the rate of re-aeration will exceed the demand so that a continuance of aerobic conditions is assured.

If the summer condition alone is examined, it is found that in order to maintain the aerobic condition, the flow of fresh water from lake Michigan must be increased to 1,700 cubic feet per second, due to the greater demand in the sewage effluent, and the smaller supply of dissolved oxygen in lake Michigan. In this case the minimum oxygen content or the critical point is not reached until considerably below Lockport. This computation is based on the assumption that the Illinois waterway project now under construction is completed so far as the stretch of river below Lockport is concerned. This work will have the effect of drowning out the present swift water, hence very materially reducing the rate of re-aeration. If the river was in its natural condition and without the existence of the power house at Lockport, the amount of diversion of fresh water necessary in summer time for 6,000,000 total human and equivalent population would be reduced to about 1,400 cubic feet per second or less, provided in all cases that complete treatment of all sewage is in effect.

Reversal of Flow

That there is no insurmountable difficulty involved in the prevention of the reversals is recognized by the fact that the Sanitary District of Chicago is now preparing plans for submission to the United States secretary of war in accordance with the latter's ruling that plans shall be submitted and controlling works completed and in operation by July 1st, 1929. Whatever form such controlling works take, whether simply a protective gate or whether a lock and gates, there will be some obstruction to navigation, either continuously or occasionally, depending on the design of the works. Heretofore, it has been this question of obstruction to navigation which has prevented the installation of some form of controlling works. With such works in operation at some point on the main outlet of the Chicago river, the question of reversal of flow can be entirely dissassociated from the quantity of diversion provided the design of the works is made with that object in view. On the other hand, if the design is made on the basis of creating the least obstruction to navigation, it may well be that the maintenance of a large diversion quantity will be necessary.

Summary of the Future Needs

From the point of view of what is actually necessary to dispose of the effluent of Chicago's sewage, the conclusion is reached that the extreme minimum which it may ever be possible to utilize is in the neighbourhood of 1,200 cubic feet per second together with sewage to the extent of about 1,500 cubic feet per second, making the total diversion out of lake Michigan 2,700 cubic feet per second. It is possible, however, that this quantity might not be sufficient for maintaining continuously decent conditions in the canal and Des Plaines river, because there may be times of storm run-offs, and other unusual conditions which would exert an extraordinary demand. It is also quite certain that the works now being undertaken by the state of Illinois in the construction of the Illinois waterway will have the effect of permanently increasing the amount of diversion necessary for sanitary reasons.

The Benefits of the Canal

The benefits of the Chicago drainage canal, whether actual or claimed, whether positive or imaginary, may be divided into two categories: the first, the saving of human lives and safeguarding the health of a community; the second, the benefits connected with trade, commerce or in some other way involving an economic or financial advantage. These two categories must not be confused. That the former is of paramount importance, will be readily admitted, but in dealing with the subject, there should be no interjection of benefits to trade and commerce as a means of adding weight to the importance of the benefit of saving life. The two elements, human life and commerce, are not of the same denomination and cannot be added. Furthermore, the question of saving human life is one on which nations will freely remove artificial barriers, but as soon as pecuniary matters are introduced, the barriers are immediately raised and apparent. It must not be overlooked, however, that the problem of safeguarding the health of a community ultimately becomes one of dollars and cents, because it is the financial power of a community which determines to a large degree the extent and nature of the enterprises which it can undertake for the bodily welfare of its citizens, and the growth of a large city would be impossible if the cost of providing any one of its essential utilities is unduly high.

Benefit to Health

Prior to the construction of the drainage canal, the greater part of the sewage of the city of Chicago was discharged directly into lake Michigan by the Chicago river. At the same time the city's sole source of water supply was the lake. There being practically no perceptible currents in the lake, except such as were set up by winds, it frequently occurred that strongly polluted water reached the intakes, with the natural result of many deaths from typhoid fever.

As previously referred to, the typhoid death rate reached very serious proportions in the eighties, as a result of which the Drainage and Water Supply Commission was appointed. This commission consisted of three engineers, namely: Rudolf Hering, Benezette Williams and Samuel G. Artingstall. The first part of their report, dated January 1887, and addressed to the mayor and council of the city of Chicago, deals with sewage disposal. They state that "Among the possible methods of getting rid of the Chicago sewage, there are but three that have been deemed worthy of an extended consideration, namely, a discharge into lake Michigan, a disposal upon land, and a discharge into the Des Plaines river." With regard to the first proposition they state that owing to the lack of current in lake Michigan, it would be necessary to widely separate the sewage discharge from the water intake, and also that "While it might be practicable to allow the sewage in its crude form to enter the lake under such conditions for many years, the necessity would arise later for clarifying it at least partially previous to its discharge." With regard to disposal on land, after explaining the nature and extent of the works required and also their cost, they state that "It appears that this project is decidedly the least expensive for the present as well as for the future." The second part of the report deals with the question of water supply and is based on the assumption that sewage will be diverted from lake Michigan by way of the Des Plaines river.

This report and investigation apparently formed the technical basis of the "Act of the State of Illinois" which was passed two years later, and presumably the drainage canal was embarked upon because, according to the abovementioned report, it was not only an entirely satisfactory method of disposal with particular reference to water supply, but was also by far the cheapest. The land disposal method was reported upon as being prohibitively expensive. No estimate was made of the separation of sewage outlets and water intakes. Repeating, it may therefore be said that the drainage canal was embarked upon because it appeared to be the best method from the health point of view with due regard to the cost of the undertaking. The two things cannot be separated. From the point of view of health alone, one would judge that the order of merit would have been: 1. land disposal; 2. Des Plaines river; 3. discharge into the lake.

The benefit to the health of the community can best be seen by studying the death rate from typhoid fever over a period of years, as published by the Sanitary District, and based on Chicago Department of Health Records.

Years	Average Typhoid Death rate per 100,000
1870-1879	57.9
1880-1889	63.7
1890-1899	66.8
1900-1909	22.6
1910-1919	6.4
1920-1924	1.3

While it cannot be suggested that the whole of the improvement in the death rate from typhoid is attributable to the drainage canal, it must nevertheless be admitted that it probably contributed to the improvement to a greater degree than any other single action. The improvement did not reach a marked degree for the first five years after opening the canal, because there were frequent reversals of the Chicago river into lake Michigan, and because many of the intercepting sewers were not completed. At the same time it was not until 1922 that the sewage of the Calumet district was kept out of the lake. In later years the introduction of chlorination of the water supply was another factor which had a marked effect on the lowering of the death rate.

Consideration must also be given to the fact that notwithstanding the adoption by Chicago of what was the least expensive method of disposing of its sewage, the per capita cost to the city has been far greater than the cost for similar work to any of the major cities of the United States, and therefore cannot exactly be classed as a cheap method.

As the situation stands to-day Chicago has spent $120,-000,000. on sewage disposal and is committed to a total expenditure of $250,000,000. by 1945. Even with the increased population by that time, the per capita cost of its sewage disposal works will still be very high. The question, nevertheless, arises:—Could Chicago do anything else under present-day conditions? The only possible alternative would be the abandonment of the drainage canal means of disposal; the discharge of the effluent from sewage treating plants into lake Michigan, and the installation of filtration plants for its water supply and change in the location of the water intakes. The financing and construction of such a project would take many years to accomplish, and in the meantime the diversion will have to continue to a greater or less degree. At the same time, sanitary experts look upon the discharge of effluent from even the most modern sewage disposal plants into the waters of lake Michigan, in such volume as necessary, for a city the size of Chicago, as a step in a backward direction, especially in view of the fact that a very large population bordering on the lake is dependent on the lake waters for domestic consumption.

Power Development

Such benefits as may accrue from the drainage canal which are directly or indirectly of a commercial nature cannot be accepted as argument for the use of water which belongs somewhere else, unless it is properly compensated for.

One of the first benefits of this nature is the hydroelectric plant at Lockport, which under state legislation is only incidental to the sanitary use of the drainage canal. While the policy is to dispose of the output of this plant *at cost*, nevertheless, there has been a large economic saving distributed among the city of Chicago, the Sanitary District, other municipalities, and some commercial concerns, owing to the very fact that this cost was lower than the current rate of the local power company. At the present time the power is sold to the four groups of customers at rates which just about balance the cost of production, which in turn is made up of fixed charges on the investment in the power house and part of the canal extension, and of operation and maintenance costs. There have also been a number of years in the past when a direct profit of as much as a quarter of a million dollars was made. On the other hand, the relationship of this development at Lockport to the total power market of the district is small, as it only represents about five per cent of the total power consumption.

Future changes in the river, caused by the building of dams, will concentrate the head which is at present wasted, into four sites, at each of which power may be developed. The following table gives a list of the sites and the power available at each site, including Lockport, under varying flows, from the diverted water alone. Allowance is made in each case for the amount of water necessary for navigation purposes, that is to say, the amount necessary for the operation of the locks, which has been stated by various authorities to be about 1,000 cubic feet per second. If the quantity of traffic on the waterway did not reach expectations, then there would be so much more water available for power.

Approximate horse power obtainable from

Site	Head	2,000 c.f.s.	4,167 c.f.s.	7,000 c.f.s.	10,000 c.f.s.
Lockport.......	34 ft.	3,400 h.p.	10,800 h.p.	20,400 h.p.	30,600 h.p.
Brandon Road..	30 "	3,000 "	9,500 "	18,000 "	27,000 "
Dresden Island..	17 "	1,700 "	5,380 "	10,200 "	15,300 "
Marseilles......	23 "	2,300 "	7,280 "	13,800 "	20,700 "
Starved Rock...	18 "	1,800 "	5,700 "	10,800 "	16,200 "
Total........	....	12,200 h.p.	38,200 h.p.	79,200 h.p.	109,800 h.p.

It will therefore be seen that there is a possibility of developing about 100,000 horse power in the Illinois valley from the present amount of diversion, and there is no doubt but that it could be immediately utilized. The potential value of this power is, of course, problematical, but on whatever basis it is estimated, whether by the net commercial benefit, or whether by the saving over cost of coal production, or whether by the cost of coal necessary to produce the same power, the value to the state of Illinois of this power is represented by something well over a million dollars a year.

Illinois Waterway

While there have been many references to the drainage canal in connection with its availability for navigation purposes, so far the benefit has been negligible, as the traffic has never amounted to a volume worthy of consideration. Instead, therefore, of there having been a benefit to navigation in the past, it might almost be said that the induced velocities in the Chicago river have in many instances been detrimental to navigation.

With the plans and construction now under way for the Illinois waterway, there will undoubtedly be a large saving in the cost of construction through increased flow in the river which induces greater depths, thus reducing the quantity of excavation necessary.

The Illinois waterway, which is now under construction by the state of Illinois, is part of the "Lakes-to-the-Gulf" waterway, which has the object of connecting lake Michigan with the gulf of Mexico for medium draft vessels by means of the Des Plaines, Illinois and Mississippi rivers, with the drainage canal as the first link. The present construction programme covers the Des Plaines and Illinois rivers from Lockport to Utica, a distance of 58 miles, and will provide for 9-foot draft in rock, 8-foot in earth, with locks 600 by 110 by 14 feet over sills. From Utica to Grafton, at the outlet of the Illinois with the Mississippi, a distance of about 230 miles, the present system provides for 7-foot draft. On the Mississippi from Grafton to St. Louis, there is a 6-foot waterway, from St. Louis to Cairo 8-foot, and from Cairo to the gulf 9-foot. The Ohio river scheme connecting with the Mississippi at Cairo has provision for 9-foot draft, and will provide a means of bringing coal from the Pennsylvania coal fields to Illinois and into lake Michigan.

In the development of its present plans for the I linois waterway the state of Illinois is undoubtedly interested in maintaining a large flow through the drainage canal. The cutting off entirely of this flow would make the present undertaking impossible, as 1,000 cubic feet per second is needed for the operation of the locks, and even with the 1,000 cubic feet per second the work would be enormously expensive as compared with its probable cost under present conditions. The benefit of saving in construction cost is fairly definite and amounts to as much as 30 million dollars for a diversion of 10,000 cubic feet per second.* The benefit that may accrue to the commerce of the country through the completion of this waterway is problematical. The state of Illinois Chamber of Commerce estimates that the traffic will amount to as much as 20,000,000 tons a year, of which figure 15,000,000 tons represents coal destined to Chicago.

*Report of Committee No. 3, Engineering Board of Review, page 8.

To go further afield, there is the suggestion that navigation on the Mississippi river will also be materially assisted by the increased flow. This, however, is subject to argument on account of the peculiar characteristics of this river.

Summing up the benefits accruing from the drainage canal, there is, first of all, a very decided benefit to the health of the community served, obtained at a cost very much less than by any other method; second, there is, or has been a small benefit from the production of hydro-electric power; third, there is a benefit to the state in the reduction of the construction cost of the Illinois waterway; and, finally, there may be a benefit to commerce, of problematical amount, through the said waterway being made possible.

Damages

The first of the damages which have been caused by the diversion is that to the Des Plaines and Illinois rivers and to the people adjacent thereto, owing to the effect of the sewage in the water, and increased quantity of water. The effects may be classed under three headings, namely, sanitary, flooding and effects on the fishing industry. The conditions in each case have been examined by the district engineer of the United States, of Chicago, who explains each situation, and apparently the sanitary condition of the river is disagreeable, but not seriously so; that the effect on fish life is beneficial rather than otherwise; and that land damages are being paid for by the Sanitary District.

Effect on Navigation—Great Lakes and St. Lawrence River

In 1896, Mr. O'Hanley reported that there was insufficient data for a reasonably accurate determination of the effect of the withdrawal of any given quantity of water from lake Michigan on the levels of the Great Lakes and St. Lawrence river. Since that time, however, most careful surveys, gaugings and meterings have been made on all the lakes with the result that to-day there is no question but that the actual effect of any given amount of diversion may be determined with reasonable accuracy. By applying the amount of diversion to the rating curves of the various lakes at their outlets, or to the St. Lawrence river as the case may be, the effect is simply a matter of mathematical calculation. The results reported by Colonel J. G. Warren, Corps of Engineers, U.S. Army, in his "Report on Diversion of Water from the Great Lakes and Niagara River," are generally accepted as being an accurate interpretation of the effects in question. Part of the results of his investigations are given in the following table, which gives the lowering of level in the various lakes by diversion of water through the drainage canal at Chicago.

Quantity of Diversion, c.f.s.	4,000	6,000	8,000	10,000
Lake Michigan............	0.20 ft.	0.30 ft.	0.40 ft.	0.50 ft.
Lake Huron............	0.20 "	0.30 "	0.40 "	0.50 "
Lake St. Clair............	0.16 "	0.24 "	0.31 "	0.39 "
Lake Erie............	0.19 "	0.29 "	0.39 "	0.49 "
Lake Ontario............	0.20 "	0.30 "	0.40 "	0.50 "

The above figures apply to the low level stage of each of the lakes. For higher stages there is a small variation in the amounts but only in the hundredths of a foot. To all intents and purposes, therefore, the utilization of the amount of six inches is accurate enough as representing the effect of the maximum diversion at Chicago.

Great Lakes Navigation

Before an intelligent idea can be obtained as to the effect of this lowering of the water levels of the Great Lakes system, it is essential that the general nature of the lake traffic should be comprehended.

The commerce of the Great Lakes is enormous. It exceeds the water-borne traffic of any trade route in the world, amounting as it did in 1923 to over one hundred million tons of freight carried per annum. Furthermore, in view of the fact that the navigation season extends over a period of eight months only, say the middle of April to the middle of December, the intensity of the traffic is very great. In order that this commerce may be properly transported, the whole traffic and system has to be very highly organized. The bulk of the freight is carried in very large vessels, of a modern type, designed and built specially to meet the needs of the traffic and of the lake conditions. They are not only of large tonnage, but also of large carrying capacity per ton of dead weight. The result of this highly organized system is that not only is the commerce most expeditiously handled, but it is also handled at an extraordinarily low cost. This is partly made possible by the fact that there are no tolls and the improvements to waterways have been made by the Canadian and United States governments.

The traffic has a load factor of approximately 3 to 1 in favour of eastbound traffic, that is to say, for every ton of traffic carried east, only one-third of a ton is obtained on the westbound trip. Obviously therefore, from the viewpoint of the trade at large, any question of the effect of the lowering of the lake levels on the carrying capacity of the vessels on their westbound trips is of comparatively small account, as there is ample tonnage in the westbound movement to take care of three times the volume of traffic. There is naturally, however, some loss to the operators, as more vessels have to be put into the westbound carrying service than would otherwise be the case, and an economic loss is therefore involved. The great bulk of the traffic westbound, (about 90 per cent), is coal from lake Erie ports.

Of the eastbound traffic, 80 per cent is ore from Minnesota and northern Michigan, while 19 per cent is grain from Fort William, Port Arthur and Duluth-Superior. The bulk of the ore is loaded at Duluth, Agate Bay and Ashland, Minnesota, and Marquette, Michigan. About 83 per cent is shipped to lake Erie ports, with Cleveland, Ashtabula and Buffalo taking the largest quantities, (about 20 per cent each).

The grain traffic, although smaller in tonnage, is nevertheless of great importance, on account of its high value, and is, of course, of supreme importance to Canada.

Approximately 280 million bushels of wheat and 165 million bushels of other grains pass through the Sault Ste. Marie canals in one season. Of this amount about 18 per cent goes to Georgian Bay ports, 22 per cent by the Welland canal to Montreal, and the balance nearly all to lake Erie ports, with Buffalo taking nearly 50 per cent.

Description of the Route

It has been shown that the bulk of the lake traffic is from ports on lake Superior to ports on lake Erie. The vessels pass down lake Superior and reach their first obstruction at Sault Ste. Marie, which is fourteen miles down the upper St. Mary's river from the foot of lake Superior.

At Sault Ste. Marie, there are five locks through which vessels are lowered approximately 20 feet to the lower St. Mary's river. These locks are as follows:—

Figure No. 7—North Side Sewage Treatment Plant under Construction.

Lock	Length	Width	Draft		Date Completed
			Design	Actual	
Canadian Lock..	900 ft.	60 ft.	22.0 ft.	17.7 ft.	1895
U.S. Weitzel....	515 "	60 "	14.0 "	12.0 "	1881
U.S. Poe.......	800 "	100 "	22.0 "	17.5 "	1896
U.S. Davis.....	1,350 "	80 "	24.0 "	24.0 "	1914
U.S. Sabine.....	1,350 "	80 "	24.0 "	24.0 "	1919

After leaving the locks, vessels pass down the St. Mary's river channel into lake Huron.

While obviously the Chicago diversion has no effect on the elevation of lake Superior, nevertheless, traffic to and from lake Superior is affected by the lowering of the water level on the downstream side of the locks, thus reducing the depth over the sills by about six inches for 10,000 cubic feet per second diversion.

After traversing lake Huron, the St. Clair river is entered, but it is not until the outlet of the St. Clair river into lake St. Clair is reached that any serious restriction in depth is found. At this point the river spreads over the St. Clair flats and artificially dredged channels have to be maintained. Lake St. Clair, which is about $5\frac{1}{2}$ feet below lake Huron level, is comparatively shallow with sand and clay bottom. For twenty miles below lake St. Clair, past the city of Detroit, no restrictions are encountered, but before entering lake Erie, 3.1 feet below lake St. Clair, shallow channels again occur. Below this point the only restriction to the draft of vessels is that occurring in harbours, although it must be remembered that lake Erie is a very shallow lake compared with the others.

In order that full advantage may be taken of fluctuation of levels in the various lakes and waterways, constant watch is kept upon the conditions, and vessels loading are kept in close touch by telegraphic advice to the end that they may load down to the maximum possible inch. Even with these precautions groundings are of frequent occurrence. For this reason any lowering of the lake levels in general has a direct reaction on the loading of all those vessels which are large enough to come within the draft limits, which applies to the majority of vessels.

The relationship between lake levels and permissible drafts of vessels is a subject of great importance and interest,

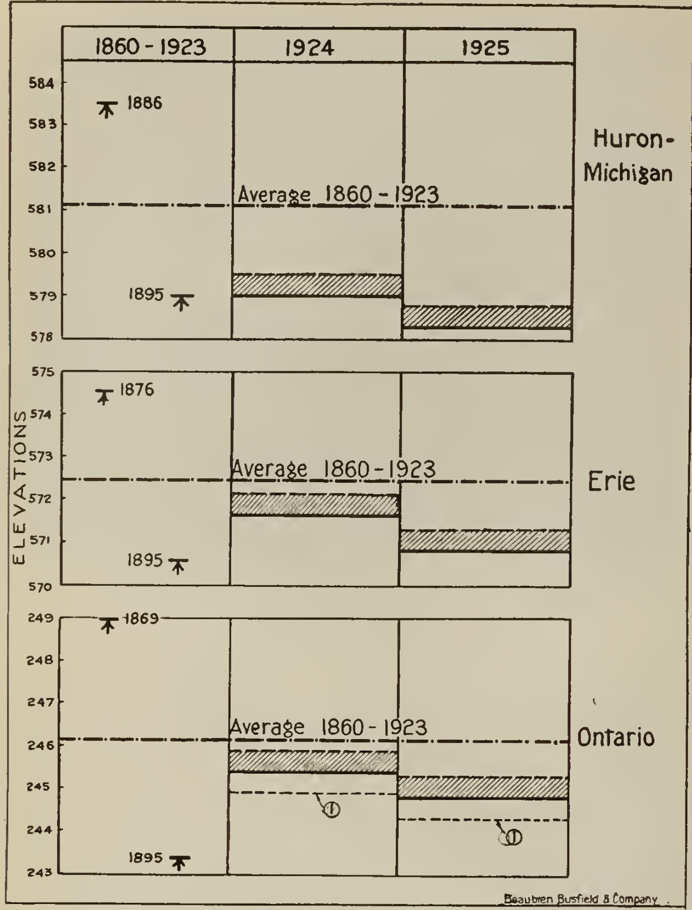


Figure No. 8—Average Lake Levels.
(Based on hydrographs of United States Lakes Survey.)

Arrows indicate extreme high and low water levels between 1860 and 1923.

Hatched portions indicate lowering effect caused by diversion of 10,000 cubic feet per second at Chicago.

Actual average lake levels in 1924 and 1925 indicated by full lines.

Dotted line: 1, represents level to which lake Ontario would have receded but for compensating effect of the Gut dam.

but beyond the scope of this paper, as only the broad principles involved need be discussed in order to comprehend the effect of the diversion at Chicago on the commerce of the Great Lakes.

Lake Levels

During the past few years, there has been a steady lowering of lake levels until in the case of some of the lakes an unprecedented low elevation has been reached. It has already been stated that the effect of the diversion at Chicago is about 6 inches at low lake stages. This is not a matter of guesswork, but is fairly close and reliable mathematical computation obtained by determining the difference in elevation of the various lakes or waterways, corresponding to measured changes in flow at the outlets of such lakes or waterways.

The claim is made by some authorities that the level of lakes Michigan and Huron has been lowered some inches by the dredging and excavation work in the St. Clair and Detroit rivers. This may be so, and indeed, the records of lake levels seem to indicate that such is the case. On the other hand, it is also claimed that a large amount of the excavated material has been so deposited in the channels as to act as compensation for the excavation.

Diversions of water for power purposes and for the Welland and Erie canal all have an effect on the elevation of lake Erie even though the greater part of such diversions are returned to the same system. Taking the discharge of lake Erie at the round figure of 200,000 cubic feet per second, 60,000- cubic feet per second or 33 per cent is withdrawn from Niagara falls, which has a very considerable lowering effect on the Chippawa-Grass Island pool, which in turn has a lowering effect on lake Erie. A small percentage of the above represents direct withdrawals from lake Erie for the New York State barge canal and for the Welland canal. The effect of all these withdrawals is estimated by the Board of Review at 4 inches for lake Erie, with an effect of 2 inches on lakes Huron and Michigan. It may be found, however, on further investigation that actually there is no lowering effect owing to compensation resulting from the dumping of excavated material into the Chippawa—Grass Island pool.

The major lowering of the lake levels has been caused by climatic conditions naturally following a long period of less-than average rainfall, and of unusually dry and warm summers, causing greater evaporation. An examination of the hydrographs of the Great Lakes covering the years 1860 to 1925 indicates that the level of lakes Michigan and Huron in 1925 was on the average 2.8 feet lower than the average for the whole period; of this amount approximately 2 feet is attributable to climatic reasons. Lake Erie has not been affected quite so much, as the lowering in 1925 due to climate may be placed at about 10 or 11 inches.

Regardless of whatever effect these different causes have, there is no getting away from the fact that the drainage canal is the direct cause of lowering all the levels about six inches below what would otherwise be the case. On the other hand, it must be recognized that in years of plenty, when the lake elevations are on the high side of the cycle, the lowering by six inches would not affect so many vessels or cargoes.

Effect of Reduced Draft

It has been shown that from a broad commercial point of view, it is eastbound traffic which has to be considered in relationship to the effect of the diversion, as the westbound traffic is not so seriously interfered with. The eastbound traffic consists of practically two commodities: ore and grain.

During the last five years approximately 55,000,000 tons of freight have been carried eastbound per year. An examination of the statistics of lake commerce, passing the canals at Sault Ste. Marie, indicates that the bulk of the traffic is carried in vessels varying from 3,000 to 7,000 tons net register, corresponding in length from 430 to 600 feet. One inch of draft on vessels of this size represents about 80 tons of cargo, therefore a lowering of the draft by 6 inches means 480 tons per vessel. These vessels carry average cargoes of about 6,000 tons, and about 9,000 vessel-trips are required to handle the total eastbound movement. Under anything like ordinary circumstances the lake levels will be sufficiently high for about one-half the season to provide full drafts regardless of the diversion at Chicago, hence it may be said that about 4,500 vessel-trips are affected, which in turn means 2,160,000 tons loss of carrying capacity. In other words, it may be said that additional carrying capacity to the extent of over 2 million tons per annum has to be provided. The actual cost of handling ore and grain is presumably something less than the freight rate which averages about 80 cents per ton for ore and somewhat higher for grain. If it is taken at 75 cents per ton, it then works out that the cost to Great Lakes navigation of the diversion of 10,000 cubic feet per second at Chicago is $1,620,000. per annum.

The Lake Carriers Association of Cleveland, Ohio, has made careful studies of this whole situation and they have estimated that one inch drop of water level is equivalent to a loss of 500,000 tons carrying capacity of the whole fleet, and therefore 6 inches represents a loss of 3,000,000 tons. With a cost of transportation of 80 cents a ton, this represents a loss of $2,400,000. per annum. The application of the actual freight rate may not be a true indication of the cost of handling the amount of freight which might have been carried by the same number of vessel-trips, if they had been able to carry more cargo per trip, but is probably close enough to give a broad indication of what the lowering means in dollars and cents.

While no doubt somebody loses this amount of money, or to put it in another way, while this represents the additional cost of handling the freight in an average year, it will readily be seen that when it comes to a question of responsibility there are many factors involved which make it a difficult problem to solve. If the subject is being discussed from the point of view of the people at large, however, the chief consideration must be as to whether or not the commerce of the country is being handicapped.

However, out of all the argument which can be made on the subject, there is one fact which stands out beyond dispute and that is that the Chicago drainage canal undoubtedly has an adverse effect on the lake traffic. That the Sanitary District admits this fact is evidenced by its offer to pay for its share of remedial works for counteracting such effect.

Remedial Works

In discussing remedial works with regard to the Great Lakes, differentiation must be made between compensation works and regulation works. The former have the effect of imposing an artificial obstruction to a waterway, which backs up the water and therefore counteracts the lowering effect which may have been caused by the dredging of channels, or by the withdrawal of water. Regulation works, on the other hand, have the function of providing a means of varying the capacity of a waterway and thus of actually regulating the discharge from a lake or flow in a river.

With regard to remedial works for the Great Lakes, the problem is one with many complications, as the general requirements are as follows:—

First—The elevation of the lakes must be raised at the low water stage.

Second—The high water elevation of the lakes must not be changed from existing conditions.

Third—The least possible obstruction to navigation must be provided.

Fourth—The works must be of such a nature as not to induce troubles from ice conditions, and if possible to improve upon present conditions.

Consideration of the first two requirements immediately eliminates compensation works from any further study. The works must therefore be regulatory and must provide means for storing some of the flood discharge of the lake, but yet at times of maximum flood must provide an outlet with a capacity at least as large as exists at present. At the low water stage the works must permit the passage of a larger quantity of water than now flows at the low stage, but must maintain the level of the water at a higher level stage.

Such regulation works have been built and are in operation at Sault Ste. Marie since 1916. By their means, lake Superior is now under regulation with an improved low level, but in order to remedy the lowering effect caused by the diversion at Chicago it is the levels of lakes Michigan, Huron and Erie which have to be remedied. Remedial works for this purpose have been under discussion by the various authorities concerned for many years. Under some plans it has been considered sufficient to build the works at the outlet of lake Erie into the Niagara river, and that there would be sufficient backwater effect through the Detroit and St. Clair rivers to raise lakes Huron and Michigan. On the other hand, plans have also been studied for two projects, one at the foot of lake Huron, the other at the Niagara river. The objection is raised to the lake Huron project that it will place an obstruction in the path of navigation on the busiest waterway in the world.

The position to-day is that the problem is not entirely solved, but there is no doubt that before very long a satisfactory solution will be found, and remedial works will be built which will at least have the effect of maintaining the desired depths in all the main waterways, regardless of the fluctuation in rainfall, and withdrawal by Chicago. The position of the Sanitary District with regard to these works is that they have agreed to bear their share of the cost as determined by the United States chief of engineers, and, in accordance with the permit of March 2nd, 1925, have deposited a million dollar bond with the secretary of war as a guarantee of good faith. It is only fair, however, to add that the trustees of the Sanitary District have been on record for many years as willing to bear the cost of compensation works as soon as the United States authorities would agree on the form to be built.

Effect of Remedial Works

Properly designed, constructed and operated, remedial works may have the effect of counteracting not only the reduction in lake levels by the diversion at Chicago, but also of the lowering caused by the diversion at Niagara Falls, and also of the lowering which periodically occurs, due to climatic reasons. In other words, the remedial works may maintain a lake level approximately equivalent to an average condition without any diversions. In this way, the present adverse effect on lake traffic may be entirely eliminated.

A second function of the works will be the improving of the regime of the outflow from lake Erie, that is, the Niagara river. By withholding some of the natural run-off during the high water period, additional water may be made available during the low water period. The discharge, for instance, of the Niagara river goes as low as 160,000 cubic feet per second, but with regulation of the upper lakes, it has been estimated that this may be increased to 180,000 cubic feet per second. The obtaining of such a result would require most careful operation of the whole storage system and it is improbable that quite such a good result would be continuously in practice, but, nevertheless, it is quite within the bounds of reason that the low flow of the Niagara river may be continuously increased by an amount at least equivalent to the amount of the diversion. At first glance, it would therefore appear that suggested remedial works will immediately have the effect of counteracting the effects of the diversion on the whole of the waterway from the Great Lakes to the gulf of St. Lawrence, partly by raising the levels of the lakes and partly by providing additional low water flow below lake Erie, but this will not be the case, as will be shown later.

St. Lawrence Canals

Heretofore the discussion has been confined to the Great Lakes as representing the major part of the traffic. It must not be forgotten, however, that the effect of the diversion at Chicago is continuously felt all the way down the St. Lawrence system, (including lake Ontario), until tidal water is reached. Furthermore, the actual lowering effect of the diversion is somewhat greater in the reaches of the St. Lawrence than it is on the Great Lakes, and according to Colonel Warren, amounts to 9 inches at low water in the reach of the river above Morrisburg.

The Welland canal forms the connecting link between the Great Lakes and the St. Lawrence waterway, and is now limited to vessels of 14 feet draft, but is being rebuilt with locks providing for 30 feet over the sills, and the canal itself with a depth of 25 feet.

The St. Lawrence river between lake Ontario and Montreal is 180 miles long, and is made up of a series of canals flanking various rapids with intermediate reaches. The rapids are utilized to a limited extent for downstream navigation although the lower ones are confined to passenger vessels. The following table gives general particulars of each of the six canals.

	Length miles	No. of Locks	Locks length feet	Width feet	Depth feet
Galops	7.33	3	270	45	14
Morrisburg	3.67	2	270	45	14
Farrans Point	1.25	1	800	50	14
Cornwall	11.00	6	270	45	14
Soulanges	14.00	5	280	45	15
Lachine	8.50	5	270	45	14

A project for improving and deepening the waterway from the Great Lakes is now being studied and reported upon by the Joint Engineering Board for the St. Lawrence Waterway.

Traffic on the St. Lawrence canals for the year 1924 amounted to a total of 5,536,374 tons, of which 4,593,618 tons or 83 per cent was eastbound and 942,756 tons or 17 per cent westbound. Here again it is eastbound traffic therefore in which the question of drafts most seriously enters, although there is quite a volume of westbound package freight business in which the vessels are loaded to draft limits. Of the 4,593,618 tons eastbound, 3,532,755 tons (77 per cent) is grain, 662,787 tons (14 per cent) is coal, and the balance miscellaneous.

The average cargo carried by eastbound vessels amounted to about 1,850 tons involving 2,360 trips per season. The loss per vessel of 9 inches draft would be represented by about 300 tons for vessels operating on this route. A large proportion of the traffic is moved during the latter part of the season, at a time when the water levels are at their lowest; the effect of the lower levels is therefore very seriously felt. If 1,000 trips are affected, it means that additional shipping has to be supplied for the movement of 300,000 tons, which would represent about 160 vessel-trips per annum with average cargoes. This in turn represents a cost per annum of approximately half a million dollars on the assumption that the vessels are only plying between Port Colborne and Montreal.

As a matter of fact the money end of the matter hardly represents the seriousness of the situation. It is well known that the grain traffic on the St. Lawrence route is badly handicapped to-day owing to the limited capacity of the canal system. Naturally the reducing of the cargo-carrying capacity of the vessels using the canals is introducing another serious handicap on top of the first one. During the limited period for movement of the grain prior to the close of navigation, there is no question but what every inch counts.

The Port of Montreal

As Chicago is the great railway junction of the middle west, so is the port of Montreal the great junction for international water-borne traffic. On the one hand, it is the great western terminus of ocean navigation to which vessels from seventeen different countries come, while on the other hand, it is the eastern terminus of the traffic of the Great Lakes-St. Lawrence system. The two great transportation systems are brought together and their goods interchanged under the auspices of the port of Montreal.

As the St. Lawrence canal system has its lower outlet into the harbour of Montreal at the lower lock of the Lachine canal, the foregoing references covering the St. Lawrence canals apply to this part of the traffic.

With the increasing size of the ocean-going vessel, the depth of the navigable waterway leading from the open sea into Montreal harbour has had to be continually increased, but for a number of years past, has been maintained at about 30 feet. The intention has been to ultimately provide a 35-foot waterway, but with the increasing difficulty of maintaining even the 30-foot depth at all times it is probable that some radical change will have to be made in the system with the increasing development of the port.

It is no exaggeration to state that a large percentage of outbound vessels load up to the last inch permissible with the river depths available at the time of sailing. In many instances vessels are unable to take on their full load at Montreal, and have completed their loading at Quebec. An examination of the records of water levels in the harbour indicated that in the past twenty-five years the levels have dropped below the height necessary to maintain the 30-foot channel ten times, while in the past five years it has been below at some period in every year. Records also show that the low level period extends over the months of August to November inclusive, or four months out of the seven during which the port is open for navigation. The latter four months, incidentally, are the busiest, and include the peak of grain shipments.

The traffic of the port, according to the last published report of the Harbour Commissioners, amounts to the following:—

Imports—General	1,472,933	tons
Exports "	931,854	"
Local "	1,918,346	"
Lumber	225,000	"
Grain	4,662,456	"
Miscellaneous	100,000	"
	9,310,589	"

This traffic was handled by 1,223 vessel-trips, representing an average cargo of 7,600 tons. It is probable that somewhat more than 4/7 of this number, or say 750, come within the period when there is limitation upon drafts, but of this number many are small vessels, and according to studies made by the Shipping Federation of Canada, about 100 vessel-trips are affected. These vessels will range from the large liners of about 16,000 tons down.

At the time of writing, the Shipping Federation of Canada are making a study of the number of vessels affected and the loss of cargo per vessel, and definite figures are not as yet available. The effect of low water levels, however, is a very serious one, as many complications are introduced. For example, some of the oil-burning steamers have to stop at Quebec for the express purpose of filling up their oil tanks. Some vessels are also delayed at Quebec taking on cargoes which should have been loaded at Montreal. Some vessels have to make the whole voyage across the Atlantic short of many tons of cargo. That the situation is a very serious one is expressing it very mildly.

Remedial Works for St. Lawrence River

Owing to the intervention of lake Ontario the additional low water flow made available by suggested remedial works at the outlet of lake Erie would not have the same effect on the river St. Lawrence. That is to say, if for example it were possible to maintain an additional flow of 10,000 cubic feet per second from lake Erie during the extreme low water period, this quantity would to a large extent be stored in lake Ontario and instead of increasing the low water discharge thereof, it would be spread more uniformly over the year, so that the low water discharge might only be increased by say, 1,000 cubic feet per second. Therefore, in order that the effect of the Chicago diversion on the St. Lawrence river be remedied, regulatory works for lake Ontario become necessary.

The lowering of lake Ontario has already been partly compensated for by the construction in 1903 of the Gut dam, across one of the small channels of the St. Lawrence, opposite the upper end of the Galops canal. This dam has had the effect of raising lake Ontario about 5 inches at low water and 8 inches at high water. This work, however, has no beneficial effect on the levels below this point.

In order to remedy low water conditions on the St. Lawrence river, regulatory works at some place suitable for the control of lake Ontario will be required. Such works may increase the low water flow by an amount at least equivalent to the withdrawal at Chicago, but, even so, it must not be overlooked that even greater benefits could be obtained if the withdrawal did not exist.

The present status of the matter is that the commission to the Joint Engineering Board for the St. Lawrence Waterway instructs the board to take into consideration the effects of the diversion at Chicago in designing regulation works for the lake system, and in view of the fact that their report is due within the near future, it is inopportune to refer further to the subject.

Summary of Effect on Navigation

As shown in the foregoing paragraphs, there are three great navigation systems, which are seriously affected by the diversion at Chicago; namely, the Great Lakes, the upper St. Lawrence and the ocean traffic from Montreal. While an attempt has been made to give an indication of the monetary effect, it must be borne in mind that this is really only a very general indication and that the interference with or obstructing of the traffic of a great trade route has effects more far-reaching than can be represented by a simple mathematical calculation.

Effect on Power Development

In considering the effect of the diversion at Chicago on power development, the first principle which must be clearly understood is that any remedial works, no matter of what nature, cannot entirely replace the value of the diverted water for power development purposes. Regulation works may increase the low flow of the Niagara and St. Lawrence rivers and thus increase the amount of power that might be developed, but if there were no diversion at Chicago, the amount of power obtainable would be just so much increased over and above such improvement as might be made by the regulation works.

Power developments or sites affected by the diversion are Niagara Falls and the various sites on the St. Lawrence river. At Niagara Falls the uses of water for power purposes are divided between Canada and the United States, and in the upper part of the St. Lawrence joint ownership is again involved. The lower part of the St. Lawrence, including the Coteau, Cedars, Cascades and Lachine rapids, is under the entire ownership of Canada. To go into the power situation fully leads one into a field of speculation and uncertainty with little possibility of any stable conclusions, but from the broad economic point of view certain quite definite conclusions as to the effect of the withdrawal at Chicago can be reached. In the first place the whole question of power development on the St. Lawrence is undergoing intensive study by the Joint Board of Engineers and at the same time there are most involved problems in connection with public policies with regard to the development in both Canada and the United States, so that a statement regarding what is a possibility to-day may become an impossibility to-morrow.

Power at Niagara Falls

In round figures, the quantity of 10,000 cubic feet per second is capable of producing 300,000 horse power at Niagara Falls. Looking at the situation as it stands to-day, the fact stands out that even if the diverted quantity were available, it could not be used, as the boundary waters treaty limits the United States to the use of 20,000 cubic feet per second, and Canada to 36,000 cubic feet per second for power purposes at Niagara. These quantities are already being utilized, and therefore theoretically, any additional water made available in the Niagara river would have to go over the falls and have no value, except that of maintaining the beauty of the falls.

On the other hand, ignoring treaty and other limitations, there is certainly a direct economic loss to somebody, as the 300,000 horse power obtainable from the diverted water, or at least a large proportion of it, could be immediately developed at Niagara without the installation of any machinery, and without changing the flow over the falls. Incidentally the demand for power is such that it could all be utilized immediately.

The St. Lawrence River

In this case the situation is somewhat different. If the diversion were non-existent, the amount of water now utilized, say 10,000 cubic feet per second, could not be utilized for power development. Unlike Niagara falls the potentialities of the St. Lawrence river for power have been practically untouched, and for this purpose the effect of the diversion can hardly be felt until such time as the power resources of the river are being utilized to an extent approaching the limit of development. That this will not be at any very distant day must be clear to any one who has the most rudimentary knowledge of the power situation centering on the St. Lawrence, and the situation that existed not so very long ago when it appeared as though the loss of possible power output was something that could only occur at a very remote time, is no longer existent.

In the International section of the St. Lawrence there have been numerous different plans suggested for development of power, but regardless of what plan is utilized, provided reasonably full advantage is taken of the total head available, a quantity of water amounting to 10,000 cubic feet per second would produce somewhere in the neighbourhood of 75,000 to 85,000 horse power. Similarly in the purely Canadian section of the St. Lawrence, between lake St. Francis and Montreal, there is a potentiality in the same amount of water amounting to 100,000 horse power or more.

The quantity of water diverted may not amount to a large percentage of the low flow of the St. Lawrence, nevertheless the total economic value of all the power which might be obtained from the diverted water, namely something approaching 500,000 horse power, is so great that it represents the power required by industries who would spend on the average $200,000,000 annually in wages alone.

Conclusion

In conclusion the author wishes to express his appreciation of the courtesies and assistance extended to him by many different people, including in particular the engineers of the Sanitary District of Chicago, without whose hearty assistance the physical description of their undertaking would have been impossible.

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Maritime Professional Meeting

Sydney, N.S., August 17th and 18th, 1926.

A tentative programme has been prepared for the forthcoming Maritime Professional Meeting which will be held under the auspices of the Cape Breton Branch of The Institute at Sydney, N.S., on August 17th and 18th, 1926.

The provisional programme provides for two papers, the first of which will be on the Humber development in Newfoundland, and arrangements are being made for the second paper to deal with the subject of coal. Extensive arrangements are being made for visits to works of interest and for the entertainment of members attending the meeting. In connection with the latter, there will be an informal dinner and dance on the evening of the first day, and the meeting will close with a banquet on the evening of the second day.

Transatlantic Wireless Telephony

Canadians, and particularly Canadian engineers, cannot fail to be interested in an important advance which has recently taken place in the development of telephonic communication across the Atlantic. Experiments in one-way radio telephone transmission from the United States to England have been conducted for some years, and a measure of success was attained in 1915. The tests of 1923* showed a marked improvement in clarity and uniformity of reception, and a further notable achievement has now to be recorded.

On March seventh last, a number of persons in London were able, by the latest development in telephonic communication, to carry on individual conversations with persons in New York, speech being heard with little or no difficulty at both ends.

This date is the fiftieth anniversary of that (March 7th, 1876), on which a United States patent was granted to Dr. Graham Bell, a Scotsman who had emigrated to Canada and afterwards worked in the United States, for his invention covering the electrical transmission of speech by undulating currents.

In Bell's time no one had any idea of the powerful weapon which the invention of the thermionic valve would place in the hands of telephone engineers, nor indeed did anyone dream that wireless telephony would be a possibility, much less that conversation would be carried on over three thousand miles of ocean and six hundred miles of land.

The results now obtained have been made possible by the tireless research of engineers on both sides of the Atlantic, particularly by the work of the technical staff of the Bell Telephone Laboratories and the Radio Corporation in the United States, and of the British Post Office and the International Western Electric Company in Great Britain.

While it is not to be expected that a public telephone service between Great Britain and the United States will be inaugurated at an early date, this marvellous result may possibly follow in due course if the experimental transmissions continue to operate successfully.

The chief difficulties encountered in attempting a regular service of this kind are due to diurnal and seasonal variation in the ratio of signal strength to static noise, and it is understood that commercial success will largely depend on whether these disturbing influences can be satisfactorily dealt with.

During the recent tests the circuits terminated at the London Trunk Exchange of the British Post Office in Queen Victoria Street, and in the Walker Street headquarters of the American Telegraph and Telephone Company in New York. Speech from New York was conveyed by a land line about seventy miles long to the transmitting station of the Radio Corporation at Rocky Point, Long Island, and thence by wireless on a wave length of 5,260 metres to the British receiving station at Wroughton in Wiltshire, some three thousand three hundred miles distant from Rocky Point, thence over an underground line ninety miles to the London Exchange. In the reverse direction speech from London was conveyed to Rugby by an eighty-mile underground line, from Rugby by wireless on a wave length of 5,770 metres to Houlton, Maine, thence by a land line six hundred miles to New York. During the demonstration each person present was permitted to converse for two minutes with another person on the other side of the Atlantic, and the opportunity was naturally taken to interchange congratulations between British and American scientists and engineers.

Many difficulties still remain to be overcome both in connection with the wireless transmission and the land line

*See Journal A.I.E.E., August 1923.

circuits, but the satisfactory results which have now been obtained indicate most favourable prospects for further development.

International Screw Thread Standardization

It is remarkable that in many continental European countries, where the metric system is in use, a very large proportion of the screw threads used in mechanical engineering work are made to inch measurement, and follow the system of screw thread standards originated in England by Sir Joseph Whitworth. Metric threads are in use also in these countries, but principally for the smaller sizes below 6 mm. diameter.

In England the Whitworth system is, of course, universally adopted, except for fine threads, for which one of finer pitch (the "British Standard Fine Thread"), is employed. In the United States the question has been authoritatively dealt with by the National Screw Threads Commission, and the resulting thread system, based on the Sellers form, together with its appropriate tolerances, has been completely defined, is generally accepted in the United States, and is largely used in Canada. With the exception of the half-inch size (which has thirteen threads per inch as against the British twelve), the American series of coarse threads has the same relation of pitch to diameter as the Whitworth, but a slightly different thread profile, with a 60° angle, instead of 55° as in the Whitworth thread. The differences in the two systems, resulting of course in lack of interchangeability, made themselves felt during the war, and there has been a feeling on both sides of the Atlantic that an effort should be made to devise some means of getting over this difficulty, so that for all work, or at all events for all work not requiring the highest class of fit between bolt and nut, a British standard nut should be capable of assembly with an American standard bolt, and vice versâ.

Informal discussions have taken place on several occasions between representatives of the British Engineering Standards Association, the Canadian Engineering Standards Association, and the American Engineering Standards Committee, and the question has recently been receiving attention at the third International Conference of Secretaries of the various national standardizing bodies, which has just been held in New York.

At this conference a suggestion was made by Sir Richard Glazebrook, based on an idea originally put forward from the American side, that a form of thread should be studied which would assemble either with the British or the American thread; such a thread having the necessary clearance at crest and root, a thread angle of $57\frac{1}{2}°$, and tolerances on pitch and pitch-diameter similar to those accepted for the present standard threads.

The practical interchangeability of such a thread with the British and American was demonstrated by a series of accurate gauges prepared at the National Physical Laboratory, and the scheme was considered so promising as to merit careful consideration by all the national standardization organizations represented at the conference. If the details of such a system can be satisfactorily worked out, there would seem to be a reasonable prospect of its adoption by some of the countries where both British and American screwed material is in considerable use, and in this manner the way might be opened for its eventual use in Great Britain and the United States. The movement thus initiated is an encouraging step along the road of international standardization.

OBITUARIES

Louis A. Herdt, M.E.I.C.

News of the death of Louis A. Herdt, D.SC., F.R.S.C., M.E.I.C., has been received with deep regret by members of The Engineering Institute of Canada throughout Canada.

The late Dr. Herdt was an outstanding figure in the electrical engineering branch of the profession, and in addition to being Macdonald professor of electrical engineering at McGill University, he was vice-president of the Montreal Tramways Commission and president of the Electrical Service Commission for the city of Montreal.

Dr. Herdt was born at Trouville, France, on June 14th, 1872, and early in life left his native land to come to Canada. He was educated at the Montreal High School and McGill University, from which he graduated in 1894 after a brilliant course in electrical engineering. In 1902 he took his Master of Engineering degree, and in 1910, the degree of Doctor of Science. He held the degree of Electrical Engineering from the Montefiore Electrotechnical Institute of Lièze, Belgium, and was also a graduate of the Laboratoire Central d'Electricité, Paris. On his return to Canada, he joined the staff of McGill University in 1896, being successively demonstrator in electrical engineering, lecturer, assistant professor, associate professor, and finally head of the department.

Among other engineering works, Dr. Herdt had been consulting engineer on the following:—hydro-electric plant, Joliette, Que; hydro-electric plant, Rimouski, Que.; hydro-electric plant, Lachine canal; steam electric plant, Witness Printing Company, Montreal; hydro-electric development, city of Winnipeg, Man.; hydro-electric plant, A. C. Edwards Company, Ottawa; street railway system, Winnipeg Electric Railway Company.

In 1905 Dr. Herdt was appointed Officier de l'Académie de France and Chevalier de la Légion d'Honneur in 1923. He was also a Fellow of the American Institute of Electrical Engineers, and was elected Associate Member of The Engineering Institute of Canada (then the Canadian Society of Civil Engineers), on January 5th, 1899, and was transferred to Member on November 13th, 1909. During the year 1906, and from 1909 to 1912 inclusive, Dr. Herdt served on the council of the Institute.

Andrew C. Loudon, A.M.E.I.C.

It is with regret that we record the death of Andrew C. Loudon, A.M.E.I.C., vice-president of the Superheater Company Limited, which occurred in Montreal on April 11th, 1926.

The late Mr. Loudon had been operating executive in charge of all branches of the company's activities since 1919. He was born at Valleyfield, Que., on July 7th, 1883, and was a graduate of McGill University, from which he received the degree of B.Sc. in 1906.

With the exception of one summer during which he was engaged on survey work, Mr. Loudon, prior to graduation, was associated with the Grand Trunk Railway as special apprentice. After completing his course at McGill University, he was draughtsman with the American Locomotive Company for two years. Subsequently he accepted the position of locomotive foreman with the Grand Trunk Railway during the latter part of 1907 and 1908. In 1909 he was with the Delaware and Hudson Company as draughtsman for a short period, later joining the staff of the A.F. & S.F. Railway. In 1910 he was appointed general foreman with the Grand Trunk Railway at Winnipeg, Man., which position he occupied until 1912, when for four years he was editor of the mechanical department of Railway Age.

In 1916 he joined the Locomotive Superheater Company and was acting assistant chief engineer, executive assistant and Canadian manager, and, subsequently in 1919, he was appointed to the position which he occupied at the time of his death.

Mr. Loudon was admitted to The Institute as Associate Member on July 22nd, 1919.

Leroy Thorne Bowes, A.M.E.I.C.

A promising career came to a sad termination on Monday March 15th, when Leroy Thorne Bowes, A.M.E.I.C., of the Hydrographic Survey, Ottawa, passed quietly away at the Ottawa Civic Hospital. The late Mr. Bowes had been in poor health since last July, following a painful accident on one of the St. Lawrence Ship Channel vessels below Quebec. From that date he had fought a courageous downhill struggle and throughout the many dreary months of his illness the fortitude and cheerfulness exhibited by him had won for him the sympathetic wonder and admiration of his large circle of friends and colleagues in The Engineering Institute of Canada, Professional Institute, and the Civil Service at large.

A native of New Brunswick, born in Sackville in 1890; a graduate in Science and Arts of Acadia University in 1912, he came into the Civil Service at Ottawa the following year, joining the staff of the Canadian Hydrographic Survey, immediately following which he spent four adventurous years in James Bay waters, on the chartering of sections of the northern sea routes. He was also engaged in similar service on the Great Lakes and St. Lawrence river and gulf, and in 1921 was a member of the hydrographic staff sent to Hamilton Inlet on the Labrador coast, to procure evidence for the Department of Justice in connection with international boundary disputes.

The late Mr. Bowes had always a fondness for literature, coming as he did from a Maritime family prominent in journalism, and was beginning to make an enviable name for himself as a writer of poetry and prose.

The large representative gathering of Institute members and friends in attendance at his funeral on Wednesday, March 17th, bore evidence of the esteem in which the late Mr. Bowes was held.

PERSONALS

Frank Folemsbee, Jr., S.E.I.C., is on the staff of the division of sewers of the City of Miami, Florida.

Harry Jardine, S.E.I.C., has been appointed district engineer with the Department of Public Highways, Ontario, covering provincial and county highways of Brant, Wentworth, Oxford and Wellington.

Joseph Hardouin, A.M.E.I.C.,who has for a number of years been in charge of survey parties for the Topographical Surveys Branch, has been transferred to the Natural Resources Intelligence Service of the Department of the Interior, Ottawa, Ont.

T. W. Creighton, S.E.I.C., who is on the engineering staff of the Canadian Pacific Railway Company, has been transferred from Lethbridge, Alta., to the divisional engineer's office at Kenora, Ont. Mr. Creighton graduated from the Royal Military College, Kingston, in 1921.

S. J. Davies, A.M.E.I.C., who recently resigned from the position of petroleum engineer with the Dominion government for Alberta, has entered private practice in Calgary as consulting engineer on oil and gas projects, and has been retained by the government of Alberta in a consulting capacity.

B. H. Segre, A.M.E.I.C., has been transferred from the Topographical Surveys Branch to the Natural Resources Intelligence Service of the Department of the Interior, Ottawa, Ont. Mr. Segre has been engaged on Dominion land surveys since 1907. He is a graduate of the University of Toronto of the class of 1913, and is also a Dominion Land Surveyor.

Miss H. M. White, Jr.E.I.C., formerly assistant plant engineer, Department of Telephones, Saskatchewan Government, has accepted a position on the engineering staff of the Northern Electric Company in Montreal. Miss White is a graduate of Dalhousie University, from which she received the degree of B.A. in 1921, after which she completed the engineering course at the same university.

W. H. Norrish, A.M.E.I.C., has been transferred from the Topographical Surveys Branch to the Natural Resources Intelligence Service of the Department of the Interior at Ottawa. Mr. Norrish has been connected with the Topographical Surveys Branch engaged in land survey work in western Canada for a number of years. He is a graduate of Queen's University and is also a Dominion, Ontario, and Alberta Land Surveyor.

W. Hamilton Munro, M.E.I.C., S.P.S., '04, has been appointed manager of the Nova Scotia Tramways and Power Company, Limited. Mr. Munro resigned as sales manager of Canadian Vickers Limited, Montreal, in order to go to Halifax, and reports having encountered a spirit of enthusiasm, good fellowship and business earnestness there which gives him much satisfaction in having chosen Halifax as a home.

H. R. Burton, S.E.I.C., has been appointed town assessor and town engineer of Fort Erie, Ont. Mr. Burton graduated from the University of Toronto, receiving his degree of B.A.Sc. in civil engineering in 1921, and since graduating has been with the Canadian Inspection Company, the city architect's department, Toronto, and the Canada Creosoting Company. Mr. Burton served for three years overseas with the Divisional Signal Corps.

Donald G. Robertson, Jr.E.I.C., is located at East Templeton, Que., on the construction of the new paper mill for the International Paper Company. Mr. Robertson graduated from Queen's University in 1924 in civil engineering and was for a short time in the Southern Canada Power Company on the construction of their power development at Hemming's Falls, Drummondville, Que., and has recently been with the Riordon Pulp and Paper Corporation at Temiskaming, Que.

H. M. Jaquays, M.E.I.C., manager of eastern plants of the Steel Company of Canada Limited, with headquarters at Montreal, has been elected to fill the vacancy on the board of directors of the company caused by the death of the late Robert Hobson, M.E.I.C. Mr. Jaquays was born at Frelighsburg, Que., on November 10th, 1870, and received his degree of B.Sc. from McGill University in 1896. He was engaged for several years on engineering work in England and the United States, and returned to Canada in 1901 to join the staff at McGill University, where he was lecturer and assistant professor in mechanical engineering. In 1906 he became chief engineer of Montreal Rolling Mills Company.

A. E. Berry, A.M.E.I.C., has been appointed acting sanitary engineer in the Ontario Department of Health, succeeding F. A. Dallyn, M.E.I.C. Mr. Berry had been assistant sanitary engineer with the department since September 1919. He was born in St. Marys, Ontario, in

1894, and after matriculating from St. Marys' Collegiate Institute he attended the Faculty of Applied Science, University of Toronto, graduating in civil engineering with honours in 1917, and four years later, in 1921, he received his degree of M.A.Sc., and in 1923 he was awarded his degree of C.E. in the University of Toronto for a thesis on "The Collection and Disposal of Municipal Refuse." Following graduation, Mr. Berry was employed with the Ontario Department of Health for a short period after which he went overseas and served with the Royal Engineers. On his return to Canada, he joined the engineering staff of the Department of Health and later became assistant sanitary engineer.

ELECTIONS AND TRANSFERS

At the meeting of Council held on April 27th, 1926, the following elections and transfers were effected:—

Members

BOLTON, Launcelot Lawrence, M.A., B.Sc., (Queen's Univ.) Asst. Deputy Minister, Dept. of Mines, Ottawa, Ont.

JONES, Charles Hugh LePailleur, Lake Superior Paper Co., Spanish River Pulp & Paper Mills Ltd., Fort William Paper Co., Ltd., Manitoba Pulp & Paper Co. Ltd., and Kaministiquia Power Co., Sault Ste. Marie, Ont.

Associate Members

ATTFIELD, Arthur Evans, examiner of topography, Dept. of National Defence, Ottawa, Ont.

CAMERON, Edward Parke, B.Sc., (McGill Univ.), Forest Products Labs. of Can., Montreal, Que.

CUTTLE, William Gordon, B.Sc., (McGill Univ.), steam plant supt., Laurentide Co. Ltd., Grand 'Mere, Que.

DUFFY, Rob Roy, B.Sc. in Arts, (Arcadia Univ.), B.Sc., (McGill Univ.), asst. land surveyor, Price Bros., Chicoutimi, Que.

FORTIER, Henri, engr., technical service of City of Montreal, Que.

HERBISON, Robert Milliken, mech'l. designer and field engr., Dom. Bridge Co. Ltd., Lachine, Que.

KENNEDY, Duncan, res. engr. on substructure of Montreal-South Shore Bridge for Monsarrat & Pratley, Montreal, Que.

MONTIZAMBERT, Harry Bell, res. engr., Highways Br., Dept. of Public Works, Strathmore, Alta.

PEARSON, Vernon, mech'l. supt. of Provincial Gov't. of Alta., Edmonton, Alta.

REID, James William, B.Sc., (McGill Univ.), Board of Railway Commissioners, Calgary, Alta.

ROSS, Alexander Daniel, M.Sc., (Mass. Inst. of Tech.), asst. elec'l. engr., Wayagamack News Limited, Three Rivers, Que.

THOMAS, Arthur, with topog'l. surveys, Dept. of Nat'l. Defence, Ottawa, Ont.

Juniors

HYMAN, Howard Davison, B.Sc., (McGill Univ.), Mattagami Pulp & Paper Co., Ltd., Smooth Rock Falls, Ont.

McKILLOP, Vernon Archibald, B.A.Sc., (Univ. of Toronto), asst. elec'l. engr., Public Utilities Comm., London, Ont.

McQUEEN, Neil, geologist, Imperial Oil, Ltd., Toronto, Ont.

SMITH, Robert Macfie, B.A., B.Sc., (McGill Univ.), Shawinigan Water & Power Co., Montreal, Que.

Affiliate

O'BRIEN, John Ambrose, managing director, M. J. O'Brien Ltd., Ottawa, Ont.

Transferred from class of Associate Member to that of Member

HARRIS, Richard C., divn. engr., Calgary Division, C.P.R., Calgary, Alta.

TRAILL, John James, B.A.Sc., C.E., (Univ. of Toronto), engr. of tests, hydraulic dept., Hydro-electric Power Comm. of Ont., Toronto, Ont.

Transferred from class of Junior to that of Associate Member

CROMBIE, Hugh Arthur, B.Sc., (McGill Univ.), i/c estimating dept., Dom. Engineering Works, Ltd., Montreal, Que.

DUSTAN, Ernest Bruce, B.A.Sc., (Univ. of Toronto), designing dftsman. with Hydro-electric Power Comm. of Ont., Toronto, Ont.

EADIE, Robert Scott, B.Sc., and M.Sc., (McGill Univ.), with Dominion Bridge Co., Lachine, Que.

FULTZ, Stephen Lloyd, B.Sc., (N.S.Tech. Coll.), with N.S. Power Comm., Halifax, N.S.

HAMER, Thurston Moseley, B.Sc., (McGill Univ.), western railroad engrg. representative, Air Reduction Sales Co., Chicago, Ill.

McKINNEY, James Harold, junior engr., Dept. of Public Works, St. John, N.B.

NORRIS, Charles Adam, B.A.Sc., (Univ. of Toronto), constrn. engr., Bremner Norris & Co., Montreal, Que.

WHITING, Harold John, with Riordon Pulp Corpn. Ltd., Temiskaming, Que.

Transferred from class of Student to that of Associate Member

HOLDCROFT, William P. R., B.A., B.Sc., (Queen's Univ.), president and gen. mgr., Holdcroft Construction Co. Ltd., Kingston, Ont.

PATTERSON, Arthur L., B.Sc., (McGill Univ.), structural and hydro-electric design, Shawinigan Engrg. Co., Montreal, Que.

POE, Alexander Spence, B.Sc., (McGill Univ.), structural and hydro-electric design, Shawinigan Engrg. Co., Montreal, Que.

WILSON, William Stewart, B.A.Sc., (Univ. of Toronto), demonstrator in engrg. drawing, Faculty of App. Sci., Univ. of Toronto, Toronto, Ont.

Transferred from class of Student to that of Junior

BRITTAIN, Charles Leslie, B.A.Sc., (Univ. of Toronto), in lab. of Gutta Percha and Rubber Limited, Toronto, Ont.

BUCKMANN, Karl Emil, B.A.Sc., (Univ. of Toronto), with Toronto Showcase Co., Toronto, Ont.

CLIMO, Cecil, B.Sc., (Queen's Univ.), asst. constrn. engr., Carborundum Co., Niagara Falls, N.Y.

HOLMES, George Raymond, B.Sc., (N.S. Tech. Coll.), junior partner, Holmes Stevedoring Co., Hamilton, Bermuda.

LANCTOT, Raymond, B.Sc., (McGill Univ.), engr., elec'l. dept., Montreal Water Board, Montreal, Que.

McCURDY, Lyall Radcliffe, B.Sc., (McGill Univ.), sessiona lecturer and demonstrator, Dept. of Mech. Engrg., McGill Univ., Montreal, Que.

MILNE, Oswald, engrg. dept., Canadian Vickers Ltd., Montreal, Que.

RAMSEY, Kenneth MacPherson, B.Sc., (McGill Univ.), i/c sales office and consltg. engr., Citadel Brick Co., Montreal, Que.

SMITH, Sanford Arnold, B.A., (Dalhousie Univ.), B.Sc., (N.S. Tech. Coll.), asst. to ch. engr., Whitlock Coil Pipe Co., Hartford, Conn., U.S.A.

SMITH, Walter Maxwell, B.A.Sc., (Univ. of Toronto), electrical engr., i/c assembly and test, Robbins & Myers Co. of Can. Ltd., Brantford, Ont.

Recent Additions to the Library

Transactions, Proceedings, etc.

PRESENTED BY THE SOCIETIES:

- Year Book of the American Society of Mechanical Engineers, 1926.
- Journal and Record of Transactions of the Junior Institution of Engineers, Vol. 35, 1924-25.
- Proceedings of the 28th Annual Meeting of the American Society of Mechanical Engineers, 1925.
- Proceedings of the Lake Superior Mining Institute, Vol. 24, 1925.
- Transactions of the Society of Engineers, 1925.
- Transactions of the Institution of Engineers, Australia, Vol. 4, 1923.
- Year Book of the American Institute of Electrical Engineers, 1926.
- Transactions of the Engineering Association of Malaya, Vol. IV, 1924.

Technical Books

PRESENTED BY THE NORMAN W. HENLEY PUBLISHING COMPANY:

- Storage Batteries Simplified—V. W. Page.
- Standard Electrical Dictionary—T. O'Conor Sloane.

PRESENTED BY JOHN WILEY & SONS.

- Concrete—Plain and Reinforced, Vol. 1, by Taylor, Thompson and Smulski.

PRESENTED BY McGRAW HILL COMPANY.

- Superpower, its Genesis and Future, by W. S. Murray.

PRESENTED BY D. VAN NOSTRAND COMPANY.

- Draft and Capacity of Chimneys, by J. G. Mingle.

Reports, etc.

PRESENTED BY THE DEPARTMENT OF TRADE AND COMMERCE, CANADA:

- Sixth Census of Canada, Vol. 5, 1921.

PRESENTED BY THE NEW BRUNSWICK ELECTRIC POWER COMMISSION:

- Sixth Annual Report, 1924-25.

PRESENTED BY NATIONAL ELECTRIC LIGHT ASSOCIATION:

- Electric Power Survey, 1925.

PRESENTED BY THE MASARYK ACADEMY OF WORK:

- Report of the Proceedings of the first international management congress in Prague.

Abstracts of Papers read before the Branches

Chicago Drainage Canal Diversion

Francis King, K.C., General Counsel, Dominion Marine Association, Kingston Branch, February 8th, 1926.

Mr. King gave first a rapid sketch of the legislation touching the question. The history of the subject is now more than a century old, there being legislation by the United States federal government as far back as 1822 and a further act in 1827 to subsidize a canal at Chicago. The Supreme Court of the United States has now removed these two original statutes from the discussion. The Sanitary District of Chicago was chartered by the Illinois legislature in 1889 and proceeded to reverse the flow of the Chicago and Calumet rivers, to build subsidiary channels and to dispose of its sewage by diluting and flushing it into the Des Plaines, the Illinois and the Mississippi rivers at the expense of the water lost to the commerce of the Great Lakes and the comfort and health of the riparian owners on the rivers mentioned. In 1899 the Federal Statute, under which successive secretaries of war have "permitted" diversion of certain limited amounts of water, was enacted. It was designed to assert and exercise the control over commerce and navigation, which lies with Congress. The permit of 1912 maintained the limit at 4,167 cubic feet per second against a strong plea for more, and at that time Canada and the Dominion Marine Association were both prominent in the fight at Washington to prevent excessive withdrawal of water from lake Michigan. Then came the action in the Federal Court in Illinois to restrain the Sanitary District from exceeding the amount of this permit. Trial was delayed, Judge Landis (of Chicago) held the case six years before giving judgment in 1920, and then for three years more before resigning. The judgment was promptly signed by his successor, enjoining the district from exceeding the permit. On the appeal to the Supreme Court came the famous judgment confirming the injunction, declaring that navigation on the lakes was injuriously affected, and that Canada had rights which should be respected (at least by the treaty of 1910), and that Congress was supreme and could protect the Great Lakes. The judgment mentioned the right of the district to apply for a better "permit." Of course the application was made. It was strongly contested, although the Dominion government made no such visible or emphatic demonstration of its wishes as was hoped for, and the result was the present permit of 8,500 cubic feet per second, good for five years, with conditions, including stipulations for the gradual building of sewerage disposal plants and the ultimate reduction of the quantity of water withdrawn to 4,167 cubic feet per second. Beaten on the sanitation plea, the district now tried to enlist the states in the Mississippi valley in support of bills legalizing 10,000 cubic feet per second, on the ground that this is necessary for navigation down to the gulf of Mexico—not to the gulf of St. Lawrence—an argument obviously having only one real motive, and just as obviously fallacious in view of the admitted fact that 1,000 cubic feet per second is enough for navigation and that the extra amount has already developed currents in Chicago's harbour which have ruined her lake trade. Finally reference was made to the action now pending in the Supreme Court in Washington brought by states bordering on the lakes to assert their rights in these waters against Chicago and the state of Illinois.

Mr. King stated that the Chicago drainage canal diversion had lowered the level of the Great Lakes at least six inches and the effect of this, in decreased carrying capacity of the lake fleet, was estimated in argument in the Supreme Court of the United States at figures as high as $3,000,000. or $4,000,000. a year. To this must be added the immense loss, almost incalculable, to harbours, docks, wharves, canals, buildings and other works, and in fact to all riparian rights. The calculation as to the ships could be checked on the basis of the known loss in carrying capacity of at least 50 to 100 tons per ship per inch of draft, or 300 to 600 tons per ship for six inches lost. In 1912 one graphic illustration was that this lost draft meant the complete capacity of the whole Canadian fleet on one trip—one full trip lost from the season.

The Dominion Marine Association insisted that no action should be taken by Canada which would commit the Dominion in any way to participation in the big St. Lawrence development scheme, until the leak at Chicago was satisfactorily controlled. It was true that power needs in eastern Ontario demanded some initial development at Morrisburg, and that Ontario had offered to stand the cost including works to take care of navigation. But Canadian vessel owners protested against this except as an integral part of a complete scheme for the whole river, and objections to that at present seemed almost insuperable. The expense alone "must give us pause." Incidentally the Dominion Marine Association was not asking for the deep waterway as was commonly supposed. Pressure behind that scheme came from a rather motley crowd of interests with arguments containing much more theory than fact. The one solid basis for the scheme was the possible elimination of a multiplicity of dangerous currents and the centralization of power plants at a certain few points, with the river conserved primarily for navigation and incidentally for power. At the present the canals are frequently sources of power at the expense of the safety of navigation.

Mr. King referred to the unfortunate fact that very few had any idea just what the Canadian government had been doing to assert its rights; rights which exist not only under the treaty of 1910 (see particularly section three referred to by the Supreme Court of the United States), but also stand firmly on the principles recognized by the law of nations and founded on abstract justice; rights which would be similarly violated if the waters of the Danube were robbed to benefit the trade of the Rhine valley, or the Rhine sources were diverted to the Black sea. The Minister of the Interior made a statement in the House of Commons on the twenty-fifth of January on the "lucus a non lucendo" principle. Canada had protested but the nature of the protests were apparently still under the seal of diplomatic secrecy. One could wish for some strong pronouncement just at present which might remind a friendly neighbour now engaged in legislation that the bills before Congress, to legalize a diversion of 10,000 cubic feet per second, propose to deal with something in which the United States of America have not more than a half interest, west of lake St. Francis, and none below, except a right of passage for its ships under the Ashburton Treaty.

The Economic and Engineering Situation in Canada

Brig.-Gen. C. H. Mitchell, C.B., C.M.G., C.E., M.E.I.C., Dean of the Faculty of Applied Science, University of Toronto, Toronto, Ont. Toronto Branch, February 18th, 1926.

If one were drawing a curve of the progress for Canadian development since the War it would take an uncertain form, advancing and receding, sometimes sharply, sometimes slowly, but it would move continuously upward.

Gen. Mitchell said that we were still in a transitional stage, but indications were not wanting that we had passed most of these difficult places in our progress, and that conditions were again set for a pronounced rise in our curve of progress. We saw definite indications on all sides that such was the case, even if we went cautiously, and appraised with moderation. No one sign might mean very much, but all, taken in conjunction, made a significant and favourable accumulation.

Some of these outstanding conditions, the speaker said, were:—

(1) World conditions—The Locarno treaty.
(2) The stabilizing of the world's financial markets, and particularly the return of sterling to parity, reflected in our own Canadian exchange.
(3) The great growth in Canadian foreign trade, and the excess of Canadian exports over imports.
(4) The steadying effect of the huge Canadian grain crop of 1925 on our whole economic position.
(5) The steady growth in gross revenue from all the industries of Canada which, in millions, worked out at 46 in 1922, 49 in 1923, 53 in 1924 and 56 in 1925, Ontario's industries representing a steady ratio of 44 per cent. This meant that the purchasing power of the country was increasing.
(6) The steady increase in savings deposits in the banks—although not in proportion to (5) owing to the extravagances of the times.
(7) The ratio of bank deposits to current loans. Deposits were still largely in excess of loans, but expanding business was calling them into use.

The engineering situation in Canada, said the speaker, was a reflex of the economic situation, and the work of the engineering profession was more sensitive to the economic condition of the country than any other. The growing complexity surrounding the development of Canada's resources and industries was more and more involved with the science of the engineer, and the inevitable era of prosperity would go hand in hand with an increase in engineering activity. Much of the expenditure of the next ten years would be on construction, and in firmly establishing channels of trade and commerce, and the burden of wise technical decision and careful economic administration would fall on the engineering profession.

A résumé was given of engineering activity, and of coming engineering developments from coast to coast, stressing the fact that the construction of highways, elevators, etc., necessary to convey and house the grain, and other products of agriculture; the redemption of the earth's treasures by mining; the problem of transportation by rail, by road, by canal; the varied requirements of municipal life; the great water power developments, and harbour developments; the advances of industrial chemistry, (to mention but a few, in the paper, rubber, paint and aluminum industries), were all factors weaving the engineer's handiwork into the economic life of the nation.

Artificial Silk

A. D. Hone, Principal of the Technical School, Sault Ste. Marie, Sault Ste. Marie Branch, March 5th, 1926.

The basis of all processes is cellulose $(C_6H_{10}O_5)n$. This is a complex material, about the constitution and properties of which there is still a great deal to be learned. The two main varieties found in nature are cotton, which is practically pure cellulose, and wood fibre. Ordinary wood is not pure cellulose as lignin is present in it and holds the fibres together. In the process of making chemical pulp, the lignin is dissolved by the calcium sulphite used, and the resultant pulp is practically pure cellulose and may be used for making silk. The ground or mechanical pulp is not suitable.

The first attempt to make a substitute for silk was made by John Mercer, who took out a patent in 1850 which covered the transformation of cotton into a silk-like fabric. The reason why cotton has not a bright lustre is because the fibres consist of a flat twisted tube. In order to be lustrous, a fibre must be smooth and straight. Mercer's process consisted in treating the cotton with a strong caustic solution; this has a tendency to thicken and shorten the fibre, but if the fibre is kept stretched it is straightened and rendered more cylindrical and thus is given a lustre. Cotton so treated is called "Mercerised Cotton."

The first process for making artificial silk used as a base nitrocellulose. This is made by treating ordinary cotton with a mixture of equal parts of nitric and sulphuric acid. Nitro-cellulose is soluble in a mixture of alcohol and ether. The resultant solution is known as Collodion. The Collodion is forced into water at high pressure, the nitro-cellulose is precipitated through a fine opening as a smooth cylindrical thread possessing a high lustre. This thread is wound on a spindle and denitrated with ammonium sulphide, whereupon the cellulose is recovered. The silk so formed is known as "Collodion Silk" or "Chardonnet Silk."

Another variety of artificial silk is known as "Cupro-ammonium" or "Paulp Silk." It is also made from cotton by treating with a solution of copper hydroxide in ammonia and dissolves cellulose without change. In making silk, the resultant solution is forced through fine openings into an acid coagulating bath. This process is still in use, particularly in Italy and Germany.

A third variety is known as "Cellulose Acetate Silk" or "Celanese Silk." The process of making this is rather complex and involves the use of a rather expensive reagent, acetate anhydride. In this process pure cellulose is treated with this reagent, sulphuric acid, which acts as a condensing agent, and acetic acid. A solution of cellulose acetate is thus obtained which is precipitated by pouring into water. The cellulose acetate thus obtained is soluble in acetone, and the resultant solution is used for dressing aeroplane wings. When the acetone evaporates, it leaves the cellulose acetate as a thin transparent film which is both water- and fire-proof. A film like this may be used in moving-picture machines and has the advantage over a cellulose film of being non-inflammable. If this solution is forced through a fine opening into a coagulating bath, for example calcium chloride, the cellulose acetate is recovered as a fine lustrous filament. This process is carried on extensively in England. Its disadvantages are that the chief reagent is expensive and the process is long and complicated. A difficulty, which has since been overcome by the discovery of special dyes, was that it is also difficult to dye.

The chief variety of artificial silk is known as "Viscose Silk." This is cheapest in manufacture and is gradually displacing the other varieties. It is made by treating ordinary chemical pulp with caustic soda, forming alkali cellulose and dissolving this product in carbon bisulphide. The resultant substance is called cellulose sodium zanthate and is a compound of cellulose containing sodium and sulphur, the composition of which varies with the quantities of reagents used. Formula—$Na_2CS_2OC_6H_9O_4$. The commercial process is described as follows:

The cellulose base for this process is provided by wood pulp. The logs, after being stripped free from bark, are cut into very small chips, which are boiled for some considerable time under pressure in a solution of calcium sulphite. The fibres after such digestion are washed, bleached and subsequently made into sheets by passing first over an endless band of fine metal gauze and then over a number of steam-heated drums.

The first stage of the process consists of soaking the pulp in a solution of caustic soda until saturated. The excess of soda is removed by pressure and the soft wet sheets of alkali cellulose thus obtained are ground into a floury mass in a milling machine. This floury mass is matured by standing and then treated with carbon bisulphide to form an orange-coloured, somewhat sticky mass known as cellulose sodium zanthate, which is easily soluble in weak caustic soda to form a viscous solution known as viscose, from which filaments of cellulose are regenerated by the decomposing action of an acid.

The viscose, after being freed from small bubbles of air, dirt and other foreign matter, is forced through a metallic nozzle containing very small holes, into an acid spinning bath where the precipitation of cellulose in the form of continuous filaments takes place. These filaments forming one thread, are taken from the spinning bath over a glass roller, through a vertical reciprocating tube, into a circular box, rotating upon a vertical spindle. Centrifugal force throws the thread to the side of the box, where it builds up into an annular cake, the twist being imparted to the thread by the revolution of the box at several thousand turns per minute.

The cake from the spinning room is now reeled into skeins, in which form the silk is freed from acid, sulphur and other impurities.

The artificial silk obtained by this process has a tensile strength much smaller than that of true silk; this is especially true when it is wet.

Kind of Silk	Dry Tenacity grammes	Wet Tenacity grammes	Elongation per cent.
Viscose	1.75	.75	20.0
Natural	2.5	2.0	21.0

If the thread is placed under tension and it is touched with a drop of water, it will break almost immediately at the point where it is moistened. Great care, therefore, has to be exercised in washing articles made from it. This is one reason why it is used so extensively mixed with wool and cotton. It is much more lustrous than real silk from which it may be distinguished by treating with forty per cent hydro-chloric acid. This reagent dissolves the real silk in two or three minutes but merely renders the artificial silk a gelatinous mass. At first it was used only for such articles as braid and neckties and was not considered washable; now it is being used for stockings, socks, scarves, underwear—in short every article that may be manufactured from pure silk, and is rapidly displacing the latter. Its use has increased tremendously in the last few years and new factories for its manufacture are being built all over the world. Production 1910, 17 million pounds; 1912, 20 million pounds; 1924, over 100 million pounds. They can hardly be constructed fast enough to keep up with the demand, for example, the December issue of the Society of Chemical Industry states that works are being put up in England, in Lancashire, Bristol, London, Warrington, Olden, Kent, and that at other centres modifications are taking place on an extensive plan suitable for this purpose. At Bristol the plant will produce 27,000 pounds per week. The plant at London will have an output of 22,400 pounds per week, and the Kent mills are being designed to ultimately give a production of 100,000 pounds per week.

In Canada a plant has been recently established at Cornwall, This company is known as Courtauld's Limited, and I am greatly indebted to them for the samples on display and also considerable of the information contained in this paper. The daily papers recently contained an announcement that a large factory is to be erected at New Westminster by a syndicate headed by the Whalen interests which will make use of British Columbia pulp. It appears to me that Sault Ste Marie is ideally situated between the east and west for an industry of this kind. The raw material is easily accessible and there is an excellent supply of power for the purpose.

The address was illustrated by samples and experiments by which small fibres of artificial silk were produced.

A lively discussion followed Mr. Hone's paper, many interesting points being brought out. Mr. Kloss in reply to a question from W. S. Wilson, A.M.E.I.C., stated that in 1920 the production of artificial silk amounted to 45,000,000 pounds, but that in 1925 it amounted to 175,000,000 pounds and also 1,600 tons of artificial horse hair had been produced. The decrease in horse hair in this country is due to the increase of the automobile.

A. E. Pickering, M.E.I.C., and Wm. Seymour, M.E.I.C., moved a hearty vote of thanks to Mr. Hone for his very interesting paper.

Industrial Development in Saskatchewan

R. N. Blackburn, M.E.I.C.,

Chief Mechanical Superintendent, Department of Public Works, Province of Saskatchewan.

Address of retiring Chairman read before the Saskatchewan Branch of the Engineering Institute of Canada, March 11th, 1926.

Up to the present time the development of our province has been principally in the direction of agriculture and its progress in that respect has been most remarkable. Last year the province produced more wheat than all the rest of Canada put together, namely a little over 240,000,000 bushels out of a total wheat crop, for the whole of Canada, of about 416,000,000 bushels. Unfortunately, wheat growing appears to partake largely of the nature of a gamble with nature and there is always considerable risk of a crop failure. Also while wheat growing at the present price of wheat, namely about $1.30 per bushel at Fort William, may be fairly profitable in a good year, present prices will probably not be maintained permanently, and our province will always be seriously handicapped by the high freight rates to seaboard, which, if the price of wheat is much reduced, may render wheat growing unprofitable.

Accordingly we find that our agricultural experts are advising farmers to go in for mixed farming, which means principally the raising of sufficient stock to consume a large portion of the products grown on the farm. But while there is a steady development in this direction in the province, it is doubtful if the development is keeping pace with the rapid increase in wheat production. Mixed farming would no doubt be more profitable and would make more rapid progress if we had a larger industrial population in the province.

While it is natural that agriculture should be the first industry to be developed, it would seem that the development of other industries ought not to lag too far behind. At the present time the development of our province seems somewhat lop-sided. We have a very large demand for farm help at certain seasons, at harvest time there is a great influx of labourers, but immediately the threshing is over there is no other work for them to do, and they have to leave the province. In the winter the surplus rural population flocks to the towns, where there is only work for a very small proportion of them; the rest often leave the country permanently. These conditions might be remedied, or at any rate the situation might be greatly relieved, if our other industries were further developed.

Now manufacturing industries cannot be established in a day. Even where the raw materials of an industry are right at hand, development is often slow; practically all that can be done by a government is to try to make conditions favourable to the development of industry and then allow the industries to develop naturally. The northern part of our province is rich in minerals, but these minerals are too far from a market to be worked profitably at the present time, and it may be some considerable time before they are developed to any great extent. In the southern part of the province there are immense clay and coal deposits which are as yet only slightly developed. In the centre portion of the province, the industries most likely to be established will be those depending largely on agriculture for their raw materials, such as the manufacture of leather goods, sugar, paper made from flax and wheat straw, building felt and so on, together with those industries in which the freight on the raw material is not a very large item in the total cost of manufacture.

The Importance of Cheap Power

While cheap power for industries is very desirable, its importance is often exaggerated in the mind of the public. In some industries such as the electro-chemical industries, cheap power is of *supreme* importance, since power is the principal item in the cost of manufacture. In the manufacture of aluminium for example, the writer understands that it requires about 25,000 k.w. hrs., or nearly 5 horsepower years, to make one ton of aluminium, but leaving out of the question industries of this type, the importance of very cheap power is not so great as many people seem to think.

The following table gives the average cost of labour, raw materials, fuel and power in a number of industries, in percentages of the total manufacturing cost:—

	Wages, Taxes, etc.	Raw Materials	Fuel and Power
Average of all manufacturing industries	20.4%	77.5%	2.1%
Iron and Steel Industries	19.6%	86.2%	1.4%
Food Products	12.4%	63.1%	1.4%
Textiles	35.5%	62.6%	5.4%
Paper	32.0%	77.5%	2.1%

The above table does not include the electric light and power industry. This is rapidly becoming one of the most important industries, not only because artificial light is essential to modern civilization, but also because the demand for industrial power is not sufficiently great in the smaller industrial concerns to justify the installation of the most modern equipment and the most skilled attendance. The actual cost of the power used in such cases may be many times greater than the cost at which the same power could be supplied from a large central power plant.

Accordingly we find that much attention is being given in many countries to extensive schemes of power generation and distribution. In England, a national board of experts is about to be appointed with wide powers to construct large central power stations at the coal mines and to distribute the power to the villages and towns throughout the country. The government proposes to appropriate $75,000,000. for the preliminary costs of organization and standardization, and the board will have power to borrow all the monies required for the actual construction. In the United States plans for the installation and development of new power generating stations and the interconnection of existing power systems are being developed to such an extent that President Franklin T. Griffith, at the 48th Annual Convention of the National Electric Light Association held in San Francisco last June, stated that: "$2,000. a minute must be raised in the next ten years to finance the electric light and power industry of the United States." The capital invested in the United States in the electric industry exceeds seven billion dollars and is being augmented at the rate of over one billion dollars per year. In Canada the total capacity of the plant installed in hydro-electric and fuel power stations at the beginning of 1925 was 3,569,275 h.p., of which about 94 per cent was hydro-electric power, and an additional 719,000 h.p. was installed during the year. The capital invested in water power in January, 1924, in Canada was $687,000,000.

Saskatchewan's Power Resources

In this province we have comparatively little water power available; the amount of continuous water power available at minimum ordinary flow being estimated at 513,480 h.p. as compared with over three million horsepower available in Manitoba, about five million horsepower in Ontario and nearly seven million horsepower available in Quebec.

The water power available in Saskatchewan is situated in the northern part of the province, a long distance from any centre of population and is not likely to be developed for some time. We are thus limited for any extensive power scheme to our coal resources, and there is little doubt that we shall eventually see large power generating stations situated in our coal fields and the power distributed to, at least, the southern, and probably also the central portions of the province.

It does not follow that because we have so little water power available in Saskatchewan that power will necessarily be costly in this province. In the Regina municipal power plant, the average cost per kilowatt hour generated at the switchboard in 1924 with coal costing on an average $8.37 per ton, was only 1.97 cents per kilowatt hour including fuel, labour, maintenance and overhead charges. Under similar conditions a plant stationed at the mine, using Saskatchewan coal at $2.00 per ton, could generate power at less than 1½ cents per kilowatt hour. With an improved load factor, and especially if small coal which would be otherwise unsaleable were used for power production, or if the power were generated as a by-product of a coal distillation or carbonization process, the cost of power would be very considerably reduced.

Under such conditions power could be generated at the mine at a cost which would compare not at all unfavourably with hydro-electric power.

By way of comparison the present scheduled light and power rates are given for hydro-electric power in Toronto and Winnipeg and for steam generated power in Regina.

	Cost in cents per kilowatt hour.		
	Toronto cents	Winnipeg cents	Regina cents
Domestic light	2.1	3⅓	4 to 6
Commercial light	4 (av'ge)	....	....
Power	1.38	3⅓ to 0.8	5 to 2½
Power (off peak)	....	....	3½ to 1¾

The above rates are subject to discounts, varying with the amount of power consumed.

The cost of power transmission depends not only upon the distance the power is transmitted, but also varies considerably with the quantity of power to be transmitted. The total electrical output of the Regina municipal power plant in 1925 was 21,373,905 k.w.hrs., and the cost of transmitting this amount of power from, (say), Estevan or Bienfait to Regina would probably be greater than the cost of the freight on the coal required to generate the power at the present Regina plant. Under present conditions, with a single transmission line, it would also be necessary to maintain the present municipal plant as a stand-by for use in case of a breakdown of the transmission line and a transmission scheme for power generated at the mines would naturally have to bear the overhead charges of the standby plant. This would appear to put such a scheme entirely out of the question at the present time. The cost of transmission per kilowatt hour would be reduced, however, if the total power to be transmitted were sufficiently increased. There is, however, a definite limit to which power generated at the mine mouth can be economically transmitted *even in large quantities*, and this limit under present conditions would probably average about 200 miles. For distances greater than this, it will in most cases be found more economical to ship the coal by railway and generate the power locally.

This situation might be considerably changed and the distance to which electrical power can be economically transmitted considerably increased, if sufficient power could be disposed of to the towns and villages along the line of route; or alternatively, if the transmission line forms part of the network of a large distribution system.

A good deal of progress has been made in the United States and to some extent in Ontario in the development of rural power lines. The power requirements of the average farm are not very large and consequently the power distribution lines must be of the cheapest possible construction in order to keep the cost of power sufficiently low to be attractive. In many cases a lead-covered cable is simply laid in a trench ploughed along the road allowances and it has been found that in many cases an average of three farm consumers to the mile is sufficient to make a rural power distribution scheme economically possible. The number of farmer consumers in this province, however, would probably not average even this, but it might be found commercially practicable, in some districts at least, to transmit power generated at central stations to the villages along the lines of railway. The installation of automatic sub-stations would still further reduce the cost of operation. While it is of course very desirable that any power scheme adopted should be self-supporting, the contingent advantages of cheap power and light to our smaller towns and villages should not be entirely overlooked.

Utilization of Saskatchewan Coal

There are also other advantages in connection with the generation and distribution of power from central stations situated at the mine mouth, one of the most important of which is the development of our own coal deposits. As you all know we have millions of tons of coal deposits in the southern part of our province. Unfortunately, the coal is of lower grade than the Alberta and British Columbia coals with which it has to compete, and the development of our mining industry has accordingly been comparatively slow.

A good deal of investigation work in connection with the carbonization of Saskatchewan coal and the briquetting of the carbonized residue has already been done by the provincial and federal governments, but the results so far obtained have not been as promising from a commercial point of view as could have been desired. According to the report of the Lignite Utilization Board, the production cost of lignite char briquettes would average from $9.50 to $10.50 per ton at the plant, and at this price there would not appear to be a large market for them in competition with western coals. This production cost could no doubt be reduced if a carbonizing and briquetting plant were operated by a mining company, which could not only use coal for carbonizing and briquetting which is at present unsaleable, but which might gain such other contingent advantages in operating a briquetting plant in conjunction with their mine, as would put the industry on a more profitable basis. But even allowing for this, the prospects for a *briquetting plant only*, do not appear sufficiently attractive to promise a very great immediate development of the lignite coal mining industry.

It is important to remember, however, that since the investigations were first undertaken, the fuel situation has considerably altered, with the result of entirely changing the problem to be solved. The investigations referred to, were undertaken with the object of providing a substitute for anthracite coal, which was then the fuel in general use for domestic heating, and the price of which was continually advancing while the available supply was a diminishing quantity. Owing to the continually increasing cost of anthracite coal, our people have been practically compelled to use soft coal for domestic heating. They have now become accustomed to the use of soft coal and there would probably be very little demand now for anthracite coal, even if the price of anthracite were considerably lower than it is. The problem at the present time is not so much to find a substitute for hard coal, but rather to find ways and means of developing the use of Saskatchewan coal in competition with the higher grade Alberta coals. Almost the only purposes for which anthracite coal is used in the province at the present time is for gas producers, and there is no reason why its use for that purpose should not be entirely superseded by Saskatchewan lignite.

At the Melville municipal electric light and power plant a 250-h.p. suction gas producer was used to supply producer gas to three gas engines used for generating electric current. The fuel used was American anthracite costing $16.80 per ton delivered at the plant. The plant was burned in September, 1923, and although the gas producer was very little damaged by the fire, it was decided to purchase two new gas producers suitable for Saskatchewan lignite, and to discard the existing anthracite producer. The result has completely justified the change. Last year, owing to the difficulty of obtaining a sufficient supply of Saskatchewan lignite of the proper grade, it was necessary to use a considerable quantity of Pembina coal at $7.23 per ton delivered, in place of Saskatchewan coal at $4.43 per ton delivered, but even with this disadvantage the average fuel cost in 1925 was only 1¾ cents per kilowatt hour as compared with an average fuel cost with anthracite in 1922 of 4.49 cents per kilowatt hour. If Saskatchewan coal alone had been used, the average fuel cost would have been a little less than one cent per kilowatt hour. The difficulty of obtaining an ample supply of Saskatchewan coal of the proper grade for gas producers has since been overcome.

Saskatchewan lignite is also being used in gas producers at the Swift Current municipal electric light and power plant. The coal costs $5.25 per ton delivered, and the average fuel cost last year was 1.05 cents per kilowatt hour.

One of the obstacles to the more extended use of Saskatchewan coal for power generation is that on account of its high moisture content and the consequent lower furnace temperature obtained, it is difficult to obtain as high a boiler rating as with higher grade coal. Where the steam boiler capacity is already somewhat limited, which is frequently the case, the steam user is usually unwilling to incur the heavy expense of installing the additional boiler capacity required for the Saskatchewan lignite, even though it could in many cases be demonstrated that it would be profitable to do so. The high moisture content also makes the coal more difficult to ignite, and certain types of mechanical stokers which operate satisfactorily with higher grade coals are not at all suitable for Saskatchewan lignite. Saskatchewan coal also disintegrates on being burned, and where a travelling grate is used much of the coal drops unburned through the bars.

The furnace temperature can be increased and the coal caused to ignite more readily by the provision of proper reflecting arches, but as the ash of Saskatchewan coal is readily fusible, the higher temperature causes a great deal of "clinkering." This clinkering becomes very objectionable even in the ordinary type of furnace, if it is attempted to force the boilers at all.

In order to obtain the best results from Saskatchewan coal, specially designed furnaces would appear to be required and further experimental research in this direction is much needed. There is good reason to believe that suitable furnaces for Saskatchewan lignite both hand fired and mechanical, which would permit fairly high boiler ratings to be carried, could be developed at very little cost for experimentation. Considerable advance has also been made recently in the carbonization of coal and the recovery of carbonization by-products, and although the writer is not aware of any commercial carbonization plant in England or the United States which is at the present time being operated successfully from a financial standpoint, several processes are being developed which give promise of very favourable results.

In order to be commercially successful with *Saskatchewan coal*, however, it would appear that a carbonizing and briquetting plant must be combined with a central power plant which could utilize the gases evolved during the carbonizing process for generating power, or alternatively, the gases could be used for burning clay products, etc. In any case, the tar recovered from the carbonizing process is only sufficient to act as binder for briquetting about *one-half* of the char produced and the remainder should preferably be burned, probably in pulverized form, in a central power plant. The writer believes that a combined plant of this kind could be installed with a good prospect of financial success. Such a plant might be installed, in the first instance, on a comparatively small scale and the power distributed locally. When the economic feasibility of such a combined plant was satisfactorily demonstrated, the plant could be extended as desired and would form the nucleus of what would without doubt ultimately develop into a province-wide power generation and distribution scheme.

EMPLOYMENT BUREAU

Situations Vacant

Pulp Mill Engineers

A large pulp mill in the province of Quebec requires the services of a number of experienced pulp and paper mill engineers for engineering office, including chief draughtsman, structural designer, designer familiar with boiler house and steam plant work, and mechanical designers. Apply giving full particulars regarding age, education, experience, married or single, and salary required, to Box No. 153-V.

Situations Wanted

Civil Engineer

Technical graduate, University of Manitoba, 25 years of age, good personality, one year surveying experience, two years municipal engineering training, including design and construction of concrete pavements and sewers, reinforced concrete floor design, etc., desires position with municipal engineering firm in Ontario or Quebec. At present employed. Apply Box No. 206-W.

Civil Engineer

Civil engineer, graduating this year, desires employment where further engineering experience may be obtained. Apply Box No. 209-W.

Members' Exchange

The Engineering Library of one of our Canadian Universities is anxious to complete its file of the Engineering Journal. The missing numbers they require are Vol. 1, Nos. 1, 2 and 6, 1918, and Vol 2, No. 1, 1919. Any members having spare copies of these numbers of the Journal might forward the same to the secretary to be transmitted to the library.

BOOK REVIEWS

Chemical Colouring of Metals and Allied Processes

Samuel Field and S. R. Bonney, London, Chapman and Hall, 1925 Cloth, 8¾ x 5½ in., 264 pp., illus., 10/6 net.

Many of the smaller metal-working shops, unable to command adequate technical assistance, are obliged to fall back on the so-called Trades Formulae Books for information and guidance in their metal finishing problems. The task, by no means an enviable one, of separating the wheat from the chaff and deriving useful and applicable knowledge from these ill-assorted stores is too often attended with expense, discouragement and failure, where an elementary understanding of the principles involved in the utilization of such formulae would bear very different results.

It is to amplify and elucidate the meagre information on colouring processes that "Chemical Colouring of Metals and Allied Processes," by Samuel Field and S. R. Bonney (Chapman and Hall), has been presented. Its value to the metal finisher is unquestioned, and even the old hand may, with advantage, follow in its pages the natural laws upon which his many, and doubtless successful, procedures are based.

The initial chapters are given over to a highly condensed, though sufficient, summary of the general laws of chemical identity and combination, leading up to an exhibition of the use of chemical symbols and formula weights. From general observation shop practice seldom realizes or takes advantage of these essentials in the calculation of quantities or bath charges, where even such acquaintance with their value as afforded by Messrs. Field and Bonney's treatise would well repay the shop supervisor.

Following chapters take up individually the production of various colour effects on metals, grouped under the headings of the metals in most common use. The text indicates in each case the basic reactions in the processes, and gives instructions for satisfactory operation. A useful chapter on cleaning precedes this particularization and the subject is given quite comprehensive treatment from the chemical as well as the mechanical aspect. Electro-deposition is accorded a prominent position, and this admittedly complex art, while incapable of concentration in its entirety into the space at the disposal of the authors, is handled in a readily comprehensible manner.

On the whole, Messrs. Field and Bonney have supplied a handbook which fulfils a definite and useful purpose in the colour treatment of metals, correlating as it does the practical intricacies of this trade with the underlying scientific structure.

Merchant Ship Types

A. C. Hardy., 316 pp., illus., tables, diagrs.

Price $4.50. Chapman & Hall, London, 1924.

This work is described by the author as "A survey of the various units engaged in the water transport of people and merchandise." It contains general descriptions of vessels ranging from mammoth ocean passenger liners, such as the Cunard liner "Aquitania," down to tugs and trawlers, including many special types, such as oil tankers and colliers. There are photographs of a large number of vessels, also folding plates showing general arrangement plans, to small scale, of ten different types.

In the chapter devoted to the ocean cargo carrying vessel is given a short general description of the terms tonnage, subdivision and freeboard, also an explanation of the considerations entering into the preliminary design of a vessel, all of which information is given in terms which should be readily understood, even if the reader has not studied the subject.

The author has collected a great deal of useful information regarding the various types of merchant vessels afloat to-day and presents it in concise form, thus providing a convenient work of reference for students of naval architecture or marine engineering, as well as for those interested in merchant shipping as a whole.

It cannot be classed as a text book on naval architecture or marine engineering nor does the author seem to present it as such. His endeavour has been to discuss the subject of transport along the lines of grouping vessels into different classes and of showing generally how the service in which any individual type of vessel is to be employed governs her construction and design. In the writer's opinion he has dealt with this subject in a very satisfactory manner.

To students and to those who desire to acquire some general knowledge as to modern merchant vessels, their design, construction, etc., this interesting work is recommended.

R. J. McClelland, a.m.e.i.c.

Constructional Steelwork

Harry Atkin., 212 pp., illus., diagrs. Price $3.00, Chapman & Hall, London, 1924.

A recent addition to the library of the Engineering Institute of Canada is a book published lately entitled "Constructional Steelwork" written by Mr. Harry Atkin and published by Messrs. Chapman & Hall, London. This book is a manual of workshop processes, methods and machines based on the practice in various structural steelwork shops in Great Britain.

One of the purposes of the book is to arouse the interest of young men in the structural steel business and the book describes theory and practice in such a way as to emphasize the close relation that should exist between them. It is to be doubted whether in the United States or Canada the benefits of this close relationship have been realized to as great an extent as they have in Great Britain and Ireland.

The author of the book reveals a knowledge of working conditions and human nature. It would appear, as might be expected, that operations such as smithing and handling are done more usually by manual labour than is the case in this country. Moreover the apprentice system seems to be in vogue to some extent. The shops described in the book, some of them about 40 ft. wide, correspond to the smaller shops in America.

Mr. Atkin calls attention to the slight differences in structural steel obtainable from various sources. Such differences probably need emphasis in this country also where various specifications are used and steel not made by the open-hearth process sometimes finds access to structural shops, particularly in Canada.

The book describes templet making, sawing, smithing and punching. It does not state whether templets are always considered necessary nor just what economy if any can be effected by the use of shears instead of saws or spacer or profile punches instead of single punches. It would be very interesting indeed to have some information by means of which comparisons could be made between the total costs of shop operations in Great Britain and America. The prevalence and size of the drills and edge planers as illustrated would indicate that British practice is somewhat more stringent than American in the finish demanded in structures of medium size.

Mr. Atkin appreciates to the full the fact that different shops have different methods which may be respectively the best for each. This is equally true of different countries and his book should be very valuable in so far as it affords a basis of intelligent comparison between British practice and our own.

D. C. Tennant, m.e.i.c.

Marine Engineering Repairs

Engineer Capt. F. J. Drover, R.N., Cloth 5½ x 8¾ in., 227 pp., illus. Price 9/6 net. Chapman & Hall, London, 1925.

Engineers in charge of marine machinery have always been remarkable for their resourcefulness and ingenuity in carrying out emergency repairs, often at sea, and under very difficult conditions with the preservation of life and property depending on their efforts.

Captain Drover's book, besides containing data regarding work of this kind, is a compendium of information of a very practical nature, as to the most approved methods of care and maintenance for marine machinery, and it will be found useful in many instances by engineers charged with the operation of modern steam or diesel engine driven power stations on shore.

Dealing first with reciprocating steam machinery, the adjustment and repair of the modern types of steam turbine units follow. The chapters on pipe systems, joints and glands, condenser defects (including corrosion) and the management and repair of auxiliary machinery, pumps, evaporators and distillers, refrigerating machines, air compressors, etc., are valuable, and are followed by a fairly comprehensive treatment of boiler work, with particular reference to the troubles arising in connection with the storage and use of oil fuel.

The sections on diesel engines are somewhat brief but draw attention to such important topics as lubrication troubles, difficulties in starting and in maintaining valves and fuel systems.

The book can be recommended as a sound and clear presentation of a highly technical subject.

Standard Electrical Dictionary

T. O'Connor Sloane & A. E. Watson., Cloth, 5 x 7¼ in., 790 pp., illus. Price $5.00. Norman W. Henley Publishing Co., New York, 1924.

This appears to be a reprint of an older dictionary to which have been added a smaller, somewhat more modern part dealing with newer terms and appliances, and a third section devoted entirely to radio.

Erratum

In the April, 1926 number of the Engineering Journal page 216 line 38, for *Vouvray* read *Veurdre*.

BRANCH NEWS

Border Cities Branch

W. H. Baltzell, M.E.I.C., Secretary-Treasurer.

The Border Cities Branch held its regular monthly meeting on Friday, March 12th, in the Prince Edward hotel, Windsor. Chairman A. J. M. Bowman, A.M.E.I.C., presided, and twenty-five, including the speaker, partook of the dinner.

The chairman called attention to the fact that the engineers on this Border were not interesting themselves sufficiently in the affairs of the community and thereby were missing many excellent opportunities to be of service to the community, and by reflection, to themselves. He stressed the fact that engineers are prone to leave all public service problems to others often not so competent to analyze or discuss them, to inform the public or reach logical conclusions. He told the assembly that he was prompted to this by the remarks made by the President, George A. Walkem, M.E.I.C., during his recent short visit. Major Walkem outlined the work being done by the engineers of Vancouver in connection with public affairs and urged upon us our duty in this regard.

After a short discussion it was moved by J. E. Porter, A.M.E.I.C., seconded by L. McGill Allan, A.M.E.I.C., that this branch become affiliated with the Border Chamber of Commerce, either as a section of the same or, in case we are not in position to meet the requirement of the Chamber by-laws, arrange to have a strong engineering committee appointed consisting of such branch members as are also members of the Chamber of Commerce. This carried unanimously.

Domestic Refrigeration

The speaker of the evening was Mr. A. McLay of the Detroit Edison Company, Detroit, and his subject was "Domestic Refrigeration."

He explained the rudimentary principles of refrigeration, and dwelt on the causes of decomposition of foods, growth of bacteria, development of ptomaines, rapidity of their production, their eventual self-destruction under certain conditions, and the ever increasing necessity of food preservation owing to the relatively decreasing areas being used for food production.

In reference to mechanical refrigerating machines for domestic use, he stated that there are now about 1,300 in use in the city of Detroit, including those in use in ice cream parlors. At Detroit the cost per year of electricity is about $22.50 for a refrigerator of about fifteen cubic feet capacity gross or eleven cubic feet net, about four cubic feet space being required by the cooling coil. Assuming a ten-year life of apparatus and no scrap value at the end of that time, the total cost per year would be about $72.00. However, as the apparatus is as yet too new to fix its serviceable life and as it is not yet being produced in what is now known as "quantity production" there is every reason to believe that these costs will eventually be materially reduced.

Mr. McLay spoke for about an hour, after which there were many interrogations from those present, showing that all were keenly interested in the subject, and following the discussion a hearty vote of thanks was tendered to the speaker.

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

The annual meeting of the branch was held on March 13th, when A. L. Ford, M.E.I.C., presided as chairman. The first report to be received was that of the secretary-treasurer, G. P. F. Boese, A.M.E.I.C., who recounted the year's activities and gave a financial statement which showed a healthy state of affairs. He reported an average attendance at meetings of approximately sixty members, which was a record for the branch, also that the largest attended meeting on record was held during the season.

In the absence of F. K. Beach, A.M.E.I.C., chairman of the Programme Committee, W. St.J. Miller, A.M.E.I.C., read his report which contained a résumé of the committee's activities in the way of arranging papers on subjects of topical interest as well as those of general interest to engineers in particular.

The chairmen of other subcommittees reported as follows:—R. S. Trowsdale, A.M.E.I.C., Applications and Credentials, stated that sixteen applications had been dealt with during the year. Prize Committee was represented by J. H. Ross, A.M.E.I.C.; Acquaintance Committee by R. M. Dingwall, A.M.E.I.C.; Attendance Committee by J. A. Spreckley, A.M.E.I.C. The branch news editor reported that rebates received for news submitted for the Journal were just about up to the record established for the last two years, and incidentally it was observed that this amount was practically the equivalent of that shown as balance in the bank on the financial statement.

Election of Officers

Scrutineers F. M. Steel, M.E.I.C., and J. A. Spreckley, A.M.E.I.C., presented the results of the ballots to the chairman, who announced the following election of officers for the ensuing year:—Chairman, J. H. Ross, A.M.E.I.C., a member of the faculty at the Institute of Technology and Art; Vice-Chairman, F. K. Beach, A.M.E.I.C., and Secretary-Treasurer, H. R. Carscallen, A.M.E.I.C., both of the Water Power and Reclamation Service. New members on the executive—W. St.J. Miller, A.M.E.I.C., J. Haddin, M.E.I.C., and R. Mackay, A.M.E.I.C.

Regrets were expressed on all sides over the retirement of G. P. F. Boese, A.M.E.I.C., from the office of secretary-treasurer. Mr. Boese has so successfully filled that office for a number of terms and his thoroughness and adaptability to the work were keenly appreciated by not only the members of the executive, but by members of the branch at large. It is somewhat of a relief, however, that he will remain a member of the executive for at least a year longer. Mr. Carscallen as the elected secretary expressed his willingness to do his best, and stated that he could hardly hope to fill the position as efficiently as the late secretary—but we shall see. Those who know him are willing to back his complete success.

At this meeting it was decided to name the heads of committees *conveners* in place of *chairmen*, in order not to conflict with the word *chairman* as applied to the head officer of the branch.

A. L. Ford, A.M.E.I.C., on retiring from the chair expressed an appreciation of the work of the executive and committees as having been of great assistance in enabling the branch to enjoy a most successful year. He then introduced J. H. Ross, A.M.E.I.C., as the new chairman whose inaugural remarks carried a note of assurance that the coming year was going to be the best yet.

Lethbridge Branch

N. H. Bradley, A.M.E.I.C., Secretary-Treasurer.

The annual meeting of the Lethbridge Branch, held on Saturday, March 6th, was a general business meeting without a speaker.

The Chairman of the Branch, Robert Livingstone, M.E.I.C., being unable to be present, H. W. Meech, A.M.E.I.C., occupied the chair.

The meeting was opened with our usual dinner, throughout which the "Rainbow Orchestra" gave several musical numbers. Following the dinner, community singing was led by Robert Lawrenec, A.M.E.I.C., and solos by A. J. Branch, A.M.E.I.C., Wm. Meldrum, A.M.E.I.C., and R. Lawrence, A.M.E.I.C., were greatly appreciated.

In the annual balloting for officers seventy-five per cent of the Branch members made returns, the result of the ballot being as follows:

Chairman	J. T. Watson, A.M.E.I.C.
Vice-Chairman	G. N. Houston, M.E.I.C.
Committeemen	J. B. deHart, A.M.E.I.C.
	Chas. Raley, A.M.E.I.C.
	A. Thomson, A.M.E.I.C.
Ex-Officio	Robt. Livingstone, M.E.I.C.
	John Dow, M.E.I.C.
Secretary-Treasurer	N. H. Bradley, A.M.E.I.C.

In addition to the above officers, Geo. Brown, A.M.E.I.C., and C. J. Broderick were elected auditors for the current year.

London Branch

E. A. Gray, A.M.E.I.C., Secretary-Treasurer.

The regular March meeting was held in the Board room of the Public Utilities Commission Wednesday, March 24th, at 8.15 p.m. Several subjects were listed for informal discussion including, "Use of Concrete in Underpinning," the discussion being led by J. R. Rostron, A.M.E.I.C., and the "Town Management System of Civic Government," discussion of which was led by W. P. Near, M.E.I.C.

Many interesting points were brought out during the discussions, the meeting proving of such interest that it was decided to hold several more of the same nature in the near future.

Niagara Peninsula Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

A most enjoyable dance was held by the branch at the Welland Inn, St. Catharines, on April 7th, 1926. About 130 members and their friends were in attendance, coming from all parts of the peninsula.

The arrangements for catering and the orchestra were excellent and much credit is due to the committee which gave so freely of its time in order that the dance might be successful.

One of the features was a demonstration of the new Brunswick Palephotophone during the supper hour; there is without doubt great possibilities in this machine for dancing as the tone can be so increased in volume that it will fill a large hall.

Another feature was a fine example of what might be termed the "modern classic dance" as interpreted by an engineer. Mr. J. E. Sears, who is evidently a hard working student and lover of the terpsichorean art, evoked a great deal of interest with his demonstration and much favourable comment was heard.

The committee which so ably looked after the preparations for the dance was composed of the following members: A. W. L. Butler, A.M.E.I.C., chairman, A. R. Bond, A.M.E.I.C., C. H. Mathewson, A.M.E.I.C., E. P. Murphy, A.M.E.I.C., R. H. Harcourt, A.M.E.I.C.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

Engineers hear Expert on Radio

The annual popular lecture of the Ottawa Branch was delivered on April 15th, at the Victoria Memorial Museum before a large attendance of members and their friends, by Major W. Arthur Steel, M.C., A.M.E.I.C., of the Royal Canadian Corps of Signals, who took as his subject, "Electrons and the Vacuum Tube as used in Radio Reception." Many interesting experiments on the conduction of electricity in vacua, illustrating the fundamentals of the vacuum tube, were carried out.

Major Steel has had a very wide experience in radio, both in peace and in war. He has recently been responsible for the design and installation of the new system of radio telegraph stations serving the Northwest Territories and for the development of ground radio communication in Canada. J. D. Craig, M.E.I.C., director-general of surveys and chairman of the branch, presided.

Irrigation in Egypt

Some of the marvellous engineering skill that went into the construction of an irrigation scheme in Egypt many decades ago was interestingly related on April 8th by Mr. Grote Stirling, M.P., Assoc. M. Inst. C.E., in an address to the Ottawa Branch, at the Chateau Laurier. Mr. Stirling spoke as an engineer and yet his address was not too technical, being readily understood by any one unacquainted with engineering problems.

After first tracing the history of irrigation in Egypt, Mr. Stirling held the close attention of his audience with a most informative talk on irrigation in British Columbia. Irrigation was necessary in B.C., to develop small areas and the problem there consisted of carrying considerable quantities of water over rough steep places to these small areas of highly valued land, valuable on account of the crops they produced. He dwelt particularly on the intricate engineering problems encountered in one of these irrigation schemes.

An Announcement

John Murphy, M.E.I.C., called attention to the impending visit to Ottawa of delegates who will be attending a big convention in New York of the International Electrotechnical Commission. They will be in Ottawa on May 1st, the Capital forming part of their itinerary on a tour of the United States and Canada. While here the Ottawa Branch of the Institute will escort them on a tour of inspection of the big paper mill project at Chelsea, being built by the International Pulp and Paper Company.

International Co-operation in Geodetic Survey Work

Large sums of money were being saved each year by the United States and Canadian governments as a result of international co-operation in geodetic survey work, Major C. V. Hodgson told the members of the Ottawa Branch, gathered at luncheon in the Chateau Laurier, March 19th.

Major Hodgson is assistant chief, Division of Geodesy, United States Coast and Geodetic Survey, Washington, and with H. G. Avers, was in Ottawa to confer with Canadian officials on certain features of co-operative geodetic work being carried on by the survey branches of both countries.

This work formed the best example of international economy that he knew of. Over $100,000 had been saved on the international boundary alone as a result of one belt of triangulation across the continent. This co-operation had been extended to the Alaskan and the Pacific coast boundaries.

Mention was made at the luncheon of the international meeting of engineers which was to take place in New York and which was to be followed by a tour of the United States and Canada. Ottawa would be visited by the party on May 1st, and a local committee of the Engineering Institute would receive them.

J. D. Craig, M.E.I.C., chairman of the branch, presided at the luncheon. Major Hodgson paid a fine tribute to the work of the Canadian engineers and said that in many ways the Canadian geodetic survey was ahead of that of his own country.

Quebec Branch

Louis Beaudry, S.E.I.C., Secretary-Treasurer.

Although no news of the activities of this branch has been given in the Journal for some time past, meetings were held regularly at which very interesting addresses and papers were presented as it will be noted in the following brief report.

Power Development in the Province of Quebec

On Monday, January 11th, Fraser S. Keith, M.E.I.C., Manager of the Department of Development, Shawinigan Water and Power Company, addressed the branch on the subject of "Power Development in the Province of Quebec," at a luncheon meeting held at the Chateau Frontenac.

Mr. Keith, at first, took his audience, step by step, over the road of progress that had been followed by the human race in various countries of the world, from the old slave-driving methods to the discovery and development of electrical energy.

After, the speaker disclosed interesting figures regarding the hydraulic development in the province of Quebec. At the end of the year 1910, Quebec had installed 330,000 h.p., or 33 per cent of the total for Canada. In the year of 1925, Quebec had produced an additional of 439,000 h.p., which was equal to 60 per cent of the total increase throughout the whole Dominion. Mr. Keith also stated that, according to statistics compiled by himself, by 1930 it will reach over 50 per cent of that total production, notwithstanding the increase in the other provinces.

Four interesting films were also shown by the Shawinigan Water and Power Company.

Mr. Keith was introduced to the gathering by our chairman, A. B. Normandin, A.M.E.I.C., and A. R. Decary, M.E.I.C., honorary chairman of the branch, thanked the speaker on behalf of the branch.

The Engineer and the Commission of Public Services

F. Chas. Laberge, M.E.I.C., member of the Commission of Public Services, dealt with this interesting subject at an evening meeting held at the Chateau Frontenac, on Monday, January 25th.

The speaker said that the reason for the development of public services was the adoption of new methods of modern life. What was considered a luxury a few years ago is now a necessity. Small municipalities have the telephone and electric light, while large cities have also tramways, gas services, aqueducts, sewers, etc. The Commission of Public Services was established in order to meet the need of regulating all these services.

Mr. Laberge outlined the powers conferred on the commission by the government, and also the work it is doing.

The speaker concluded by saying that the commission depends to a large extent on the knowledge of the engineer for settling many difficulties. He invited the engineer to become familiar with the laws concerning the commission. In that way much money would be economized for the good of everybody.

Mr. Laberge was tendered a vote of thanks moved by J. Duchastel de Montrouge, M.E.I.C., and our chairman, A. B. Normandin, A.M.E.I.C., also added his thanks for this very interesting lecture.

General Meeting

On Tuesday evening, February 16th, a general meeting was held at the City Hall. At this meeting, the affairs of the branch and of the Institute were studied in a discussion open to all the members of the branch.

Chairman A. B. Normandin, A.M.E.I.C., presided at that meeting which was largely attended and proved quite useful.

The Telephone

This was the subject of the lecture delivered at the evening meeting held at the City Hall on Monday, February 22nd, by Capt. G. M. Hudson, A.M.E.I.C., division plant engineer of the Bell Telephone Company at Montreal.

After having briefly traced the history of the telephone, Mr. Hudson clearly described the telephone instrument's parts and explained their respective functions. The speaker also drew a comparison between the telephone system and the power system. On the telephone the amount of power on the line is very small, while the power for the transmission lines is very great.

Mr. Hudson also described the function of the transmitter which changes the sound waves into electrical waves, and also the receiver which reverses the electrical waves into sound waves. He then described the condenser and the condenser coil.

The above descriptions were illustrated by means of lantern slides and films.

The speaker was heartily thanked by S.L. deCarteret, A.M.E.I.C., and A. B. Normandin, A.M.E.I.C., chairman.

Transportation

R. A. C. Henry, M.E.I.C., director of the Bureau of Economics, Canadian National Railways, delivered an address, entitled "Transportation," before the members of the Quebec Branch, at an evening meeting held on Monday, March 8th, at the Chateau Frontenac.

The speaker, who was introduced by A. B. Normandin, A.M.E.I.C., in a brief résumé traced the history of the steam railways on this continent. He first drew the attention of his hearers to the fact that the first steam railway was built in the city of Quebec in 1830, when a line was laid to carry stone from the King's wharf to the Citadel.

The lecturer then reviewed the development of railway transportation in Canada, the origin of the Canadian Pacific, the Transcolonial, the Canadian Northern and the Grand Trunk Railways. To-day, this country, with a population of about 9,000,000, has 40,000 miles of railways.

The speaker went on to describe the work required to move the great crops of grain every year. The whole crop, or at least the larger part of it, must be moved to the head of the lakes between October 1st and December 15th, and this meant that the railways had only 75 days to handle some 280,000,000 bushels of grain, or an average of 3,700,000 bushels a day. Since a car can carry about 1,200 bushels, it would take from 55,000 to 60,000 cars to move the crop during the short space of time at the disposal of railways.

Mr. Henry concluded his lecture with some very interesting remarks on transportation by road and the tremendous development of the automobile industry on this continent.

R. J. F. King, A.M.E.I.C., thanked the speaker on behalf of the branch.

Diversion of Water from the Great Lakes by Chicago

On Monday, April 12th, de Gaspé Beaubien, M.E.I.C., consulting engineer of the city of Montreal, addressed the Quebec Branch on the subject of "Diversion of the Water from the Great Lakes by Chicago," at a luncheon meeting held at the Chateau Frontenac.

At the first of his address, Mr. Beaubien gave a short history of the Chicago drainage question. It has existed, he stated, since 1842 when the city found it necessary to divert a few hundred feet of water per second from lake Michigan. In 1871, this diversion was increased to 1,000 c.f.s., while to-day 10,000 c.f.s. is required for the city's sewerage system.

The speaker then passed on to the question of damage done to navigation. From this diversion had resulted a drop of six inches in the lake levels, nine inches in the St. Lawrence from lake Ontario to Montreal, and six inches to one foot at Montreal. The loss suffered by our hydraulic powers must also be considered. This loss for a diversion of 10,000 c.f.s., is more than 100,000 h.p., said the speaker.

Mr. Beaubien went at length into the standing, both financial and political, of the "Sanitary District" of Chicago, the state body which controls all sanitary and sewage problems for an area containing 487 square miles, and which involves, beside the city of Chicago, thirty-eight other municipalities. The speaker declared that this body had a well organized propaganda bureau and was prepared to carry out their fight to the bitter end. The present administration in the United States, Mr. Beaubien declared, was inclined to look with favour on the Canadian aspect of the diversion, and now was the time for action.

A. B. Normandin, A.M.E.I.C., introduced Mr. Beaubien to the gathering, and A. Amos, A.M.E.I.C., thanked the speaker heartily, on behalf of the branch.

Saskatchewan Branch

R. W. E. Loucks, A.M.E.I.C., Secretary-Treasurer

The regular January meeting of the branch was held at the Kitchener hotel on the 20th of the month, R. N. Blackburn, M.E.I.C., the chairman, presiding. The meeting was preceded by a dinner attended by twenty-one members and guests. When the routine business had been disposed of, the programme for the evening, consisting of papers on "Transportation," was commenced.

Transportation

The chairman called on S. T. Lewis, M.E.I.C., division engineer of the Canadian Pacific Railway, for his paper on "The Miracle of Transportation." Mr. Lewis described the advantages and advances of transportation in a paper particularly rich in speculative and philosophical illustrations. The speaker pointed to the parallel advances of civilization and transportation particularly on this continent, and the corresponding lack of progress in countries lacking in transportation facilities. In concluding Mr. Lewis sounded a note of optimism with regard to progress and prosperity in Canada, predicting that within the near future mineral production would place the country in so sound a financial condition that agricultural depression would not have the effect it now has.

D. W. Houston, A.M.E.I.C., was then called on for his paper entitled "The Street Railway of Today and Tomorrow." Mr. Houston dealt with street railway problems, principally the competition offered by gasoline driven vehicles. The street railways had at first tried to keep these vehicles out of competition but are now meeting the competition by studying the wants of the car rider and trying to meet them. It is the opinion of authorities that the street railway will continue to be the chief transportation facility for local use. In many of the larger communities the motor bus is being used to supplement street railway operations. It was the opinion of the speaker that with the growth of our western cities the motor bus would be used in co-ordination with existing street railways.

The chairman then called on P. C. Perry, A.M.E.I.C., division engineer of the Canadian National Railways, for his paper on "Railway History in Canada." Mr. Perry recorded that there are at present fifty-four railway companies in Canada, operating some 40,000 miles of trackage, of which a little over one-half is operated by the Canadian National System. The oldest steam railway was chartered as the Champlain and St. Lawrence in 1835, and built from Laprairie on the St. Lawrence to St. John on lake Champlain. The speaker narrated many interesting facts concerning the development of the different railways such as the original use of wide gauge on the Grand Trunk Railway, building of the Grand Trunk bridge at Montreal, the political and strategical considerations which entered into the building of the Intercolonial Railway and the varying surveys and choices of route for the Canadian Pacific Railway between Winnipeg and Vancouver. Mr. Perry showed that in costs per ton mile Canadian railways compared very favourably with railways of other countries.

Highways and Drainage

A regular meeting of the branch was held on February 18th, at the Kitchener hotel. In the absence of the chairman, H. S. Carpenter, M.E.I.C., presided. H. R. MacKenzie, A.M.E.I.C., took the opportunity of thanking the members of the branch for their support in electing him as councillor for this district. The papers for the evening dealt with the subject of "Highways and Drainage."

The chairman called on H. R. MacKenzie, A.M.E.I.C., for his talk on "Progress and Construction of Provincial Highways." For the benefit of members who had not seen them before, Mr. MacKenzie showed some very fine lantern slides illustrating highway construction. Mr. MacKenzie then gave some figures showing the growth of highway work under Federal Aid from its commencement in 1919 to the past year. Figures were also given showing the costs of different classes of work. In conclusion the speaker dealt with the economic and social benefits of improved highways.

D. C. M. Davies, A.M.E.I.C., was then called on to read his paper on "Bridges and Bridge Sites." Mr. Davies gave a very comprehensive outline of the various factors concerned, such as choice of site, approaches, materials, value to traffic and maintenance.

The chairman then called on M. B. Weekes, M.E.I.C., for his paper on "Drainage Development in Saskatchewan." Mr. Weekes outlined briefly the scope and intention of the Drainage Act and described the results obtained by the schemes at Water Hen lake and in the Yellow Grass district.

Annual Meeting

The ninth annual meeting of the branch was celebrated by a banquet at the Kitchener hotel on the evening of March 11th, 1926. R. N. Blackburn, M.E.I.C., presided and forty members and guests sat down to the dinner, enhanced by refreshments from the government cellars. Following the dinner the toast list was commenced by drinking to The King. The chairman then welcomed our guests to the meeting and asked their forbearance for a short time while a small amount of routine business was being despatched.

Mr. Blackburn then gave his address as retiring chairman of the branch. He commented on the fact that, to the present, development in the province has been almost entirely along agricultural lines. Prosperity or the reverse is therefore dependent on the yearly success or failure of the farmer. A remedy to this situation would be the development of other industries. The speaker then went on to show the possibilities for industrial development. The questions of fuel and power, including its distribution, were dealt with at some length as was also the problem of the development of the coal mining industry in southern Saskatchewan. In closing, Mr. Blackburn said that commercial success with Saskatchewan coal seemed to depend on combining a carbonizing or briquetting plant with a central power plant.

H. S. Carpenter, M.E.I.C., on behalf of the branch, presented Mr. Blackburn with an Institute badge, at the same time complimenting him on his faithfulness and success in conducting the affairs of the branch during his term of office.

The scrutineers presented their report as showing the election of officers to be as follows:

Chairman..............	W. H. Greene, M.E.I.C., Moose Jaw.
Vice-Chairman.........	M. B. Weekes, M.E.I.C., Regina.
Secretary-Treasurer....	R. W. E. Loucks, A.M.E.I.C., Regina.
Committeemen.........	J. W. D. Farrell, A.M.E.I.C., Regina.
(2 years)	A. M. Macgillivray, A.M.E.I.C., Saskatoon.
	P. C. Perry, A.M.E.I.C., Regina.

Nominating Committee

L. A. Thornton, M.E.I.C., Regina.
H. T. Crosbie, M.E.I.C., Yorkton.
J. D. Peters, A.M.E.I.C., Moose Jaw.
W. R. Warren, A.M.E.I.C., Regina.
G. M. Williams, A.M.E.I.C., Saskatoon.

Messrs. J. McD. Patton, A.M.E.I.C., and Stewart Young, A.M.E.I.C., were elected auditors by acclamation.

The chairman then called on R. W. E. Loucks, A.M.E.I.C., to propose the toast to The Province. In his proposal Mr. Loucks described the early happenings in the West, outlined the growth since the province was formed and projected its future development and prosperity. The response was made by the Hon. T. C. Davis, Minister of Municipal Affairs and Minister in charge of Bureau of Labour and Industries. Mr. Davis professed a very keen concern towards any subject touching on the development of Saskatchewan. Having been born in Saskatchewan he had been able to follow the growth of the West with the closest interest. Mr. Davis pleaded for the fullest use of Saskatchewan products in the construction programmes of the coming years.

Mr. R. S. Salmond then regaled the members in his own hilarious style with a couple of Scotch songs, red whiskers and plaid thrown in.

D. W. Houston, A.M.E.I.C., was then called on to propose the toast to The Institute. In his well-known humorous vein, Mr. Houston traced his progress from one responsibility to another since becoming a member of the Institute. The response was made by H. R. MacKenzie, A.M.E.I.C., Institute councillor for this district. Mr. MacKenzie spoke of the benefits obtainable from membership in the Institute, showing these benefits to be proportional to one's effort to attainment. The speaker also mentioned the erroneous ideas of engineers held by a portion of the public. Mr. MacKenzie stressed the need of engineers taking a more active part in public life.

Mr. Wood, a guest of the branch, gave two humorous monologues with piano accompaniment, which were much appreciated.

The toast to Allied and Sister Professions was moved by S. R. Parker, A.M.E.I.C., who voiced the opinion that the naval architect was the first professional man in the earth's history; that doctors and surveyors came later; that the youngest profession was that of electrical engineering. Dr. Morrison replied on behalf of the medical profession and stated as his belief that there had been a Great Surgeon at work before any other profession. Dr. Morrison said that the common aim of both medicine and engineering was the betterment of conditions for the human race and went on to outline some of the advances recently made in medical science. F. B. Reilly, A.M.E.I.C., replied on behalf of the Regina Architects Association. D. A. Smith, A.M.E.I.C., made response for the Saskatchewan Lands Association, showing the antiquity of land surveying. Mr. J. R. Young responded on behalf of the Saskatchewan Section American Institute of Electrical Engineers and hoped for the closest co-operation between that body and the E.I.C.

The toast to The Ladies was proposed by J. McD. Patton, A.M.E.I.C. The response on behalf of The Ladies was made by our chairman-elect, W. H. Greene, M.E.I.C., who deplored the absence of the ladies from the meeting.

Report of the Executive Committee

To Members of the Saskatchewan Branch:

Your Executive Committee have to report as follows concerning the condition of the branch and its operations during the past year:

The membership is 112 as compared with 128 reported this time last year and is made up as follows:

Honorary Members	1
Members	19
Associate Members	70
Juniors	7
Students	9
Affiliates	2
Branch Affiliates	4
Total	112

The Executive Committee have held eight meetings for planning and conducting the affairs of the branch. The number of branch meetings has been reduced to one per month and the attendance has been fairly satisfactory. During the summer a special meeting was held in honour of a visit from R. J. Durley, M.E.I.C., the general secretary of the Institute. Just recently Major Geo. A. Walkem, M.E.I.C., the new president of the Institute, made an informal visit to the branch on his return from the east.

Attached hereto is a financial statement showing current accounts for the past year's operations and a statement of assets and liabilities. This statement has been examined by your auditors.

It may be of interest to the members to know that owing to our reduced membership, rebates have been received from headquarters at the rate of 30 per cent instead of 25 per cent as formerly.

Attention should probably be called to the smallness of the deficit on meetings, indicating that this expense is almost entirely borne by members attending the meetings.

(Signed) J. W. D. Farrell, A.M.E.I.C.,
Secretary-Treasurer.

Financial Statement 1925-1926

Expenditure

Office expenses	$ 79.26
Meeting expenses	17.70
Honorarium, 1923-24	100.00
Scholarship	50.15
Sundries	36.65
	$ 283.76
Bank balance	113.38
	$ 397.14

Revenue

On hand from 1925	$ 68.88
Branch dues	61.00
Headquarters rebates	250.60
Sundries	16.66
	$ 397.14

Assets

Bank balance	$ 113.38
Headquarters rebates—current, (est'd)	221.10
Headquarters rebates—arrears, (est'd)	63.60
Branch dues—arrears, (est'd)	74.00
Branch dues—current, (est'd)	25.00
Furniture and Library	50.00
	$ 547.08

Liabilities

Branch dues paid in advance	$ 23.00
1926 Scholarship	50.00
Accounts payable	156.47
	$ 229.47
Surplus	317.61
	$ 547.08

This is to certify that we, your auditors, have examined the books and vouchers of the Saskatchewan Branch of the Engineering Institute of Canada and believe the above statement represents the correct financial position of the branch.

(Signed) A. C. Garner, M.E.I.C.
J. N. de Stein, M.E.I.C.
Auditors.

Sault Ste. Marie Branch

A. H. Russell, Jr.E.I.C., Secretary-Treasurer.

A regular meeting of the Sault Branch was held on Friday, March 26th, 1926, in the Y.W.C.A. following a dinner.

C. H. Speer, M.E.I.C., chairman, called the meeting to order and the business was disposed of before he introduced the speaker, Carl Stenbol, M.E.I.C., superintendent of the mechanical department of the Algoma Steel Corporation, who gave a most interesting paper on "Wind Measurements."

Wind Measurements

Mr. Stenbol pointed out that when any structure was designed, that wind loads were taken into account and that in all structures that are anchored to foundations the wind loads were easily taken care of, but in the case of movable structures, such as ore bridges, coal bridge and stackers, it was a different proposition. It can readily be seen that in the case of the ore bridge, accurate data on the wind must be obtained in order that the bridge may be stopped and securely clamped to the rails in the case of a strong wind arising. The bridges at the Algoma Steel Corporation are equipped with the "Stenbol" wind gauge so that the velocity of the wind is recorded and as soon as it registers 35 miles per hour the operator shuts down the bridge and applies the clamps.

Mr. Stenbol is deserving of great credit for this wind gauge. After making a careful study of wind, he found that the available formula and gauges differed considerably in results. During a heavy windstorm in 1911, readings taken at different points by different instruments varied from 60 to 20 miles per hour. The standard formula for United States is $P=0.004v^2$, and that of Great Britain is $P=0.003v^2$, showing a difference of 25 per cent. Having all these facts to contend with, Mr. Stenbol determined to design a gauge and calibrate. After making five tests under the best conditions possible, mean readings were taken and he established the formula $P=0.0034v^2$ for his gauge, which is known as the pressure plate type.

A model and photographs of his gauge were shown. A most interesting chart showing the wind pressure and direction at the same time by means of two pens was shown. This chart was made by Mr. Stenbol's gauge at the steel plant and covers a period of 24 hours.

A general discussion followed and a hearty vote of thanks was tendered to Mr. Stenbol.

St. Lawrence Waterway and Chicago Drainage Canal.

Part of an address by Mr. James Harper, president of the Minnesota Arrowhead Association, was read. This article dealt with the relation between the St. Lawrence waterway and the Chicago drainage canal. Two of the outstanding points were:—First, the decrease in freight rates which would result by having the ocean traffic through to the Great Lakes, thus allowing a direct water route. Since the Panama canal has been opened goods can be shipped from the Pacific coast and delivered to New York, by boat, cheaper than the same articles from Wisconsin and Minnesota shipped by rail. Secondly, at present in the Chicago district there is developed a considerable quantity of electrical power by utilizing the diverted waters, and they propose to develop more power from the same source. The speaker gave this as one reason why Chicago does not want to do away with their drainage canal. Mr. Harper clearly showed that to get the development of the "Deep Waterway" meant hard work and consistent organization.

Toronto Branch

J. W. Falkner, A.M.E.I.C., Secretary-Treasurer.

The Chicago Drainage Canal*

Two of the objects of the Engineering Institute of Canada, amongst others, are "to facilitate the acquirement and interchange of professional knowledge amongst its members" and "to enhance the usefulness of the profession to the public"; and these objects were abundantly fulfilled at an open meeting of the Toronto Branch held on March 18th, 1926, when J. L. Busfield, M.E.I.C., gave an illustrated lecture before several hundred members, and friends of members, on "The Chicago Drainage Canal."

Mr. Busfield dealt with this much discussed project—of the nature, history and magnitude of which the public at large, and even perhaps many members of our profession have only had very general ideas—in an authoritative and impartial manner, and covered very fully the many aspects of the case, historical, technical, financial and international; the numerous excellent lantern slides making it easy to follow the massed detail presented.

As an engineering project this canal directly interests all engineers; as affecting the diversion of waters from a waterway in which Canada has riparian and international rights, it is of consequence to all citizens, and a knowledge of the facts is essential to right public opinion. There is no one more qualified to speak on such a matter than a practising engineer, and those present felt that Mr. Busfield had done a great public service in coming to Toronto to give this lecture.

Annual Meeting

The annual meeting of the Toronto Branch was held on Thursday evening, March 25th, 1926, in room 22 of the Mining building, of the University of Toronto. About thirty-five members were present, Professor T. R. Loudon, M.E.I.C., being in the chair.

The secretary read the notice to members, calling the annual meeting, and the minutes of the annual meeting held on March 19th, 1925, were read and approved.

The Nominating Committee acted as scrutineers to count the ballots.

The retiring chairman gave a short address, in which he particularly emphasized the question of meetings and the attendance by members.

The secretary-treasurer presented the annual report and financial statement of the branch for the year.

Reports by the chairmen of the following sub-committees were read and adopted:—

Programme—T. R. Loudon, M.E.I.C.
Finance—J. G. R. Wainwright, A.M.E.I.C.
Publicity—S. G. Talman, A.M.E.I.C., and J. W. Falkner, A.M.E.I.C.
Attendance—L. W. Wynne-Roberts, A.M.E.I.C.
Library—A. C. Oxley, A.M.E.I.C.
Student Relations—W. L. Thompson, S.E.I.C.

A number of members then took part in a discussion on meetings and attendance, and the chairman contributed his views on this subject and concluded by expressing his appreciation and warmly thanking the officers of the Executive, the Annual Meeting Committee, and members for their support and assistance during his term of office.

Geo. A. McCarthy, M.E.I.C., chairman of the Nominating Committee, then reported the new officers elected for 1926-1927:—

Chairman—J. G. R. Wainwright, A.M.E.I.C. (Acclamation)
Vice-Chairman—R. B. Young, M.E.I.C.
Sec'y-Treas.—J. W. Falkner, A.M.E.I.C.
Committeemen—A. E. K. Bunnell, A.M.E.I.C. (2 years)
H. W. Tate, A.M.E.I.C. (2 years)
L. W. Wynne-Roberts, A.M.E.I.C. (2 years)
A. T. C. McMaster, M.E.I.C. (1 year)
I. H. Nevitt, M.E.I.C. (1 year)

Mr. Wainwright then took the chair and made a short address thanking the members for the honour conferred on him. Messrs. Young, Wynne-Roberts and Falkner also made a few appropriate remarks and thanked the members for their election.

R. O. Wynne-Roberts, M.E.I.C., on behalf of the branch, very effectively moved a hearty vote of thanks to the retiring chairman, secretary, and members of the Executive, which was seconded by Geo. A. McCarthy, M.E.I.C., and carried. Professor T. R. Loudon, M.E.I.C., aptly replied, followed by the secretary and J. A. Knight, A.M.E.I.C., who offered strong support for the coming year.

Vancouver Branch

P. H. Buchan, A.M.E.I.C., Secretary-Treasurer.

President Walkem Tendered Dinner by Branch

The Vancouver Branch held a dinner at the University Club on the evening of Saturday, March 13th, in honour of Major Geo. A. Walkem, M.L.A., M.E.I.C., president of The Engineering Institute of Canada, who had returned, a few days previously, from several weeks' tour of the central and western branches of the Institute, following the annual meeting in Toronto.

To describe adequately the pleasurable features of that occasion would require a combination of journalistic abilities not found in the present associate editor of the branch. One would need to be a parliamentary reporter, a social editor, a musical critic and a good bartender all rolled into one. It is safe to say, however, that the affair was an unqualified success, and that all those members of the branch who were unable to attend missed the best party ever given by the Vancouver Branch.

The dinner was the outcome of a general desire to celebrate the occasion on which a member of the Vancouver Branch has been elevated to the highest office in the Institute. The only other British Columbian engineer who has occupied that office is F. C. Gamble, M.E.I.C., a member of the Victoria Branch, who was elected in 1915. The occasion was of further interest, arising from the fact that the guest of honour is also president of the Association of Professional Engineers of B.C., and a very popular figure in the engineering profession in the province.

The dinner arrangements were in charge of a committee under the direction of L. F. Merrylees, A.M.E.I.C. Notices were sent to all of the district members of the branch, as well as branch residents; and it was most gratifying to the committee to witness an attendance of over forty guests and to receive communications of regret from a large number unable to be present.

The presiding officer was W. H. Powell, M.E.I.C., chairman of the Vancouver Branch. Following the toast to the King, Mr. Powell on behalf of the Vancouver Branch, formally congratulated the guest of honour, Major Walkem, on his election to the office of president of the Institute.

In responding to his toast, President Walkem described the functions of the Engineering Institute of Canada as being analogous to a privately owned university for engineers. He outlined its growth in prestige and influence since its inception in 1887, when it was originally incorporated as the Canadian Society of Civil Engineers. He stated that its educational value among engineers had been an increasingly important factor in bringing the engineering profession in Canada to its present high standard, and prophesied that its future progress would be marked by the upward trend of that standard, and by the improved relationship of engineers to employers and the public, generally. He showed how the standards and activities of the Institute, especially in the older provinces of the Dominion, had received such strong endorsation by employers and the public, that it is becoming general practice to give members of the Institute preference when appointments are made.

President Walkem referred to the recent efforts of the Institute towards fostering the growth of the professional engineer movement, and stated that the influence and facilities of the organization had been definitely placed at the disposal of the professional engineering bodies of the various provinces to assist in bringing about close cooperation and uniform standards. A meeting in Montreal, attended by delegates from each provincial body, had already been productive of very encouraging results. E. A. Wheatley, A.M.E.I.C., registrar of the Association of Professional Engineers of B.C., had been the delegate from the local body at that meeting, and since his return, several of the recommendations of the meeting had been placed in effect here.

*This paper has been presented before a number of branches of the Institute and is published in full in this issue of the Journal.

The speaker also drew attention to the duty of engineers to take an active part in public life, by offering themselves for service in public bodies. He said that the education and professional training of engineers equipped them with abilities of the utmost value in public service, and that their lack of interest in such opportunities had not only caused the profession to suffer, but had been detrimental to the Dominion as a whole. He voiced his gratification that an increasing number of engineers in Canada had assumed duties in public capacities, during tne past few years, and that the example of these men was having noticeable effect in the encouragement of other engineers to follow suit. He urged those present to give this matter their earnest consideration, as he believed that only by such a movement would the engineering profession ever be of maximum benefit to the nation.

Special interest was attached to the dinner by the presence at the guest table of two veteran members of tne Vancouver Branch, Thomas H. White, M.E.I.C., and James H. Kennedy, M.E.I.C. The senior member of this group of "Pioneer Railway Builders," H. J. Cambie, M.E.I.C., was unavoidably absent, and greatly missed by everyone. The sincere respect and unquestioned popularity of the trio was very marked when their health was proposed during the evening. Mr. White, on behalf of Mr. Camoie and himself, acknowledged the demonstrations of friendship in a brief but well-chosen address, followed by Mr. Kennedy, whose naive wit provoked considerable amusement amongst his listeners.

The more serious aspects of the after-dinner programme were offset by an address on "Reminiscences of Army Life," given by Mr. E. E. Delauvault, who served throughout the war in the Corps of Interpreters of the French Army, and by a very enjoyable musical programme rendered by Ernest Smith, A.M.E.I.C., assisted by several members of the New Westminster Operatic Society. The instrumental and vocal selections given exhibited musical talent of very superior quality and were received with many requests for encores. Mr. Delauvault's picturesque descriptions of the duties of interpreters and their relation to the interior economy of the British Army in France were keenly enjoyed, not only as interesting side lights on the late war, but as a series of anecdotes of a more or less personal nature relating to the humorous phases of life behind the lines.

A very able contribution to the success of the dinner was the menu card which was designed and executed by W. G. Gale, A.M.E.I.C. The artistic aoilities of Mr. Gale show a high degree of excellence, as also does his originality of design.

President Walkem not only expressed his genuine pleasure in being the guest of honour at this function, but bespoke the success of future occasions of this nature, and hoped that the executive would let pass no opportunity which might arise to bring the members of the branch together under similar enjoyable circumstances. In the aftermath of the dinner, the numerous comments of those present bore testimony to the president's appreciation of the need for such events in the life of the branch, and indicated that the next committee which undertakes a similar enterprise will be rewarded with even greater success.

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

At the close of a business meeting held in the branch club room on March 3rd, J. H. McIntosh, S.E.I.C., gave a paper on "The Manufacture of Cement." Several diagrams illustrating the growth of production of Portland Cement on the North American continent, and the varying amounts imported were shown, after which the historical development of cements was sketched up to the time that Joseph Aspdin of Leeds took out letters patent for "Portland Cement"; the improvements since that date were then outlined.

It was pointed out that the varying quality of the raw materials demands, under present-day standards, the services of a works chemist whose duties are not only to obtain a mixture of suitable composition, but to see that proper control ensures continuance of the desired proportions, so that the finished cement can always be relied on to have the same characteristics.

The processes in manufacture were outlined, and illustrated, not only by photographs, but by an excellent series of samples taken at different points in the progress from slurry to clinker as it passes through the rotary kiln.

At the close of the paper, Mr. E. Tomlin, director-treasurer of the B.C. Cement Company, added a few remarks on costs, and particularly emphasized the quick-hardening properties of the Bamberton cement, due to the superior quality of the raw materials obtained, backing up his assertion by a reference to the record-breaking speed obtained with movable forms on the Prince Rupert grain elevator.

A lively discussion followed in regard to quick-setting and quick-hardening of cement, and as to the causes of various difficulties met with, the meeting adjourning at 11 p.m.

Congratulations were extended to Mr. McIntosh on the excellence of his paper, and thanks to Mr. Tomlin for much information given. Mr. Tomlin kindly extending an invitation to the members of the Victoria Branch to visit the works at Bamberton at a later date.

Victoria Fire Department

On March 16th, at the invitation of Fire Chief Stewart, members and friends met at the Central Fire hall, and after being welcomed by the chief, the latest piece of apparatus, an American-La France pumper, capable of delivering 300 gallons per minute at the end of 1,200 feet of hose, was run out, connected to a hydrant, and two fire-streams pumped. The other motor apparatus in the fire hall was inspected, with particular interest in the 75-foot aerial, and the various smaller equipment, including the life-line and gun.

Humidity readings, taken every few hours at the Yates Street hall, have been kept during 1925. While the value of these has not been fully settled as yet, press notices as to dangerous atmospheric conditions seemed to have been of considerable service, as the number of fires in July and August, 1925, were only 50 per cent of those of the previous year.

Various record books and report forms were shown, and the party then adjourned to the operating room, where the operator in charge outlined the methods by which the box alarms were automatically recorded, and the various fire halls notified. A separate automatic alarm system, connected with the parliament buildings and other structures of note in the city, which comes into play when the heat in the buildings exceeds a fixed degree, was also examined. While in the operating room, the deputy chief turned in an alarm from one of the city boxes, so that the whole of the operations and responses from the fire halls could be followed.

On returning to the Central hall, in which the motor apparatus stands in readiness, a zero call (the fire alarm by telephone), was received, and with a scuffling overhead as the alarm gong rang, and a rush by door, and rapid descent by post, in a few seconds two of the motors were manned ready for directions.

Retiring to the firemen's bandroom, the chief mentioned some of the historical fires in the city, adding a résumé of the various causes that had led to the burning of residences, etc., in the past few years.

Victoria has two fire protection areas, the business part having a high pressure system directly connected to the Humpback reservoir, with a hydrant pressure of 125 pounds to the square inch; the residential section having an average pressure of 65 pounds to the square inch from Smith's Hill reservoir.

In the event of a breakdown in the city supply from the Humpback, a high pressure pumping station can boost the pressure from Smith's Hill, or can connect directly with salt water in case of need.

The training of the fire-fighting staff was briefly dealt with, and the wide knowledge of all apparatus and its use emphasized by the statement that, owing to the adoption of the two-platoon system, the legal requirement of one day's rest in seven, and the allowance of an annual holiday, out of a fire-fighting force of 74, it was necessary to have 32 qualified drivers.

At the close of his talk, Fire Chief Stewart answered a number of questions, and the thanks of the members of the branch were then expressed by F. C. Green, M.E.I.C., member of council, who acted as chairman owing to the regrettable absence of the branch chairman, J. N. Anderson, A.M.E.I.C., through illness.

The Pacific Great Eastern Railway

On the last day of March, T. Kilpatrick, general manager of the Pacific Great Eastern Railway, gave a concise review of matters affecting that much discussed line.

After giving numerous figures as to costs, and annual deficits, Mr. Kilpatrick emphasized the gradual advance being made, and stated that for a recent month, the receipts on the main line from Squamish north showed a surplus over operating expenses. He considered the P.G.E. should be looked upon as a colonization line, and time should be given to prove its real value. Specific cases were given of increase in freight through the growth of farming, cattle-raising, and the discovery of large deposits of soda.

Following the line from Squamish to Quesnel, Mr. Kilpatrick drew attention to the scenic attractions at different points, fishing, hunting, mineral and timber wealth, agricultural and range land available, and various water-power sites.

Garibaldi park, with the construction of twelve miles of road, would make it possible for citizens of Vancouver to reach glaciers within five hours of their city.

In the area around Quesnel lake, there was sufficient timber with approved methods of cutting to keep a pulp and paper development of considerable size working in perpetuity.

The development of the Bridge River power site by the B.C. Electric Railway Company would mean much to the province and the railway; it was an ideal site, as, with a comparatively short tunnel, 1,200 feet of head could be obtained, giving a development variously estimated as from 400,000 to 700,000 horse power.

In conclusion it was pointed out that the people of the province occupied a somewhat similar position to the shareholders of a company, and that it was to their benefit to do their utmost to make it a paying line, instead of indulging in a lot of criticism, much of which was unjust.

Mr. Kilpatrick was the recipient of many congratulations on his excellent presentation of facts and his vision of future progress, and received a hearty vote of thanks from the Victoria Branch for his kindness in addressing them.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
Stanley A. Neilson, A.M.E.I.C., Branch News Editor.

Montreal-South Shore Bridge

The Montreal-South Shore bridge formed the subject of an interesting lecture, illustrated with lantern slides, which was delivered by P. L. Pratley, M.E.I.C., on March 25th to the Montreal Branch.

Mr. Pratley opened his address with a lucid description of the various bridges that have been projected from time to time to augment the means of transportation between the north and south shores of the St. Lawrence at Montreal, now supplied by the Victoria Jubilee bridge, which is no longer capable of taking care of the vast amount of traffic that is required of such a connecting highway.

The Victoria tubular bridge was officially opened in 1860, and was replaced by the present structure in 1898. Other projects have since been considered, but it was not until last year that authorization was given and the first sod was turned on June 3rd last year.

Mr. Pratley then proceeded to outline the construction that has already been executed, showing a series of slides demonstrating certain piers in course of erection and in their completed form.

A short discussion followed the reading of the paper after which a vote of thanks moved by J. J. York, M.E.I.C., was tendered to the speaker by the chairman, F. P. Shearwood, M.E.I.C.

Modern Problems of Synchronous Converters

April 1st brought some bad weather, but the members of the branch who braved the storm were well rewarded by the very fine paper on the above subject which was read by E. B. Shand.

Mr. Shand dealt with the recent developments of the synchronous converters discussing the troubles of flashing, the starting of rotary converters, the ventilation of this type of apparatus and other interesting problems. The paper was well illustrated with slides and was followed by a brief discussion.

In moving the vote of thanks, P. S. Gregory, M.E.I.C., said that he was glad to hear someone speak with authority on this subject and he was also glad to hear that the synchronous converter had been tamed as he had always considered it a wild animal to be put in a place by itself and left alone.

G. A. Wallace, A.M.E.I.C., occupied the chair.

Cost System for a Large Engineering Establishment

J. S. Houston, comptroller of the Dominion Engineering Works, addressed the Montreal Branch on the above subject on the evening of April 8th, and gave some interesting information on the special problems in accounting which are developed in an engineering manufacturing establishment.

W. C. Adams, M.E.I.C., occupied the chair.

Some Features of Hemmings Falls Power Development

On April 15th, the Montreal Branch had the pleasure of hearing J. S. H. Wurtele, M.E.I.C., tell of some of the difficulties experienced during the building of the above mentioned plant. Mr. Wurtele discussed the reasons for the selection of the size and type of units, the position and type of dam, the number and size of sluice gates, etc.

The damage done by a sudden flood which brought down thousands of sticks of pulpwood and carried away the concreting trestle, was well illustrated by a number of slides. Ice troubles before and after the erection of the dam were also discussed and aroused quite a bit of interest judging by the number of questions that were asked. The proper allowance for ice pressure to be used in the design of the structures was also a point of considerable interest.

Questions were also raised regarding concrete mixing, placing and the proportion of plums.

S. F. Rutherford, A.M.E.I.C., proposed the vote of thanks which was tendered to the speaker by the chairman, J. A. McCrory, A.M.E.I.C.

Tribute to Prof. L. A. Herdt, M.E.I.C.

C. J. Desbaillets, M.E.I.C., chairman of Montreal Branch, spoke as follows before the meeting on April 15th:—

Gentlemen:—

The members of the Institute are deeply moved by the death of Dr. Louis Anthime Herdt, M.E.I.C., which came last Sunday, the 11th of April, at noon. In him, the young generation loses a valuable educator; the engineer of to-day, a faithful and devoted companion; and humanity, a gentleman.

Born in France, he came to this country as a boy; he was educated at McGill, and took further degrees at the Ecole Spéciale d'Electricité of Montefiore, in Belgium. Successively demonstrator and lecturer at McGill, he rose to the rank of professor, then head of the electrical department.

His research in the electrolysis field, his work and publications on the compounding of alternators gained for him the title of Doctor of Science and the decoration of Officier d'Académie.

Later, he was elected chairman of the Canadian National Committee of the International Electrotechnical Commission; chairman of the Electric Service Commission; vice-chairman of the Tramways Commission of Montreal; and member of numerous societies and clubs which would take too much time to mention here. Three years ago, he was made Chevalier de la Légion d'Honneur by the French Government. He was a member of council of this Institute for five consecutive years.

Internationally known, the Governor of Bermuda called upon him to make a report on an important transportation problem, and his recommendations were followed. He investigated in Sweden the application of electricity to blast furnaces. From east to west, large developments will remain a tribute to his skill and to his untiring energy. His conceptions were well balanced, his vision precise, and consequently his advice valuable.

His integrity made him the arbitrator of many important cases, and I cannot help mentioning one remark he made to me after having rendered his decision in a rate controversy between the city of Montreal and a public utility company:—"Well," he said, "a few more of these arbitrations and I am a ruined man." In order to render a disinterested judgment, he had sold (not passed to a third party for the time being), all the stock he had in that company at a loss far exceeding the amount of his fee.

When the war broke out, he went to France and reported to the military authorities. He was told: "What can we do with a Doctor like you? Go back to Canada and if we need your class we will let you know." He came back with a broken heart. But when Captain Dulieux came from New York looking for someone to take charge of the inspection of war material purchased by France in Canada, the work was considerable, the specifications from abroad had to be adapted to the manufacturing process of this country, Louis Herdt stepped forward and said: "I will do it;" and he put in, besides his regular duties, two years of strenuous work, and he refused to be paid for it.

This is the gentleman we have lost.

Death would be useless if it did not teach us a lesson, and this is the lesson of this sad case. A few weeks before his death Louis Herdt told me: "If I am in this state, I deserve it; I kept on working without rest, without vacations, without relaxations. Don't do the same, a man must take care of himself. Take care of yourself. Take care of the ones that are working for you; give them their vacations when they need them, not when it is convenient to you alone."

There is his advice. . . . kindness to the end.

Gentlemen, I propose that the following resolution be passed and presented to his family as a mark of esteem on the part of his colleagues of the Institute:—

Resolution

It is the desire of the Montreal Branch of The Engineering Institute of Canada to express their deep regrets on the death of Dr. Louis Anthime Herdt, past Member of The Engineering Institute of Canada, past chairman of the Canadian National Committee of the International Electrotechnical Commission, past member of the Council of the Institute for five consecutive years.

His strong personality, his admirable character and his highly developed sense of professional integrity gained the hearts of all who came in contact with him.

Internationally known, this eminent engineer and technical educator leaves behind him the remembrance of a gentleman devoted to his friends, kind to his pupils, always ready to lead the way to work because he believed in work.

The Montreal Branch feels his loss deeply, recognizes the magnitude of the services he rendered to the Institute, and wishes to offer to his bereaved family the expression of their profound and sincere sympathy.

International Electrotechnical Commission

Members of the above commission are arriving in Montreal in the early evening of May first, and are to be entertained at a cabaret.

On May second they will be driven around the city in the morning, entertained to lunch, and then driven around the Island in the afternoon. The party are leaving for Boston in the evening.

Papers and Meetings Committee

This committee are at work on next year's programme and will welcome suggestions and contributions. Send yours to the Branch Secretary.

Presentation of the Plummer Medal

At the meeting of the Montreal Branch on April fifteenth, C. E. Bronson, assistant inspecting engineer, New York Central Lines, was present to receive the Plummer Medal, which, in accordance with the report of the Plummer Medal Committee, was presented to him for his paper on "Steel Rails," presented before the Montreal Branch of the Institute on October 30th, 1924, and printed in the

December 1924 issue of the Journal. The presentation was made by K. B. Thornton, M.E.I.C., who made a few appropriate remarks. Mr. Bronson replied as follows:—

Mr. Chairman, Members of the Institute, and Guests:—

In accepting this distinguished medal, I feel deeply honoured as its recipient, and appreciate the hearty and cordial manner in which the presentation is made by the Engineering Institute of Canada.

Little did I anticipate such an honour some eighteen months ago when addressing you upon the subject "Steel Rails," and the news of the award came as a delightful surprise.

While the speaker takes great personal pride in the award, the paper itself was not necessarily noted for its originality or research features, being more a record of the progress and achievements to which hundreds have contributed both past and present. It is in reality a tribute to all of the men who have utilized their skill, talent and efforts towards the development of the rail in particular, and railroad service in general.

Remarkable progress can be recorded for steel rails during the past two years. The general acceptance by the manufacturers and railroads of the 1925 American Railway Engineering Association specification has created the 39-foot rail as the standard of length; also classification of rails as to fitness and chemistry, improvements in details of manufacture, further use of special composition rails, together with the installation of heavier sections.

Upwards of five million dollars will be expended by the steel plants for necessary changes to accommodate the longer length rails, and in a number of ways will virtually revolutionize mill practice. The mills are taking these progressive steps without passing the cost along to the railroads, and shows the spirit of co-operation which is indeed gratifying.

The past year has been a momentous one for the New York Central Lines, marking as it does the installation of the first 45,000 tons of 7-inch, 127-pound Dudley section rail in the main line high speed tracks between New York and Chicago. The System has also standardized on the three tie supported joint with 38-inch heat treated splice bars, and heat treated bolts; decided on and installed canted and cambered tie plates after two years of extensive research, arranged for pre-boring and adzing of ties before treatment, and has purchased copper bearing spikes and tie plates in large quantities for more widespread use.

The first rolling of the 127 pound section will be made shortly of Hadfield manganese steel, and will be the highest and widest base section ever rolled of this peculiar steel.

Eight thousand tons of the one and one-half per cent manganese rails are being purchased, and the noticeable ease with which it pours, the quiet setting in the molds, the toughness and flow properties in the various rail shaping passes, and finally the resistance to deflection under impact coupled with higher exhausted ductility augur well for the future possibilities of its use in rails. The same material has proven its merit in the automotive industry as a forging steel of unusual toughness and strength either with or without heat treatment.

While research should continue for still further improvement in steel rails, there are equally important problems in the steel field to be investigated in such materials as wheels, axles, tires, forgings, draft gears, springs, frames and numerous other commodities. Research covering any of these lines should be largely of a practical nature on the railroad, in the shops and in the steel mills for refinement in manufacture and more intelligent use of the materials in service, supplemented by such chemical, physical, metallurgical and microscopic work as the exigency of the case becomes essential.

Researches and investigations need not be narrowed down to the confines of some quiet little laboratory to delve into the mysteries of atoms, molecules and the structural condition of crystals, for the problems we face are practical in nature in the realm of applied science rather than theoretical in the field of pure science. Our steel purchases each year are in enormous tonnages, made from heats of such size that a high degree of practical experience and skill is required to attain the necessary refinement in quality to meet the demands of present-day service.

The feeling is somewhat prevalent that the limit of endurance of carbon steels has been reached and that a super-steel is necessary to meet our requirements. Various alloy and heat treated steels are advocated to solve the problem. The speaker believes the sound advice of the late Dr. H. M. Howe, one of the foremost American metallurgists, made nearly ten years ago, that well-made carbon steel is equal if not superior in many respects to the so-called "fancy steels," and can be purchased at much lower prices and with less hazards. While the alloy steels are known to produce wonderful qualities of toughness and tenacity, the greatest care is required in handling these somewhat tender steels, and frequently detrimental effects are encountered which more than outweigh anticipated advantages.

An excellent example of this point is found in the automotive industry. The popular thought a few years ago was that alloy steels were essential for inherent strength and stability to withstand shocks and hardships of service. The reversion to carbon steel and one and one-half per cent manganese steel has been quite marked.

What we need at the present time is to strive for an improvement in the quality of our present grades of steel rather than make a radical departure to the use of alloy and heat treated steels; together with more intelligent understanding of their service utility.

This distinguished medal which I understand is presented from time to time, and the pride one feels in winning its award, acts as an incentive and inspiration to us to strive upward and onward; to seek the light of knowledge and its useful application for service; to aim for and aid in the betterments and improvements within the respective fields we are engaged in, to the end that the results may be beneficial to the welfare, safety and comfort of humanity.

All honour to the man through whose lofty ideals this award was made possible, and my sincere thanks and gratitude to the Engineering Institute of Canada for the bestowal upon me of this distinguished emblem, which will also be cherished as a token of your own high ideals and purposes.

Convention of Canadian Chemists

A convention of Canadian Chemists will be held at the Windsor Hotel, Montreal, May 31st, June 1st and 2nd. The committee in charge of the arrangements for the convention have announced the following tentative programme:—

CELLULOSE SYMPOSIUM

"The Bearing of X-Ray Analysis on the Constitution and the Technical Application of Cellulose Derivatives."

"Recent Scientific Developments in the Field of Textile Chemistry"—Professor Herzog, director of the Faserstoff Institute, Berlin-Dahlem.

"Canada's Opportunity in the Field of Cellulose Chemistry"—Professor Hibbert, McGill University.

"Nitro-Cellulose, its Manufacture and Uses"—J. Bascom Wiesel, Hercules Power Company.

"Effect of Heating on Cellulose"—Professor J. Watson Bain, University of Toronto.

"Nitro-Cellulose Lacquers—Developments and Uses."—T. W. Smith, The Flint Varnish Company.

In addition to the regular papers given by Professor Herzog, an X-Ray demonstration of "Fibre Analysis" will be given in co-operation with the Department of Physics at McGill University.

In addition to the above there will be papers on artificial silk, although the authors for the same have not yet been decided upon.

GENERAL PROGRAMME

"Electrical Properties of Refractory Materials" from the viewpoint of a physical chemist—Professor J. B. Ferguson, University of Toronto.

"Alkali Hydroxides as Catalysts in Oxidation Processes."—by Dr. M. C. Boswell, University of Toronto.

"The Present State of the Bios Question"—W. Lash Miller, University of Toronto.

"Saturated Solutions of Gases at Pressures up to 200 Atmospheres" (illustrated)—Dr. F. B. Kenrick, University of Toronto.

"Experimental Study of the Carbon Arc with currents up to 800 amperes" (illustrated)—Professor T. J. Burt-Gerrans, University of Toronto.

"The Effect of Radiation on Reaction in Gels"—Dr. A. F. C. Cadenhead, Queen's University, Kingston.

"Gasoline and Substitute Motor Fuels, with special reference to Synthetic Methanol and Synthol"—E. E. Gilmore, Testing Laboratory, Ottawa.

"Examination of Used Lubricating Oils" —P.V. Rosewarne, Fuel Testing Laboratory, Ottawa.

"Electrolytic Iron from Ilmenite Ores"—R. H. Monk, McArthur, Irwin Company, and R. J. Trail, Department of Mines, Ottawa.

"Dyeing Difficulties"—W. R. Allen, The Ciba Company.

"Principles of Corrosion and Methods of Testing"—Frank N. Speller, M.E.I.C., National Tube Company, and Dr. R. P. Russell, Massachusetts Institute of Technology.

"Study of Reaction of Sulphur on Linseed Oil"—G. S. Whitby and Miss H. B. Chataway, of McGill University.

"Study of Diffusion of Oxygen in Silver"—Dr. F. M. G. Johnson and E. W. R. Steacie, of McGill University.

"Problem of Oxidation in Organic Chemistry"—Dr. W. H. Hatcher, McGill University.

"Reaction between Halogen Hydrides and Unsaturated Hydrocarbons"—Dr. O. Maass and C. Severtz, McGill University.

It is expected that a complete programme will be available shortly.

Full information regarding the convention can be obtained from Mr. Harold J. Roast, consulting chemist, 145 Mill Street, Montreal.

Major-General Sir Alexander Bertram, M.E.I.C.

Members of the Institute, throughout the Dominion and abroad, will learn with profound regret of the death of Major-General Sir Alexander Bertram, M.E.I.C., which occurred on Saturday morning, April 24th, 1926, at his home, 315 Kensington avenue, Westmount, Que.

Sir Alexander's genial personality and distinguished career won for him a multitude of friends and admirers, not only among the engineers and industrialists with whom he was so actively associated, but also among men in all walks of life, and the news of his death will come as a great shock to all those who have been privileged to come in contact with this remarkable man.

His loss will be particularly felt in connection with the affairs of the Institute, of which he has been Treasurer since 1919, and to which his services have been invaluable.

In good health up to almost the last, Sir Alexander passed away surrounded by members of his family, and in an atmosphere of love and kindliness that was a part of the very man himself.

To the public generally he is best known as the man who in the dark days of war, when it became apparent that the Empire was engaged in a struggle for existence, built up through knowledge and thoroughness an organization that as time went on saw to it that Canadian soldiers were supplied with all that was needed in the matter of shells. To his friends he was known for the last thirty years at least as a captain of industry, ever ready to serve in good causes, to help friends and to cheerfully bear all the burdens which went with his high ideas of citizenship.

Sir Alexander Bertram was 73 years of age, but far from showing signs of age, had been attending to his business affairs at his office in Montreal, headquarters of John Bertram and Sons, Limited, within comparatively few days of his death. He was stricken with illness only last Monday, after attending a meeting of the Engineering Standards Association at the headquarters of the Institute, to which organization he gave much of his time and knowledge.

Born at Dundas, Ont., on February 18, 1853, the son of John Bertram, prominent even in those earlier days of Canada's industrial life, he was quickly initiated into craftsmanship, for at the age of fourteen he went to work in his father's plant, a plant he was destined to head in later years, and to see grow under his direction into a great institution. He was head of the company when he died, and its active director. Until 1912 he lived at Dundas, extending his affairs throughout the country, and it was in 1912 that the operations of the company had reached such magnitude that he felt it necessary that he personally should move to Montreal to supervise matters from there.

With the militia he had been associated from the age of sixteen when he joined the 13th Regiment at Hamilton as a bugler boy. He won his way forward rapidly and became commander of the 77th Wentworth Regiment of Hamilton, and later was appointed to the command of the 3rd infantry brigade, which gave him the rank of brigadier-general. He was on the reserve of officers when the world war broke out in 1914, and he immediately offered his services to Sir Sam Hughes, Minister of Militia at the time. In those early days of the war, when it was realized that Canada needed haste and knowledge in the matter of providing munitions, the Government turned to Sir Alexander Bertram, it being the unquestioned opinion that he was the best qualified of all industrial men in Canada to form the necessary organization to do the work. Not only had the Government of the day faith in him, but its faith was also shared by brother manufacturers from one end of the country to the other, and as chairman of the shell committee, which was called into being, he set to work. At that time Canada produced nothing but some 18-pound shrapnel shells at the Dominion Arsenal in Quebec, hence it was necessary for the committee to commence from the ground, and so earnestly did Sir Alexander and his colleagues set about and execute their plans that there grew up in a comparatively short time workshops which turned out shells in great quantity for the service not only of Canadian soldiers but for the Allies generally. At that time the United States was not in the shell making business, and Sir Alexander Bertram and those with him had to aid that country in turning its great industrial machine to the task of shell making. There came here men from the Bethlehem Steel Corporation and other vast United States organizations to learn what must be done. So strenuous was the task, and so earnestly did he give himself up to the work, that Sir Alexander's health broke down in 1915 and a rest of three months became imperative.

MAJOR-GENERAL SIR ALEXANDER BERTRAM, M.E.I.C.
Born, Dundas, Ont., February 18th, 1853.
Died, Montreal, Que., April 24th, 1926.
Treasurer of The Engineering Institute of Canada, 1919-1926.

What the activity of Sir Alexander Bertram and his colleagues meant to Canada in an industrial way is shown by the fact that the British Government in 1914 was not aware that Canada could quickly be placed in a position whereby it could supply needed munitions, yet in January of 1915 it was estimated that fifty Canadian manufacturers were engaged in this industry, and the steel plants throughout the country had their organization well under way for continuing and enlarging the work.

His interest in the military organization of Canada went further than actual connection with militia regiments. He was a deep believer in the theory that young Canadians should be trained to shoot, and trained to shoot straight. In 1909 he commanded the Canadian Bisley team which did so well in England in that year, the Canadians carrying off three cups—the McKinnon, the Kolopore and the Queen's Jubilee, the first time in Bisley history when all three cups were won by one team.

Sir Alexander at the time of the Bisley shoot was given the Colonial Auxiliary officers' decoration. His interest in rifle shooting led to him taking an active part in the affairs of the Dominion Rifle Association, and he was president of that organization for a number of years. Only a few weeks ago Sir Alexander was honoured by the association, he being, together with E. W. Beatty, Sir Henry Thornton, and General Sir Arthur Currie, made an honorary life member of the association.

Sir Alexander took a pride in the fact that he had grown up from the commencement in the engineering business, and was ever ready to aid fellow engineers. He joined the Institute in 1911 when he was elected Member on October 14th of that year. His devotion to the interests of the Institute is well known to all its members but more particularly to the executive officers who have served on its council during the past eight years. In addition to being Treasurer of the Institute, he was on the Council during the years 1919 to 1921 and served on many of its committees. He was chairman of the Engineering Standards Committee of the Institute, and vice-chairman of the Main Committee of the Canadian Engineering Standards Association, and attended a meeting of that committee at the Institute headquarters on Monday, April 19th, which was his last public appearance.

Sir Alexander was also interested in golf, lawn bowling, and curling, and was a member of the Thistle Curling Club, of the Beaconsfield Golf Club, of the Senneville Club, as well as of a host of other clubs, such as the Mount Royal, the St. James Club, the Rideau Club of Ottawa, the Hamilton Club, the Rotary and Railway Clubs—in fact there were few clubs in Canada where at some time or other he was not welcomed with pleasure. He had an excellent memory for men and things, was ever cheery and encouraging to younger men, so that he was liked and admired wherever he went.

Preliminary Notice

of Applications for Admission and for Transfer

April 19th, 1926

The By-laws now provide that tne Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of tne record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in May 1926.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council, shall be required to pass an examination before a board of examiners appointed by the council The candidate shall be examined on the theory and practice of engineering with special reference to the branch of engineering in which he has been engaged. This examination may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects: geography, history (that of Canada in particular), arithmetic, geometry, euclid (books I, IV and VI), trigonometry, algebra up to and including quadratic equations.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed successfully an examination equivalent to the final examination of a high school or the matriculation of an arts or science course. He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination equal to that prescribed for admission to the grade of Junior in the foregoing section and he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

ADDIE—DONALD KYLE, of Montreal, Que., Born at Sherbrooke, Que., Aug. 17th, 1902; Educ., B.Sc., McGill Univ. 1925; about 3 yrs. machine shop and foundry apptceship; 5th engr. S.S. "Cabotia", Anchor-Donaldson Line, 1921; engrg. staff Price Bros., Kenogami (summer) 1923; engr. i/c survey 2nd power transmission line between St. Joseph d'Alma and Kenogami with Grande Decharge Development, 1924; at present mech. engr. and at times night supt. with Dom. Glass Co. Ltd., Point St. Charles factory.

References: G. P. Cole, H. W. Racey, G. K. Addie, J. B. Porter, C. M. McKergow, E. Brown.

BAIRD—JOHN AINSLEE, of Sarnia, Ont., Born at Leamington, Ont. Feb. 9th, 1887; Educ., B.A.Sc. Univ. of Toronto, 1911; student under A. Baird, munic. drainage and reclamation schemes; 1914, town engr. of Leamington, Ont., i/c sewers, pavements, etc.; 1915-21, city engr. Sarnia, Ont., also priv. practice in surveying and munic. drainage and bridge work; 1921, installed water works system at Courtright, Ont.; 1922-23, drainage and surveying works; 1924, associated with A. Baird, survey, plans, etc. for reclamation of Holland Marsh, also asst. engr. erection of Dom. Alloy Steel plant, Sarnia, Ont.; 1925, with A. Baird as engr. on constrn. of Holland Marsh drainage scheme; at present, engaged on sub-divisions and munic. drainage.

References: C. A. Mullen, A. J. Halford, R. C. Muir, F. A. Dallyn, F. W. Thorold, F. W. Ure, P. Gillespie, J. L. Lang, F. W. Farncomb, Ross Dobbin, G. A. McCubbin.

BRADLEY—ROBERT AULDOM, of Merritton, Ont., Born at Merritton, Ont., May 21st, 1898; Educ., Junior Matric. 1913; 1914-16, rodman, Welland Ship Canal constrn.; 1916-19, overseas, 19th Battery, C.F.A.; 1919 to date, on Welland Ship Canal constrn. as instrumentman, i/c layout wrk., including weirs, entrance walls, deep foundations of lock No. 3; since 1924, Junior engr. i/c field work Sec. 2.

References: A. J. Grant, E. G. Cameron, F. C. Jewett, R. D. Inness, D. E. O'Brien,

LOGGIE—COLIN CAMPBELL, O'Brien, Que., Born at Chatham, N.B., Aug. 31st, 1895, High School, Chatham; 8 mos. course in dfting with D.S C.R., Toronto; 1920, I.C.S. course partially completed; 1920-23 chainman mtce. C.N.R.; 1923, chainman and rodman, constrn. Long Lac cut-off, C.N.R., 9 mos.; asst. eng. H. Hull, town engr. of Saranac Lake, N.Y., 3 mos; 1924, chainman, mtce., Capreol div. C.N.R.; 1925, dfting, etc. in div. engrs. office, Capreol, Ont.; Oct. 1925 to date, office engr. constrn. Rouyn Mines Rly.

References: C. H. N. Bonnell, W. H. B. Bevan, S. McIlwain, K. G. Polyblank, D. E. Carriere.

McLEOD—NEIL, of Glace Bay, N.S., Born at Sydney, N.S., Jan. 16th, 1888; Educ., High School and I.C.S. in elec'l. engrg.; 1904-08, aptceship in Dom. Iron & Steel Co.; 1908-10, elec'l repair shop, Gary Steel Works, Gary, Ind.; 1910-16, foreman of elec'l. repairs N.S. Steel & Coal Co., Sydney Mines; 1916-21, gen. foreman N.S. Steel & Coal Co.; 1921-25, ch. elect., N.S. Steel & Coal Co.; 1925 to date, ch. elect. all coal mining operations Brit. Empire Steel Corp.

References: E. L. Martheleur, J. J. McDougall, J. Purves, A. Dawes, A. L. Hay, S. C. Mifflen, C. M. Smythe.

MURPHY—GEORGE ARNOLD, of Montreal, Que., Born at Ottawa, Ont., July 31st, 1901; Educ., R.M.C. 1922; Univ. of Toronto, Sept. 1922 to Apl. 1923; 1923-24, foreman, re-inforcing steel and checker of hydraulic equip. St. Maurice Power; 1924-25, engrg. clerk, dept. mtce. of way, Q.R.L. & P. Co.; at present, ch. clerk, office of the gen. supt., Montreal Tramways Co.

References: D. E. Blair, K. B. Thornton, C. J. Pigot, C. S. Saunders, J. C. Smith, S. Svenningson, P. S. Gregory.

NELSON—MAXWELL STEWART, of Montreal, Que., Born at Montreal, Aug. 14th, 1893; Educ., B.Sc. McGill Univ. 1915; betweel coll. terms, chainman, rodman and instman C.P.R. mtce.-of-way dept. Montreal; Sept. 1914, demonstrator surveying field school McGill Univ.; 1915, May to Aug. geological survey; Aug. to Dec., surveyor, Int. Nickel Co., Ont.; 1916-17, chemist, industrial inspection, etc.; 1917, May to Nov., works engr. A. F. Byers & Co. Ltd.; 1917-18, plant chemist, Can. Electro Metals, Shawinigan Falls, Que.; 1918-19, Can. Engrs. Lieut.; 1919-20, bldg. foreman and supt. A. F. Byers & Co. Ltd.; 1920-23, purchasing and engrg. A. F. Byers & Co., i/c purchasing and sub-contracts; 1923 to date, asst. mgr. and sec. treas. A. Faustin, Ltd., i/c sales engrg. etc., in connection with English-speaking clients.

References: A. F. Byers, C. K. McLeod, J. B. Carswell, J. H. Norris, C. S. Kane.

NIKLASSON—GUNNAR, St. Andrews East, Born at Elmebode, Sweden, July 11th, 1893, Educ. Chem. engr. Chalmers Tech. Inst., Gottenburg, Sweden, 1916, 2 yrs. apptceship at various pulp and paper mills in Sweden; 3½ yrs. asst. supt. at Klippans Finpoppersbuck, Klippan, Sweden; 9 mos. mill supt. at Brusofors, Halifors, papermill, Sweden; 9 mos. mill supt. at A. B. Tegefors Verk papermill, Sweden; 1 yr. mill supt. and asst. to mgr. Poland Paper Co., Mechanical Falls, Me.; 1 yr. mill supt. Superior Paper Mill Co., mill at Franklin, Ohio; 3 yrs. to present mill supt. Western Quebec Paper Mills, St. Andrews E., Que.

Reference: J. M. Robertson, P. L. Pratley, S. Svenningson, D. W. Ross, J. Morse.

PATTERSON—THOMAS MACMILLAN, of Ottawa, Ont., Born at Kincardine, Ont., Dec. 29th, 1901; Educ., B.A.Sc. Univ. of Toronto, 1925; during summers of 1921-22-23 and 24, office and stream measurement work with Dom. Water Power Br.; May to Dec. 1925, with H.E.P.C. instrumentman on power house constrn. Hydro, Ont.; at present with Dom. Water Power & Reclamation Service on stream measurement work and preparation of engrg. reports.

References: J. T. Johnston, S. S. Scovil, N. Marr, J. R. Bissett, F. C. Rust.

SWITZER—JAMES EVERETT, of Calgary, Alta., Born at St. Marys, Ont., Sept. 30th, 1888; Educ., High School St. Marys and I.C.S. course in surveying and mapping, priv. instruction in egrg. subjects under officers of Reclamation Service, Dept. of Int.; 1909-15, chainman, rodman, and instrumentman on land subdiv., rly. location and irrigation surveys; 1916-17, dist. hydrometic engineer, dept. of Int.; 1917-19, active military service overseas; 1919-22, asst. to engr. i/c party irrigation land classification and canal surveys; 1922-25, engr. i/c party irrig. land classification, canal location, reconnaisance of reservoir and power sites and surveys, Dept. of Int.; 1925 to date, dist. hydrometic and irrig. insptg. engr. collecting data for water power devel. and inspctg. irrig. schemes and constrn. of irrig. and indust. schemes, Dept. of Int.

References: J. S. Tempest, A. L. Ford, H. H. Moore, B. Russell, P. J. Jennings, M. H. Marshall.

THOMPSON—EDWARD WILLIAM, Hamilton, Ont., Born at Gainsborough, England, Oct. 10th, 1899; Educ., Gainsborough Technical School, Hamilton Technical School, and Finance and Business course, Alex. Hamilton Inst., N.Y.; 1915-20, indentured mech. engrs. apptce. Marshall Sons & Co. Ltd., Gainsborough, Eng.; 1918, officer cadet R.A.F., after demobilization with Marshall Sons & Co., building mill and gas engines, condensors and superheaters and testing same, travelling for company, carrying out tests on large mill engines and repair work, etc.; 1921, engine erector and expert, Sawyer Massey Co. Ltd., Hamilton, Ont., and asst. to asst. ch. engr. on design of asphalt, distributors, scarifiers, and grain threshing machinery; 1922-23, dftsman to master mech. Steel Co. of Can.; 1923-24, asst. plant engr. and master mech. National Steel Car Co.; 1924 to Feb. 1926, asst. foreman, radio assembling dept. and inspr. press punch and shear dept., Can. Westinghouse Co., Hamilton; Feb. 18, 1926 to date in master mechanic's office, Nat. Steel Car. Corp. Ltd.

References: W. F. McLaren, H. U. Hart, J. A. MacFarlane, H. M. Thompson, H. B. Stuart.

VERDON—JOSEPH BENJAMIN, of 135 Berri St., Montreal, Que., Born at St. Edouard, Que., June 16th, 1872; 1893-98, aptce. on constrn. and mtce. of power plants; 1898-1903, Thompson & Houston Elec. Co., Lynn Mass.; 1906, 6 mos. Mead Morrison on Can. Northern Coal & Ore Docks, Port Arthur, Ont., and 6 mos. C.P.R. shops, Fort William, Ont.; 2 yrs. engr. i/c shift constrn., later master mech. i/c all equipment; 1911, master mech. Chinook Coal Co. power plant and coal handling equipment constrn.; 1911-13, ch. engr. Can. Coal Consol., Frank, Alta.; 1913 (Jan.-May), master mech. West Can. Collieries, Bellevue, Alta.; 1913-14, engr. i/c constrn. Hudsons Bay Co., Edmonton; 1914-16, master mech., Brazeau Collieries, Nordegg, Alta.; 1916-18, master mech., Can. West Steel Co., Redcliffe & Medicine Hat Mills; 1919 (Mar.-Sept.), and 1920 (Sept.-Dec.), ch. engr. Chateau Lake Louise, Alta., C.P.R.; 1919-20, master mech. Jasper Park Collieries, Pocahontas, Alta.; 1921-25, ch. engr. Chateau Frontenac, Quebec, C.P.R.; 1925 to present, Boiler inspr. Prov. Gov. of Quebec (Dept. of Public Works and Labour), Montreal, Que.

References: J. T. Farmer, J. A. Shaw, A. Surveyer, W. A. MacKenzie, N. S. Walsh, R. S. Trowsdale, J. Ruddick, N. Marshall, E. Drolet.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO THAT OF MEMBER

BOWNESS—ERNEST WILLIAM, Edmonton, Alta., Born at Kensington, P.E.I., Aug. 12th, 1878; Educ. B.Sc., McGill Univ. 1905; 1903 (summer) studied hydro-elect. and elect. ry. installations in Europe; 1904 (summer), Pittsburgh shops of Westinghouse Elect. & Mfg. Co.; 1905-07, lecturer in engrg. Case School of Applied Science, Cleveland, Ohio, also consltg. and testing work for Cleveland firms; 1907, with Chas. Mitchell, on survey and report of water power devel. on Bow River and tribs.; 1908, survey and report of Seven Falls and Chaudiere Basin hydro elect. dev. for C. H. Grant, also consltg. work re choosing of motor equipment and extensions, and later, valuation of Levis City Ry.; 1909, engr. and salesman in Vancouver office of Can. Westinghouse Co., later mgr. of Calgary office; 1910, in B.C. office of Smith, Kerry & Chase i/c hydro-elect. work; 1911, report on Mt. Hood Ry. & Power Co. hydro-elect. steam and elect. Ry. scheme in Portland, Ore., later engr. and mgr. of light and power dept., organized and i/c of new business, line operating publicity divs., etc.; 1912, employed by North-western Elect. Co. re Salmon River dev.; 1912-14, efficiency engr. for Edmonton, Alta.; 1914-18, mgr. and engr. Edmonton Power Co.; 1918-19, exam. and report with estimates on N.S. water powers for New Glasgow plant of N.S. Steel Co.; 1919-23, consltg. engr. in Edmonton; 1924, misc. work including report on proposed steam elect. plant for Edmonton; at present, consltg. engr. for International Utilities Corp. of N.Y.

References: R. S. Lea, W. S. Lea, R. S. Kelsch, J. Haddin, A. W. Haddow, R. Boyle, A. C. R. Yuill, C. J. Yorath.

KELLY—EDWARD ARTHUR, of Lethbridge, Alta., Born at Sarnia, Ont., July 1st, 1889; Educ., Grad. Univ. of Toronto, 1911; 1911 to date, with the C.P.R. as follows: 1911-14, constrn. dept.; 1915-19, mtce. of way; 1919-22, constrn. dept.; 1922-23, mtce. of way; 1923 to date, asst. engr. on constrn.

References: W. A. James, C. D. MacKintosh, J. R. C. Macredie, G. N. Houston, T. Lees, F. W. Alexander, J. Callaghan, C. H. Fox, J. C. Holden, H. R. Miles.

KESTER—FRED HENRY, of Walkerville, Ont., Born at Richland, Mich., Sept. 5th, 1885; Educ., struct. and mech. engrg. Univ. of Wisconsin, 1906-07; 1908-09, dfting dept. Can. Bridge Co. Ltd., June 1907-Sept. 1908, and June 1909-Feb. 1911, detailer and checker; 1911-12, designer (minor structures); 1912-19, designing and estimating dept.; 1919 to date, contracting engr.

References: F. C. McMath, W. Pope, G. F. Porter, C. M. Goodrich, W. H. Baltzell, C. P. Disney, W. Walkden, A. F. Byers, J. P. Hodgson, W. C. Thompson.

McCRORY—JAMES ALEXANDER, of Montreal, Que., Born at Pittsburg, Pa., Dec. 5th, 1880; Educ., B.S. Pennsylvania State Coll. 1907; 1901, arts course, Westminster Coll.; 1902-3 drafsmn Deed Registry Office Pittsburgh,; 1907, mech. dftsman Crucible Steel Co. of Am.; 1908-09, mech. dftsman., Pittsburgh filtration plant; 1910, designing engr. i/c Toronto office of H. J. Glaubitz, consultg. engrs. on water works, and sub-station design; 1911-16, designer Trussed Concrete, Steel Co. of Can.; asst. engr. Shawinigan W. & P. Co., gen. design power plants, sub-stas. trans. lines, chem. plants, dams, etc.; 1918-25, i/c hydro-elect. and gen. engrg. as off. engr. Shawinigan Engrg. Co. Ltd.; 1925 to date, Power Engrg. Co. off. engr.

References: S. Sveninngson, C. S. Saunders, E. Brown, C. R. Lindsey, F. Newell.

MOODIE—KENNETH, Calgary, Alta., Born at Montreal, Que., Mar. 25th, 1871; Educ., B.A.Sc., McGill University, 1895; 1895 (summer) Mica mining; 1896, dftsman, Fraser & Chalmers, Chicago, Sargent & Lundy Consltg. engrs., Chicago; 1897, dftsman Western Electric Co., Chicago; 1898 with same Co. i/c telephone dfting work; 1899, dftsman, Am. Siemens Halshe Co., Chicago, i/c smaller machines; 1900 dftsman, Link Belt Machy Co., Chicago; 1902-03, Western Electric Co., leading dftsman; 1903-08, mech. engr. and asst. ch. dftsman. plant engr., ch. inspr. power apparatus Hawthorne Works, Western Electric Co.; 1908-14, C.P.R. piece work inspr. (about 3 mos.) then asst. supt. Angus locomotive shops; 1914-20, Rosedale Coal & Clay Products Co. Ltd., Rosedale, Alta.,ch. eng. and supt. i/c at mine; about 3 yrs., priv. practice; 1924 to date ch. engr. P. Burns Co. Ltd., Calgary, includes supervision of all company's plants in eastern B.C., Alta., and Sask.

References: H. K. Wicksteed, B. L. Thorne, R. S. Trowsdale, E. B. Tilt, O. S. Finnie.

MORSE—JOHN, of Montreal, Que., Born at Rattvik, Sweden, Feb. 20th, 1881; Educ., E. E. Chalmers Tech. Inst., Gottenburg, Sweden, 1906; 1906, dftsman Otis Elevator Co., Yonkers, N.Y.; 1907, dftsman, Gen. Electric Co., Schenectady, N.Y.; 1907 to date, with Shawinigan Water & Power Co. as: 1907, dftsman; 1910, constrn. engr. for sub-stations, ch. dftsman; 1911, supt. of operations; 1916 to date, gen. supt.

References: J. C. Smith, C. S. Saunders, S. Svenningson, J. A. McCrory, F. S. Keith, J. B. Challies, F. T. Kaelin.

POLYBLANK—KENNETH GRAHAME, of O'Brien, Que., Born at Bristol, Eng., Aug. 17th, 1884; Educ., Bristol Cathedral School, Coopers Tech., London, Ongar Coll., Essex; 1905-07, chairman and rodman, T. and N.O. Rly., and G.T.P.; 1907-11, rodman, instrman, and res. engr. N.T.C. Rly.; 1911-12, res. engr. C.N.R.; 1912-14, div. engr., C.N.R.; 1915-19, overseas service with infantry and Can. Engrs.; 1919-20, res. engr., C.N.R. western region; 1920-22, div. engr. C.N.R. central region; 1922-24, div. engr. i/c field work, C.N.R. Long Lac cut-off constrn; 1924-25, div. engr. central region, C.N.R.; 1925 to date, asst. ch. engr., Rouyn Mines Rly., O'Brien, Que.

References: H. T. Hazen, G. P. MacLaren, C. S. Gzowski, R. A. Baldwin, C. H. N. Connell

RIPLEY—WILFRED JAMIESON, of Sydney, N.S., Born at Nappan Stn., N.S., Mar. 22nd, 1891; Educ., B.Sc. McGill Univ. 1914; May to Sept. 1914, transitman i/c party on realinement of main line track C.N.R.; 1914-18, transitman i/c party attached to res. engrs. office on mtce. and constrn. C.N.R.; 1918-19, field engr. with By-Products Coke Co. of Can. i/c constrn. in field of 120 coke ovens; 1919-20, designer and squad boss, engrg. dept., Dom. Iron & Steel Co.; 1920-21, field engr. By-Products Coke Co. i/c constrn. and cost accounting on plant of 60 coke ovens; 1921 to date with Dom. Coal Co. as designer and squad boss engrg. dept. and acting ch. draftsman.

References: W. E. Clarke, W. M. Sutherland, N. C. Chipman, J. P. Freeman, A. Dawes, M. W. Booth.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

GLOVER—THOMAS STANLEY, of Hessle, Eng., Born at Hull, Eng., Aug. 10th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1922; 1913, 14, 19 and 20, Highways Dept., City of Toronto; 1920, shop work, McGregor & McIntyre, Toronto; 1921, hydraulic engr. to investigate and report on water power scheme at St. Anthony, Nfld., for Int. Grenfell Assn. of N.Y.; 1923, Humber Arm, Nfld. water power devel. as asst. Fraser Brace Ltd.; 1925, asst. engr. public works dept. Nigeria, on design and constrn. of drainage scheme, water supply, roads constrn. and mtce. of public highways to date.

References: C. H. Mitchell, W. A. McLean, P. Gillespie, C. R. Young, R. W. Angus.

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References: H. M. Mackay, C. J. Chaplin, T. W. Harvie, J. F. Harkom. A. W. K. Massey.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

BEAVERS—GEORGE ROBERT, of Kitchener, Ont., Born at Gosforth, Eng., July 11th, 1901; Educ., 2 yrs. Tynemouth Municipal High School, Marine School of South Shields, 1916; 1917-21, apptce. Wallsend Slipway & Engrg. Co. Ltd., in steam turbine blade shop, tool room, marking off, fitting and erecting steam turbines, i/c boiler room on trial of liner "Julius Caesare;" 1922, sales engr. with Ross & Greig, Montreal; 1922 to date, with Can. Blower & Forge Co., Kitchener, Ont., in tool room, draughting office, and mech. engr. i/c drfting.

References: A. H. Ross, S. Shupe, W. J. Turnbull, W. A. Gilmour, C. Breithaupt.

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References: G. G. Mills, A. S. Miller, R. W. Angus, P. Gillespie, C. B. Ferris R. W. Downie.

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References: R. de L. French, E. Brown, C. M. McKergow, C. V. Christie, A. R. Roberts.

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References: S. Svenningson, C. S. Saunders, J. A. McCorry, A. B. Rogers, C. V. Christie, J. Morse.

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Modern Problems of Synchronous Converters

An outline of recent developments and means adopted to overcome various problems

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Paper presented before the Montreal Branch of The Engineering Institute of Canada, April 1st, 1926.

The engineering development of the synchronous converter may be said to date from the early nineties of the last century so that it can be considered as having had over thirty years of existence. The converter, combining as it does the functions of both a d.c. generator and a synchronous motor, is in principle a more complicated piece of apparatus than the electrical machines being built in this early period, so that it is not surprising to find that some of the problems encountered in its development were found to be particularly difficult. As an instance of this the "hunting" problem might be mentioned.

The action of hunting in a synchronous converter is essentially the same as in a synchronous generator or motor, but it proved very baffling for a long time in the case of the former machine on account of the complication resulting from commutation. In the alternating current machines a limiting amount of hunting might result in no great disadvantage, but when the converter hunted even with slight magnitude it was invariably accompanied with sparking at the brushes. It is frequently possible to follow the oscillation of hunting from the fluctuations of the visible sparking at the d.c. brushes. The general phase of the trouble due to hunting was solved with the introduction of an efficient system of damper windings in the pole-faces of the converter and with the greatly decreased use of the reciprocating prime-mover which imparted its speed fluctuations to the frequency of the electrical energy supplied to the converter.

Flashing*

Another problem, closely related to that of hunting, still remained; this was the problem of flashing at the commutator. Railway converters of the order of 600 volts d.c., gave by far the most trouble of this sort, and those operating on 60 cycles more than those of 25 cycles. The most frequent cause of flashing is due to heavy and sudden overloads caused by short-circuits on the d.c. load circuit. These faults are almost always on the trolley wire or somewhere in the car equipment, so that if feeders between the substation bus and the trolley wire are of sufficient resistance the load surge will be limited thereby. For a considerable period these long feeders seemed to be the most effective, but there came an insistent demand for a converter which would withstand more severe overloads. As a consequence a very considerable amount of work was done investigating the causes of the trouble and the possible remedies for it.

Speaking briefly in this connection it may be said that when the converter is operating under normal conditions the electrical input and output are equal, if the small internal losses are neglected, and the relations of the a.c. and d.c. components of current in the armature result in a nice state of balance of its magnetic forces. These forces are not entirely annulled at all places on the periphery but their value at any point will be small. The reactance effects in a converter and the external circuit produces a phase displacement with load, so that when the load on a converter is increased its armature must drop back through a small angle, necessitating a small momentary drop of speed. Conversely, when a load is removed the armature will accelerate forward to a slightly advanced angular position.

In spite of the fact that these angular changes are so small, if they take place in a short period of time as represented by the most severe load surges, the rotational energy liberated or consumed may be comparable with the total load on the machine. In the case of a short circuit almost at the terminals of the converter, it has been found that even for a medium sized machine the initial rate of rise of the direct current may be as great as several million amperes per second, and during such a transient the power output may be furnished in about equal proportions from the a.c. supply system and from the stored kinetic energy of the rotor. This unbalance of electrical power is accompanied by a corresponding unbalance in the magnetic forces of the armature, and the fluxes set up generate high voltages in the coils undergoing commutation. There is this difference,

*E. B. Shand.—An Analytical Investigation of the Causes of Flashing of Synchronous Converters. Trans. A.I.E.E. 1922.

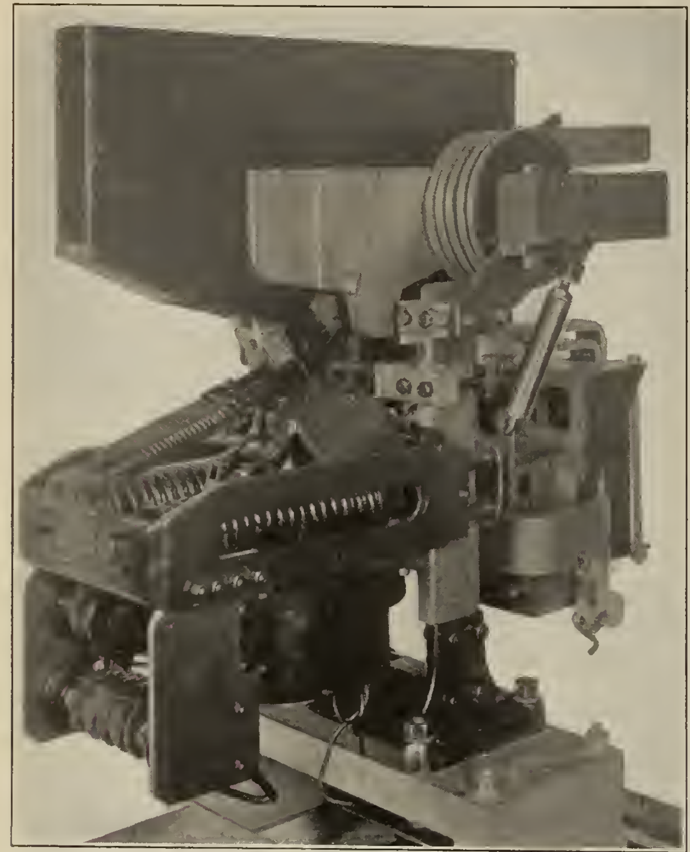

Figure No. 1.—3,000-Ampere, 1,500-Volt, High-Speed Circuit Breaker.

then, between the d.c. generator and the synchronous converter on short-circuit: while the ampere turns of the commutating pole of the former machine always bear the same proportion to those of the armature so that the overload limitation is merely due to the heavy current being commutated, in the case of the converter the resultant ampere-turns of the armature are determined not only by the load current but also by the rate of change of load, for which condition there is no simple means of compensation. These transient conditions add a heavy burden to the commutation requirements of the converter which are not found in the d.c. generators.

It has been found from actual investigation that the commutating voltages generated during a transient decrease of load have a much more serious effect in producing flashes than during a transient of increase. This confirms many observations made in service which indicated that the converter usually flashes when the circuit-breaker opens rather than at the instant of maximum current. When a circuit-breaker opens suddenly on short circuit the power input accelerating the rotor may be instantaneously considerably more than the rating of the machine.

In these short transient periods the commutating-poles form low reluctance paths for the unbalanced magnetic forces, and it is probable that commutating conditions would then be much better, if these poles could be suddenly removed and replaced again when the load becomes steady. The high-reluctance commutating-pole constitutes a means of improving the condition. In this arrangement additional air-gaps are used in the magnetic circuit of the commutating-poles. This increases the air-gap reluctance at the critical position, yet by increasing the ampere-turns to the proper amount the advantages of the ordinary commutating-pole on steady loads are retained.

A second means of protection against flashing has been to insulate all vulnerable parts in the vicinity of the commutator. Experiment has demonstrated that if an arc, once having formed on the commutator, cannot pass to any adjacent part of fixed polarity it will be relatively harmless, and that it will not persist beyond the opening of the circuit-breaker. This type of protection is probably of greatest service in preventing momentary flashes from developing into serious flash-overs.

In the type of design here considered a flash barrier has been placed on either side of the brush-arm to protect the brushes and brush mechanism. The cross-connections between brush-arms have been completely insulated. Some time ago it was found the gases developed during the short-circuiting of some of the largest railway converters could short-circuit the brush-holder arms to its supporting ring. To prevent this, very large intervening insulating washers, somewhat dish-shaped, were developed, which increased the creepage distance over the insulation to several times that ordinarily used, and renders this possibility of flashing still more remote.

A large number of the type of converters considered in the above discussion have now been in service over a period of time extensive enough to give definite operating data. They have shown themselves to be a very decided improvement over the converters of ten years ago. It can be stated very conservatively that the newer machines can stand 50 per cent more severe short-circuit conditions than the old ones. Glancing at some standard recommendations for the minimum feeder resistance, that for a 1,000 k.w., 600-volt, 60-cycle railway converter is 0.038 ohms, which will probably correspond to from 2,000 to 3,000 feet of feeder.

The high-speed circuit-breaker for d.c. circuits has been developed as an auxiliary means for the protection of commutating machines from the effects of short-circuits. It is intended for use where the operating conditions are very severe, which usually means that the feeder resistance is much less than that required to give the machine adequate protection. Engineers had been looking for such a circuit-breaker fifteen years ago, but the difficulties were so great in building a practical piece of apparatus that it has been only within the last few years that a thoroughly satisfactory breaker has been developed.

In considering the case of severe short-circuits the d.c. current of the converter builds up at a faster rate than in a corresponding generator, showing that the effective inductance of the converter armature is the smaller. If the circuit-breaker is to give protection under these conditions it must operate quickly enough to limit the current to a safe value only a few thousandths of a second after the short-circuit occurs.

For converters the high-speed circuit-breaker has a second function, viz., to cut off the converter from the short-circuit before the inertia transients have developed. The ordinary type of carbon circuit-breaker will operate in a period of slightly less than one-quarter of a second; and a good high-speed circuit-breaker in less than one-tenth of this time. There is one period of time between these two at which the condition of the inertia transient is most unfavourable, and at which, if the d.c. circuit were quickly interrupted, the tendency to flash due to this cause would be a maximum.

In the types of high-speed circuit-breakers which have been developed both in Europe and America, the ordinary type of mechanical latches have been dispensed with, the breaker being held closed by the pull of an electro-magnet. To trip this device the load current is used to produce a magnetic force to transfer the armature flux to another path, thus releasing the moving contacts. In some cases the

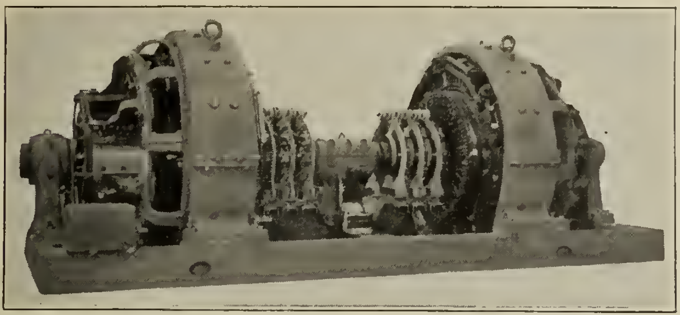

Figure No. 2.—2,000-Kw., 1,500-Volt, 50-Cycle Converter Unit.

speed of this action has been increased by using the inductive surge of the short-circuit current to add to the tripping current. The actual opening of the contacts is accomplished by very powerful springs. Figure No. 1 shows a high-speed circuit-breaker constructed on the basis discussed above. This breaker is rated at 3,000 amperes and for 1,500-volt service.

A series of short-circuit tests were made recently on a synchronous converter intended for severe railway service and to be protected by this circuit-breaker. The converter unit was rated at 2,000 k.w., 1,500 volts, 50 cycles, and it consisted of two 750-volt converters, connected in series and mounted on the same bedplate. Figure No. 2 is a photograph of the complete unit. This arrangement, it might be remarked, differs somewhat from a practice in Europe where a number of single unit converters for 1,500 volts, 50 cycles have been built. It is the opinion here that the more liberal design made possible by using two machines makes the two-unit set more reliable and satisfactory.

In the tests referred to, short-circuits of different severity were thrown on the set, the most severe being a complete short-circuit where the resistance across the terminals of the converter was only that of the cable necessary to connect the apparatus together. Several of these short-circuits were thrown on the machine within a short interval without any apparent distress. An oscillograph record of one of these short-circuits is included here as figure No. 3. The initial rate of current rise is approximately 4 million amperes per second, but the circuit-breaker limits the current to 20,000 amperes in 0.007 second and operates completely in from 0.012 to 0.015 second. The peak value of current is approximately fourteen times the normal rating of the machines, which demonstrates its undoubted capability of carrying heavy load surges.

It should be mentioned that the conditions of these tests are more severe than what may be expected in actual service. The resistance of the short-circuit and the ground return will always be appreciable, and the inductance of the feeder and the trolley wire will always reduce the rate of current rise and assist the breaker. With 1,000 feet of feeder or trolley wire between the machine and the short-circuit the rate of current rise will be reduced to about one-half, giving the apparatus a large margin of safety.

Shunt-Wound Converters

Before leaving the subject of these railway type converters it may be mentioned that, while formerly all converters for this type of service were designed with fairly strong series fields to give flat compounding of voltage when operated from high reactance transformers (usually about 15 per cent reactance), the present tendency is somewhat in favour of shunt-wound converters with transformers of normal reactance, *i.e.*, of the order of 6 per cent or 8 per cent, which will give the converter a drooping voltage characteristic to the extent of about 4 per cent or 5 per cent.

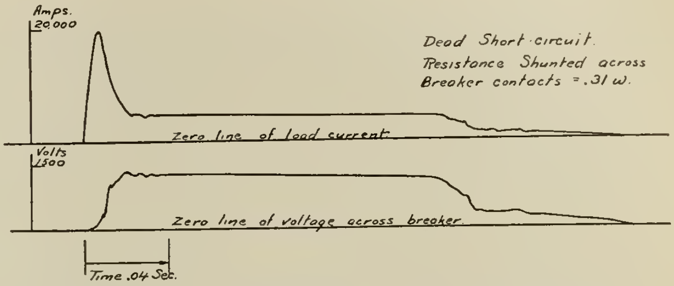

Figure No. 3.—Oscillograph Record of Short-Circuit.

With the low reactance transformers the angular displacements with load will be reduced and with them the kinetic energy transients on short circuits, so that with the low reactance transformers the converters are enabled to withstand heavier momentary overloads. With the changed conditions of operation brought about by the automatic substation and by the tendency to distribute substation capacity even where there are dense traffic conditions, advantages are found for the drooping voltage characteristic. At periods of heavy load on a substation the lowering of the line voltage with the shunt machine will tend to reduce the load taken from it and becomes a protective element. This is sometimes done forcibly in automatic substations by inserting a resistor in series with the converter, but with the shunt-wound converter their use is simplified, as the same result is accomplished inherently to a limited extent in the machine itself.

In heavy city service where it is becoming the practice to feed the trolley network from a number of substations of limited capacity distributed over the area, the shunt voltage characteristic permits a much more equable distribution of load between the substations.

Developments in Starting Converters

The method generally employed to start synchronous converters has been to apply a reduced voltage obtained from taps on the transformer secondaries to the collector rings, and to let the converters come up to speed operating as induction motors. The development of effective damper windings was necessary for the successful application of this

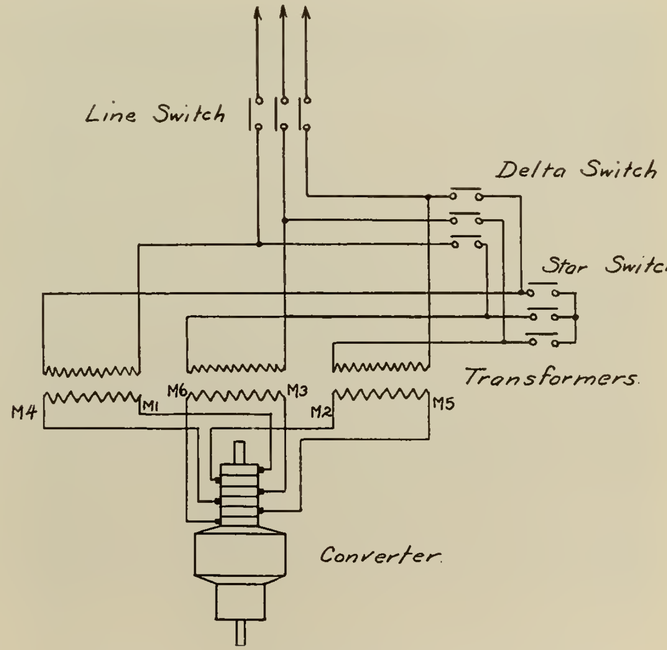

Figure No. 4.—Diagram for Star-Delta Switching.

method. For the large and heavy current machines the starting switches become unwieldy to operate, and the necessity of running an additional set of heavy cables from the transformers to this switch is sometimes undesirable. To obviate these difficulties a system of high tension switching is now frequently used on these machines whereby the transformer primaries are connected in star during the starting period, giving 58 per cent of normal voltage to the collector rings; then for normal operation the primaries are connected in delta. This is known as the "star-delta" system of starting. The starting voltage is usually somewhat higher than would be used with tap-starting, but the converter can be designed so that an excessive starting current will not be drawn from the supply line.

In addition to the main oil circuit-breaker, two other breakers are required to complete the star and delta connections. A simple diagram of the connections is shown in figure No. 4. After the converter is brought up to speed and synchronized in the star connection, the changeover is accomplished by pressing a single push-button which opens the star breaker. The latter is so interlocked that the delta breaker will then close automatically. If the voltage of the converter and the supply voltage are not in phase when the delta switch closes, a very severe surge will result. The usual arrangement is that the full voltage applied to the rings will be 30 electrical degrees behind the corresponding starting voltage. This allows the converter to drop back this amount during the time interval for the switching operation. The coincidence of these angular relations is not always close enough to eliminate the shock, so that it has been found desirable to have some means for eliminating it. Some interesting experimental work has recently been done on this subject by Mr. W. B. Anderson. It was found that a discrepancy of 15 or 20 degrees was sufficient to cause a mechanical shock on a very large converter which was too severe to be permitted in ordinary service. With the aid of the oscillograph, the necessary time delay to be introduced into the switching circuit was predetermined so that the delta switch would be closed at the instant when the converter voltage was in phase with the voltage of the transformer secondary. When this was tried out the changeover could be accomplished without perceptible effect or shock on the converter. The use of such an adjustment will constitute a very appreciable improvement in the starting of the larger converters.

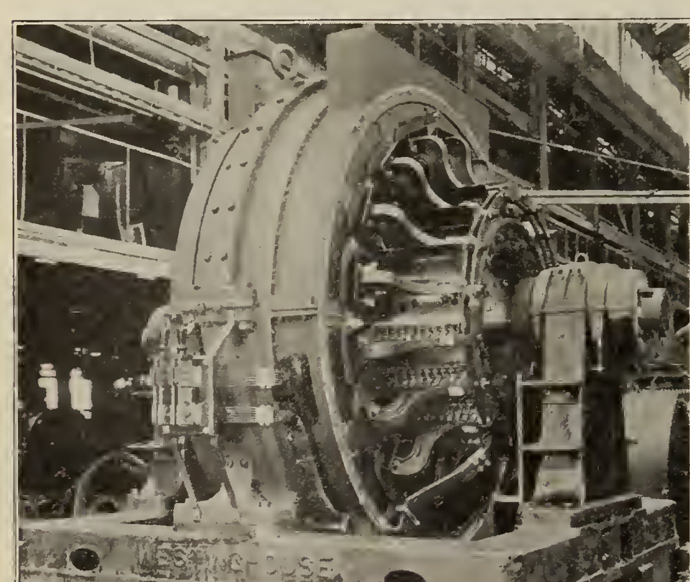

Figure No. 5.—Semi-Enclosed 3,000-Kw., 600-Volt, 60-Cycle Converter.

Ventilation*

Probably the most serious limitation of the rating of electrical machines comes from the rise in temperature of the insulating material. As a consequence the problem of ventilation is one of perennial importance. Several phases of this problem as connected with synchronous converters are of interest at the present time.

In the early stages of the engineering development of the converter it was found that great improvements in the cooling of the machines could be made by increasing the ventilating passages through the armature and field structure and exposing the windings wherever possible to the action of the cooling air. The increases in the ratings of electrical apparatus during this period were very great indeed, although they were not due entirely to this one cause. Somewhat later, however, it was found that very often a large amount of additional air circulation could be obtained without adding materially to the effectiveness of cooling, although the windage loss was increased proportionately. This produced a further development of the type so that although the windings were still left exposed as much as possible, the air was limited in volume but controlled to produce greater efficiency in its cooling action. To accomplish this result it has been necessary to study carefully the relation between the natural circulating paths in the machine and the temperatures of the different parts, and to introduce baffles and blowers to give the proper amount of air where required. When not complicated with the presence of a booster (as in the booster-converter type), it is found that the losses at the front end of the machine are considerably greater than at the rear, so that the former requires more ventilation. This greater loss results from the brush friction and the brush resistance losses on the commutator. Although the commutator temperature might rise to very high temperatures without affecting its mica insulation, such temperatures will produce high stress and consequent mechanical deformations in the commutator which will injure its commutating capabilities. High temperatures will affect the operation of the brushes as well. It is necessary, therefore, that the commutator temperatures be kept within moderate limits. It is frequently found desirable to obstruct the entire opening into the rear of the converter armature so that the cooling air must be taken from the front end, and thus give the commutator and adjacent parts its full benefit. Inclined blowers placed between the armature and commutator have been used to increase the air velocities.

Another condition in connection with ventilation has been that of the recirculation of air in a machine, by which is meant that the air on being expelled from the converter may be sucked in through the machine again, thus raising the air temperature at the intake considerably above that of the surrounding air in station. Although this is generally more serious in connection with motor generator sets with the open type of ventilation it must be given some consideration when arranging the ventilating scheme of a converter.

During the past few years a more general aspect of the ventilation problem has come into prominence; it is that aspect which extends the problem to include the whole substation. There are a number of factors influencing this situation; for instance, the high cost of land and buildings have forced the concentration of large power units into small and often inaccessible spaces, such as the basements of office

*F. T. Hague.—Ventilation and Noise Control of Substation Machinery. Electric Journal, March 1924.

buildings in city districts, where the free access and exit of the cooling air is much restricted. In such cases it has been found that the ambient air may rise to such high temperatures that the full rated load could not be put on the machines without raising the internal temperatures of the insulation above their safe limits, with the additional consideration that the room temperatures would be exceedingly uncomfortable for the operating staff. It has seemed desirable, therefore, to enclose the converters in some way and to bring air ducts from the outside to the machines, or to bring ducts away from the machines to the outside, or to use both ducts to constitute a completely enclosed ventilating system comparable to what is commonly used for turbine-generators.

There are other reasons which render the enclosure of converters desirable; as the first of which might be mentioned the effect of copper dust from the collector-brushes. Although a very real improvement has been made during the past few years in the metal-graphite brushes used on collector rings it is an inherent characteristic that they will give off dust as they wear. If in a heavy current machine the volume of dust given off with a normal rate of wear be calculated, it will be found surprisingly large. Where the natural ventilation can take this dust into the machine it will form a conducting coating on the insulating surfaces and will pack into the interstices of armature coils, interfering with their ventilation. If the air circulation is directed to prevent this dust from entering the armature, a considerable improvement will be effected. Another benefit derived from enclosed machines is the suppression of noise. When machines are located in a business district such as the basement of an office building, it is necessary that the noise be definitely limited. In a residential district a noisy substation will inconvenience the residents, and in the case of an enclosed machine the suppression of noise is considerably simpler than with the open machine.

The conditions met with are so varied, and the development of the art with respect to enclosing converters is so new that no general practice has developed in this connection and each case is considered by itself when investigated from this standpoint. It is natural also that it has happened that the types of enclosures have been evolved through the co-operation of the operators who understand the specific requirements of the installation and the manufacturers who know the capabilities of the converters. It is very obvious that the problem of enclosing a commutating machine is considerably more difficult than a machine like an alternator. However, it has been done with success in a number of installations.

The enclosures of converters may be divided into two general classes, the semi-enclosed and the totally enclosed. The former class consists of those with arrangements for only one duct, usually the exhaust duct, the intake being taken directly from the operating room, and sometimes with the commutator or collector rings exposed. With this last-mentioned arrangement the enclosing parts are simplified considerably, but where the elimination of noise is sought it may not be sufficient, for the commutator noise cannot be suppressed. The semi-enclosed arrangement necessitates large volumes of cooling air to be brought into the station which may result in discomfort to the operators in winter.

An example of this type of enclosure is shown in figure No. 5. The machine is a 60-cycle railway converter rated at 3,000 k.w. The main consideration for enclosing this particular machine was one of high ambient temperature. With 4,000 k.w. of installed capacity the temperature of the substation was found to be uncomfortably warm during the summer months, so that when it was proposed to increase this to 10,000 k.w., some means for carrying away the heated air were deemed necessary. The commutator was left exposed on account of the possibility of flashing with 600-volt machines. The method of enclosure consists in placing end bells of sheet metal on the frame to come down in close proximity with the armature. In addition, the air paths within the armature may be set so that the air will pass into these end bells. The exhaust ducts are fitted both at the top and at the bottom of the frame so that two ducts, one in the basement and one overhead, would be taken outside the substation. The air pressure developed within the machine is sufficient to drive the air through these ducts under ordinary circumstances. In this particular installation noise was not particularly objectionable so that there was no necessity on this account for the complete enclosure of the machine.

Where it is wished to isolate the cooling system entirely from the main body of the substation it is necessary to completely enclose the converter and use both intake and outlet ducts to the outside. This allows the circulation of large volumes of air without affecting the temperature of the substation. It also permits the use of filtering systems which are justified in some cases, the use of external blowers to control the amount of air circulated, and it allows more complete suppression of noise than any other way. The importance of clean air for converters is emphasized when the windings are removed from an armature after its service for a year or two in a dusty district of a city. Many of the smaller passages and the interstices of the winding will be found to be packed solidly with dirt. When a substation is located in a basement it is often necessary to construct such long ducts to the free air that an auxiliary blower has to be used. This is convenient in allowing some control over the amount of air circulated but very frequently the power required is larger than is desirable.

One type of complete enclosure is shown in figure No. 6. The machine is of the booster type for three-wire lighting service and is rated at about 4,000 k.w. The enclosure or housing extends in two main parts from the frame to the bedplate to cover completely both commutator and collector

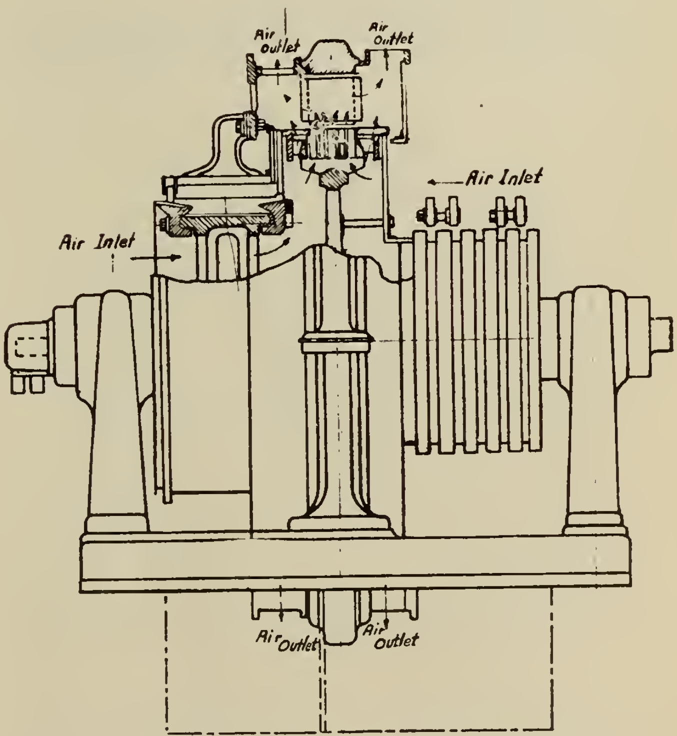

Figure No. 5a.—Details of Semi-Enclosed 3,000-Kw. Railway Converter.

Figure No. 6.—Completely Enclosed Booster Converter.

rings. The brushes on both ends of the machine are made accessible through parts which are furnished with removeable glass covers. In addition a door is furnished on each side of the commutator for further access. The air is led through the intake duct to the pit under the converter and after passing through the machine in the general direction of from the front to the rear it is taken through an overhead exhaust duct over the collector rings.

A somewhat different type of enclosure is indicated in the cross-section view, figure No. 7. It might be described as a housing supported from the machine bedplate or from the floor and large enough to completely cover the machine, frame and all, with space enough inside to allow the operator to make necessary inspections and adjustments. Doors are provided for access to the interior. As in the last-mentioned arrangement the air enters from below the commutator and leaves from above the collector rings. In the particular case shown, considerable care was taken in the placing of baffles within the machine itself as well as in the housing to direct the air and also to prevent recirculation. This has been a carefully considered arrangement and it is believed that it will prove very satisfactory.

A number of other schemes have been tried out but those mentioned above are typical and will give some idea of the tendencies of this development. It is probable that after more experience has been acquired with this phase of ventilation the general arrangement for enclosures will become standardized to some extent but that condition may not be reached for some time. It may be true also that for completely enclosed ventilating systems more study will have to be given to the characteristics of the ventilating system as a whole, considering the converter as one component part of it, for it seems that better efficiencies are yet attainable.

In referring to the noise problem, it may be mentioned that in cases where these closed ventilating systems are used the noise, due to both windage and magnetic causes, may be confined within the ducts, but if the intake or outlet are in the vicinity of other buildings all the noise may be found to be concentrated at some undesired point. Sometimes these ducts can be raised above surrounding buildings, but if not practicable it may be necessary to place baffles of felt or similar material within the ducts to act as mufflers.

In cases where the suppression of noise and not ventilation has been important, a solution has been found by making the whole substation sound proof. The building costs will be increased considerably and it is probable that their use will be found justified only in special cases.

Unbalanced Voltages

Recently some peculiar operating phenomena led to a cursory investigation of the effect of unbalanced voltages on

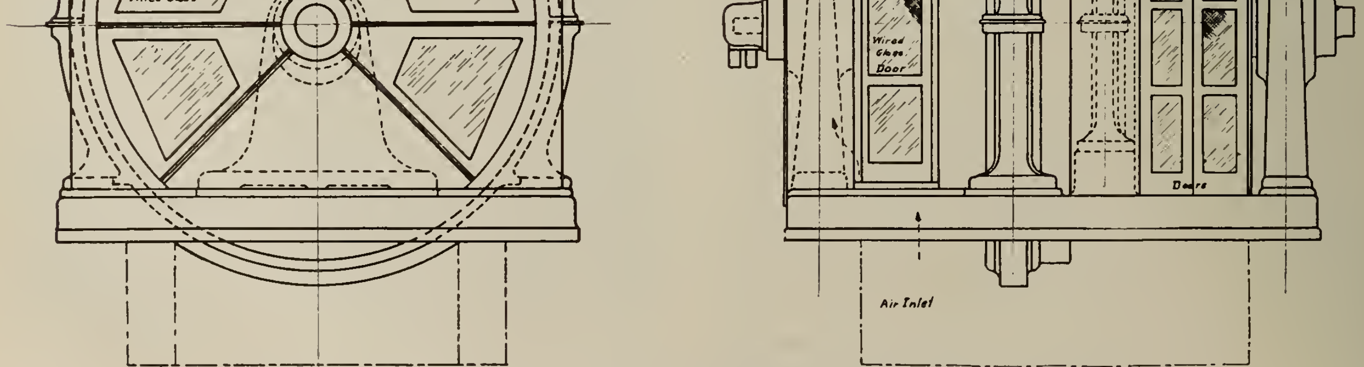

Figure No. 6a.—Details of Completely Enclosed 17,000-Ampere Converter.

a converter. In a large central station system including a high-voltage distribution network which supplies synchronous converters along with other apparatus, it was found that on the occasion of faults on the high tension line the converters were frequently found tripped off the line. Although the momentary drop in voltage might be serious, the fact that converters will operate with full load current on relatively low voltages (25 to 50 per cent of normal), without pulling out of step, this seemed to be precluded as a possible explanation. Further consideration of the problem indicated that the voltage unbalance which exists when such faults occur might furnish an explanation of the phenomenon.

When any balanced electrical machine is connected to a system of unbalanced voltage it immediately tends to act as a phase balancer to the system by circulating large currents through its own windings. The amount of current circulated in this way is proportional to the voltage unbalance and the total impedance of the circuits. Such problems have been attacked satisfactorily by considering the unbalanced system of voltages as made up of two balanced systems, the phase sequence of one system being of normal phase rotation and the other of reverse phase rotation. The relation of the magnitude of the latter system of voltages to that of the former represents definitely the amount of voltage unbalanced. The resulting currents may be treated in the same manner.

The reverse phase rotational quantities of voltage and current bear the ordinary relation to impedance. In the case of machines rotating at, or near, synchronous speed the counter-rotational currents produce a field rotating at double synchronous speed with respect to the stator so that the stator will produce a strong damping action on the fluxes. The result of this is that the impedance to these negative sequence voltages is very low and a small amount of voltage unbalance will produce a large current unbalance. In a series of tests it was found that a voltage unbalance of 17 per cent at the collector rings the unbalanced component of current was 100 per cent of the normal current rating of the machine. It can readily be seen that when disturbances on the a.c. system result in unbalanced voltage all the converters on the system will act as phase converters, taking magnetizing current from the phases of high voltage and delivering it to the phases of low voltage and that when the disturbance is severe enough in character the resulting currents in some of the connections to the converter may be sufficient to operate the overload relay and trip the machine from the line.

Various analyses and tests have been made to show that the effect of unbalanced voltage supplied to an induction motor is to increase the losses seriously. A similar analysis for a converter shows that the effect for this type of apparatus will be still more serious. The well-known effect, under normal conditions of operation when the partial neutralization of the two current components in the converter armature causes a decrease in the loss, is entirely upset. The average armature loss for a given load will be increased while the unequal distribution of the currents in the various phase belts causes the losses at certain points to be relatively greater than the average increase. In the tests referred to above, the 17 per cent voltage unbalance at the collector rings produced additional losses in the machine as determined from input-output measurements to the extent of from 10 per cent to 15 per cent of the full load rating of the converters. The above data indicate that the possibility of unbalanced conditions in the voltage supply, either abnormally or permanently introduce serious complications in the operation of the converter, and therefore they should be carefully guarded against.

Current Collection

The problem of the collection of current is an ever-present one with the synchronous converter, and its gradual progress requires the expenditure of considerable effort. At the present time, however, the requirements are greater than ever before. The difficulties represented in modern commutator construction can be appreciated only when the characteristics of the principal elements, the copper and the mica, are considered. Copper, even when hard-drawn, is much inferior to steel as a material of construction, so that all stresses in the commutator-bar must be kept to a low value.

For very long bars the copper-section must be made large for this purpose. The mica plate is still much less satisfactory. It is not homogeneous but is composed of small flakes bonded together with some such material as shellac. It can be used only in compression, and even here its characteristics are uncertain. These depend largely on the type and amount of bond and on the treatment it has received. It is found, for instance, that when mica plate is subjected to the action of heat and pressure it will take a permanent deformation, and that when the temperature is of moderate value the process may extend over a period of months. In addition to these conditions the operating temperatures will produce unequal expansions of the various component parts of the commutator and it must be provided for that neither excessive stresses nor any undesirable slackness will occur in these temperature cycles. In spite of these limitations the commutator should have a true and smooth surface at all times so that the quality of commutation will not be affected. The conditions met with in the larger converters are considerably more exacting than those found in the ordinary type of direct-current machinery; therefore, the commutator problem is closely connected with converters.

The collection of current from the a.c. side of converters,

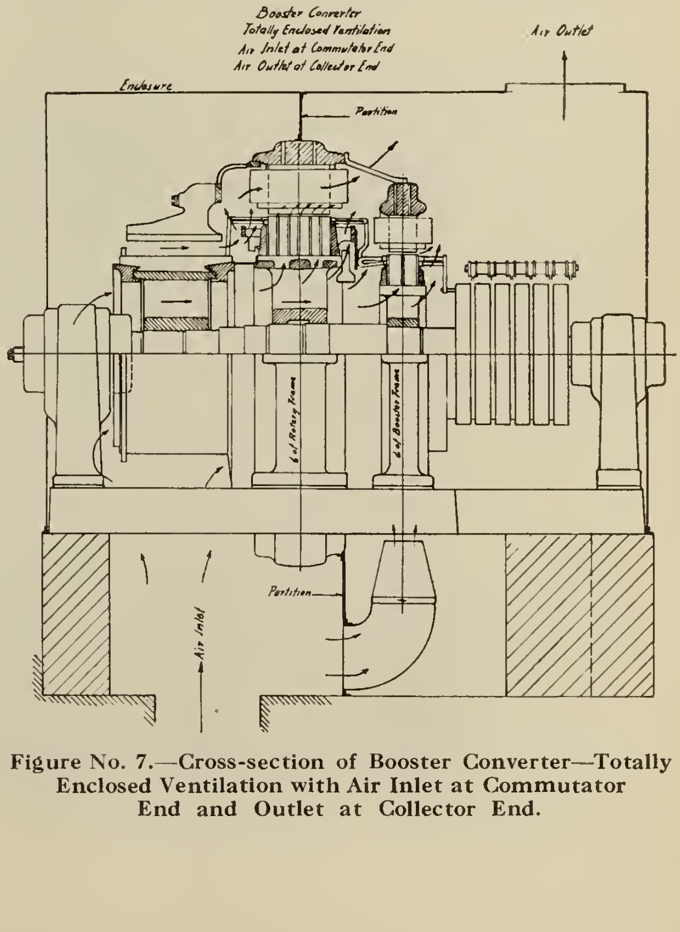

Figure No. 7.—Cross-section of Booster Converter—Totally Enclosed Ventilation with Air Inlet at Commutator End and Outlet at Collector End.

although in general a simpler process than from the d.c. side, has also been the cause of much study. Many details have been arranged to maintain the brushes in close contact with the rings. The metal-graphite brushes ordinarily used on the collector rings are found to be somewhat sensitive to the least sparking or high contact temperatures; thus maintenance of this close contact is found essential to satisfactory operation.

The characteristics of brushes both for collector rings and for commutators are the subject of careful study, for these constitute an important element in the converter.

Automatic Switching

So far as the converter itself is concerned the introduction of automatic and supervisory control has brought about no great fundamental changes in apparatus. A motor-operated brush-lifting mechanism to be used during the starting period and thermostatic bearing relays have been added, but otherwise a converter for this service will be the same as when manually operated. These developments, however, have changed some of the ideas regarding the application of converters. This type of equipment gives the means of reducing the operating costs at expense of capital cost.

Ordinarily it becomes economical to use automatic substations of smaller capacity and to have them distributed to a greater extent. In interurban railway service the substations will be placed at closer intervals to reduce the line copper loss. For service in congested city areas the same advantages of distributing the substation capacity are found, but in addition there has been some tendency to use supervisory control in such cases rather than completely automatic control. With this arrangement these converters may be started and stopped at will with the object of distributing the load to a number of machines that operate at their point of maximum efficiency. If carried to completeness the converting apparatus for the supply of such an area could be remotely controlled from one point with the same ease obtained in a single manually operated substation. With this method it is found that very appreciable economies can be effected in the reduction of the total power losses of the system.

It may be said in conclusion that a limited number of converter problems have been briefly considered in this paper. The synchronous converter is used in a number of highly organized types of application of which the principal ones might be stated as: motive power for railways, three-wire city lighting, mining and industrial applications, of which a very special type of service is encountered in electro-chemical plants. Each of these types of apparatus has certain requirements peculiar to itself, raising special and often new problems to be solved so that the state of the art is never allowed to remain at rest.

Aviation and Modern Engineering Practice

Recent Developments in the Application of Aerial Transportation to Engineering Problems

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Abstract of paper read before the Montreal and Peterborough Branches of the Engineering Institute of Canada, November 26th, 1925, and February 11th, 1926, respectively.

An engineer has been defined as one whose art and aim is devoted towards the harnessing of the great forces of nature to the use and services of man. In order that an engineer can carry out his work, it is necessary for him to employ methods that have been well established and that he knows will give him the desired results. It is, however, necessary for each engineer to consider continually whether the methods that he is using take advantage of all the most recent advances made by other people, and in fact whether his methods can be called modern engineering practice.

The object of this paper is to set out some of the facts concerning aviation, showing the work that has been done, and outlining the work that the author thinks can be done by aviation for engineers, in the hope that it may prove the first stepping stone by interesting more engineers in this line of development and lead them to investigate whether they also can use aviation with advantage in their work.

Engineers in aircraft work at the end of the war were convinced that, if properly developed, photographic surveying from the air could be carried out, and in order to convince professional surveyors, they undertook a certain amount of photographic work for this purpose, with the result that very soon the professional surveyors took this work up with enthusiasm, and very valuable results were soon achieved.

It is a question for each engineer to consider carefully, and to decide for himself, whether or not aircraft can be used for his work, particularly in view of the valuable work being done by aircraft for other branches of engineering.

Transportation

In Europe one of the most obvious uses of aviation was the provision of transportation between centres of dense population, and the London-Paris route was particularly attractive, because in ordinary circumstances this journey involved changing from railway to steamboat and back to railway.

For successful air transportation, run on schedule, a ground organization is just as necessary as for any other means of transportation. The aerodromes, beacons, radio communication, emergency landing grounds, etc., are all of as much importance as railroad tracks, stations, signals, etc., are in railway transportation, and until these ground facilities are provided aircraft are as useless for passenger transportation as automobiles would have been before the advent of the hard road.

The usefulness of air transportation has been well demonstrated by the subsidized routes in Europe, but the development of air transportation must be handled by large corporations, comparable with the railway companies, and preferably by corporations already specializing in the transportation business.

The only air route operated regularly in Canada was established by the Laurentide Air Service in 1924 to run from Haileybury, Ont., to the Rouyn gold fields. This route was run with great reliability and was much used by mining engineers, prospectors, and others, and also for the conveyance of telegrams, letters and goods. It was continued this year by Captain Broatch.

Transportation by air can be extended to goods, express matter and mail. A good example of the latter is the United States Air Mail which has been run with conspicuous success, and is now being made to include long stages flown at night.

Another useful air transportation service is that to be found in Quebec where the Dominion Aerial Exploration Company (now known as Canada Airways Limited) has carried out a good deal of work during the past summer. This company operating for Messrs. J. D. Lacey and Company, provided air transportation for forest surveys and the sketching of timber types over the limits of Messrs. J. R. Booth and Company. The fact that an established company, such as Messrs. J. D. Lacey and Company, noted for its conservative policy, should decide to adopt aircraft as an assistance in carrying out forest surveys indicates that aircraft have a definite place in this work.

A similar operation was carried out by the Dominion Aerial Exploration Company for Mr. Thomas Maher in connection with a cruise over the timber limits recently obtained by the Port Alfred Pulp and Paper Corporation. The same company made a general reconnaissance for the Department of Lands and Forests of the province of Quebec, covering 20,000 square miles, during which the general waterways and timber types were sketched.

The same company provided transportation for Mr. Henri Boulanger in connection with a ground survey of the headwaters of the Hamilton river watershed on the Labrador slopes in northern Quebec. In this case aircraft were provided for the purpose of taking provisions from Seven Islands up to an advanced base at Lac Ashuanipi. Over 12,000 pounds of goods were transported in this way and thus saved twenty-four portages, one of which was ten miles long. The work was estimated to take three months by canoe, whereas by employing aircraft, the main party went in light by canoe and made the journey in three weeks. Upon their arrival at the base, they found that 8,500 pounds of provisions and gear had already been delivered. The balance of the year's supply was delivered by air within two weeks, and during that time the party had received two visits from their chief. It is to be remarked that there were no losses by the air transportation, whereas it is usual to allow for a considerable percentage of material lost when taken by canoe.

In passing, it is only necessary to mention that aircraft transportation can be usefully employed by persons engaged upon *geological reconnaissance*, because changes in formation can be easily recognized from the air.

Under this heading for transportation, mention must be made of the fishery patrols. Some considerable success has attended this comparatively new line. The patrols seek out the fishing boats and observe that the fishery laws relating to time of fishing, length of net, etc., are observed.

Another regular use of aircraft has been in the payment of treaty money to the Indians, thereby saving a great deal of time and labour in visiting the many remote posts.

Vertical Photography

One of the most important developments in aerial photography has been the production of vertical photographs. Useful applications are for purposes such as city planning where many easily recognized points in the city have already been accurately mapped. By using these known points the material appearing in the photographs can be plotted on the maps.

A similar application is in city tax revisals where a series of vertical photographs taken over the city give at once an indication of all alterations to city properties since the last assessment. The increased taxes so collected offset many times the cost of the photographs. The Fairchild Aerial Surveys (who have also a company in Canada) have completed some very successful work along this line in Connecticut.

Figure No. 1.—Aeroplane View of Power Plant, Pointe du Bois, Man.

Vertical photographs are also used for such things as plant layouts, traffic studies, navigation charts, harbour studies, water power development, flood control, etc. Examples of these are also supplied by the Fairchild Aerial Surveys, Inc. For instance, the Alabama Power Company mapped last year about 500 square miles of the Tallapoosa River valley and used the maps before the Federal Power Commission in making application for permits for several water power developments; harbour surveys have been made of the harbours of Mobile, New Orleans and Boston; city maps have been made of Kansas City, Newark and New York City; a traffic study map of the heart of Los Angeles was made for the Automobile Club of Southern California; a flood control map was made of the Colorado River delta covering about 325 square miles of waste land subject to shifting channel conditions.

Vertical photographs show clearly all sand bars in rivers and such photographs would be of great assistance in producing navigation charts of rivers subject to changing sand bars.

In Canada the Fairchild Aerial Surveys have photographed 400 square miles for the Topographical Survey Branch, Department of the Interior, and have partially finished 2,000 square miles for the province of Quebec, this latter consisting of a vertical photographic traverse filled in by sketching. They have also completed 400 square miles of photographic map for the Quebec Streams Commission.

Preliminary railway surveys can be quickly made by means of contoured aerial photographs. Messrs. Brock and Weymouth are engaged upon this work in Canada with considerable success. Two contour maps have been supplied for use of the Canadian National Railway for preliminary location. These maps had a horizontal scale of 400 feet to the inch with 20 feet interval and 10 feet interval contours respectively. This company is now working upon a map for use in connection with power development in the Saguenay, and this map will have a horizontal scale of 500 feet to the inch and 10 feet interval contours.

Oblique Photography

The most important use of oblique photography at the present time is in the method of preliminary mapping as developed by Mr. Narraway.

The essential thing about this method, which is best suited to flat country, is that the aircraft should fly at a predetermined height over the country to be mapped and take a series of oblique photographs, which include the horizon. It is usual to take one view forward and then one to each side.

The photographs so obtained are used by a land party whose duty it is to locate certain well marked points on each photograph, but also the photographs are used as a guide to indicate to the ground party the route to be taken. In this way the party can pass quickly through the country locating a few points as they go. By plotting the located points and applying a system of grids it is easy to plot the details of each of the photographs and so produce quickly a preliminary map.

There are many good points about this method which are not apparent at first. In the ordinary ground map a white space does not mean blank ground, but merely that that part has not been covered; on an air map all the ground has been covered and a white space means that there is nothing there. Also it is possible to indicate in the air map the nature of the top cover as this can be recognized from the photographs. The Oisean sheet is an excellent example of a map produced by this method.

Other uses of oblique photographs are for timber cruising, for distinguishing different timber types, for preparation of navigation charts and for such things as views of power plants, factories, bridges, dams, wharves, piers, etc. (See figure No. 1.)

A use for these photographs that has no small value is

Figure No. 2.—Aeroplane View of Mount Assiniboine.

for advertising, such as photographic scenes of mountains along a railway route. (See figure No. 2.)

DUSTING

Messrs. Huff Daland and Company have conducted experiments in conjunction with the United States Board of Agriculture and have demonstrated that dusting of cotton plantations with calcium arsenate as protection against the boll weevil can be more effectively carried out by the use of an aeroplane than by any other method.

The method used is to carry a hopper of the poison in an aeroplane and fly low over the cotton fields. As soon as the beginning of a cotton field is reached, the discharge of the hopper is opened and the dust allowed to fall out. The stream of dust is scattered by the blast from the propeller and driven downwards into the cotton plant. This method can be used for the protection of other forms of crops and of trees.

FOREST FIRE PROTECTION

During the past few years, a great deal of work has been done upon the use of aircraft for forest fire protection. The organization of the Royal Canadian Air Force is used for fire detection and suppression in the lake Winnipeg district where use is made of seaplanes or flying boats.

In the forest reserves of the Crow's Nest, Bow River and Clearwater on the eastern slopes of the Rocky Mountains, fire detection is carried out by the Royal Canadian Air Force, using land aircraft with wireless communication. The suppression work is carried out by the usual land service.

Some of the most important forestry work in Canada is carried out by the Ontario Provincial Air Service. In 1924, the Ontario provincial government established its own air service as part of the Forestry Branch, and this service has operated with great success during the last two seasons under the able direction of Captain Maxwell.

The Right Honourable James Lyons, minister of lands and forests (Ontario Government), recently wrote that at the end of last year they were satisfied that the service had proved successful beyond a doubt and that 90 per cent of the fires never got beyond 100 acres due to the fact that as soon as a fire was detected men were placed in a position to control it immediately.

In conclusion, the author desires to say that if anybody wishes to obtain more information upon what has been done or can be done by aircraft, he will be pleased to either advise them himself or put them in touch with people more qualified to advise. Many aircraft are operating in Canada today, and in most cases if an aircraft is operating in a district it can carry out many other duties than it is doing at present with an all round reduction in costs. The Civil Aviation Branch of the Royal Canadian Air Force is in a position and anxious to help co-ordinate this work.

Patents and Inventions

A General Review of the Subject with Details of Requirement under the Canadian Patent Act

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By the creation of monopolies to first and true inventors in the right of using their inventions, a species of property is created in favour of inventors, as a reward for the benefits which they have conferred on humanity, by the exercise of their thought, knowledge, and industry. It is to the interest of the community that persons should be induced to devote their time, energies and resources in furtherance of the development of arts and manufactures, and this was recognized in England at an early period. No measure of reward can be conceived more just or equitable, and bearing a closer relation to the benefit conferred by an inventor, than to grant him the sole right of making, using and vending his invention for a limited period of time.

In the corrupt age of the Stuarts, it is not to be wondered at, that the prerogative of the crown to grant monopoly rights to first and true inventors should have been made a lever for assuming a prerogative to grant monopoly rights in trade generally. To such an extent had this abuse been carried in the reign of James the First that it was deemed advisable by the legislature that the rights of the crown in respect of letters patent should be declared by legislative enactment. This was the origin of the Statute of Monopolies which was given Royal assent on March 24th, 1624.

It has been supposed that the prerogative of the crown to grant letters patent for inventions was created by this statute, but the most cursory perusal of its enactments and of the authorities which preceded it, shows clearly that, so far from the statute giving to the crown any right which it did not previously possess, it had as its intention the limiting the right of the crown, and the declaring of that which had always been the common law upon the subject. In the first section of this act, for instance, we find it recited, " That all monopolies, and all commissions, grants, licenses, charters, and letters patent heretofore made or granted or hereafter to be made or granted . . . . are altogether contrary to the laws of this realm, and so are and shall be utterly void and of none effect, and in no-wise to be put in use or execution."

Notwithstanding the above, section 6 saved the granting of letters patent to inventors in the following words: " Provided also, and be it declared and enacted, that any declaration before mentioned shall not extend to any letters patent and grants of privilege for the term of fourteen years or under, hereafter to be made of the sole working or making of any manner of new manufactures within this realm, to the true and first inventor and inventors of such manufactures, which others at the time of making such letters patent and grants shall not use, so as also they be not contrary to the law, nor mischievous to the State by raising of prices of commodities at home, or hurt of trade, or generally inconvenient; the said fourteen years to be accounted from the date of the first letters patent or grant of such privilege hereafter to be made, but that the same shall be of such force as they should be if this Act had never been made and of none other."

So it is that in the present day, notwithstanding the various statutes which have been passed in relation to letters patent for inventions, these monopolies are still granted upon the mere motion of the sovereign, in the exercise of His royal prerogative, and that all that has been done, has been declaratory of the limits within which that prerogative should be exercised, and of the method of procedure to be adopted in obtaining letters patent for inventions.

The congress of the United States has power to promote the progress of science and useful arts by securing for limited times to inventors the exclusive right to their discoveries, such being set forth in the Constitution of the United States of America, article 1, section A, and this constitutional law is the foundation of the patent laws of the United States. Congress has from time to time enacted certain statutes, the principal enactment being section 4886 of the Revised Statutes of the United States as amended March 3rd, 1897.

Subject to certain conditions and limitations, this section provides that any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvements thereof, may obtain a patent therefor. Statute law identical with this was enforced in the United States since April 10th, 1790, except that the conditions and limitations attending it varied somewhat from time to time and except that compositions of matter were not mentioned in the statute prior to February 21st, 1793, although they were doubtless covered by the word " manufacture " which the early statute contained.

From the above it will be seen that an invention is not found but is created, being the result of original thought. Laws of nature can never be invented by man though they may be discovered by him and when discovered they may be utilized by means of an art, a machine, a manufacture or a composition of matter. It is the invention of one or more of these for the purpose of utilizing a law of nature and not the discovery of that law that may be rewarded with a patent.

The British patent act does not in general affect Canada, except as regards international arrangements for the protection of inventions. The earliest statute on patents found in the legislation of the provinces now constituting the Dominion, is an act of Lower Canada, passed in 1823, termed "An Act to Promote the Progress of Useful Arts in the Province." The first patent act of the province of Upper Canada was passed in 1826 with the same intent. At that time only an inhabitant of the provinces could obtain a patent for an invention and the term was fourteen years.

In 1849, after the union of the provinces, an act was passed to consolidate and amend the laws and patents for invention, and one of the provisions at the time was that the invention must be one not known or used in the provinces by others, and not at the time of the application for patent in public use or on sale in the provinces by others. Shortly after this the Bureau of Agriculture received patent applications.

In 1869 a further act was passed, being the first after Confederation, and the Patent Office was constituted for the first time, the Minister of Agriculture being made the Commissioner of Patents. By this act patents were granted for five years and could be renewed for two further terms of five years, making fifteen years in all. Certain conditions were imposed relative to manufacturing and importing which had to be complied with to maintain the patent in force, and further there was a restriction that the applicant be a resident of Canada for at least one year. In 1872 this latter restriction was removed, so that foreigners could obtain patents on the same terms as Canadians.

In 1892 the term for patents was extended to eighteen years, divided into three six year terms, with a Government fee payable for each six years. Section 7 of this act set forth what constituted an invention and reads: "Any person who has invented any new and useful art, machine, manufacture or composition of matter or any new and useful improvement in any art, machine, manufacture or composition of matter which was not known or used by any other person before his invention thereof, and which has not been in public use or on sale with the consent or the allowance of the inventor thereof for more than one year previous to his application for patent therefor in Canada, may obtain a patent."

The term " any person " included both men and women and foreigners of all description. An application could be made also in joint names where parties were co-inventors.

Principles or Laws of Nature Not Patentable

As before stated, principles or laws of nature are not patentable, although when discovered, they may be utilized and patent obtained. The dividing line is very fine, and a number of very important decisions have been rendered by the Supreme Court of the United States on this question.

One case related to the casting of rollers or cylinders in a mould, it being desirable to give a rotary motion with the object of throwing the flog or dross into the centre instead of the circumference of the casting. The fact that rotary motion would so result was an understood law of nature, an understood operation of centrifugal force. The problem was to produce a motion more conveniently and more uniformly than by stirring the liquid metal with a circular movement of an implement inserted therein. James Harvey solved this problem by discovering that the rotary motion desired could be imparted to melted metal by injecting that metal into a mould tangentially. Litigation arose on the patent and coming before the Supreme Court was held to be a patent for a process.

Samuel Morse, inventor of the telegraph, did not discover either of the laws of nature which he utilized. He did, however, invent a machine by means of which those laws could be utilized to carry information from a distant point. The machine was dependent for success on several laws of nature, and lacking any one of them would have failed. In one claim of his patent he attempted to cover the use of an electric current for making intelligible signs at a distance, and this particular claim was held void by the court.

In connection with the telephone we have likewise the question of the utilization of the laws of nature in a patentable combination. It had been known for centuries that articulate sounds could be produced at a distance from the place where they were originally uttered by means of using two metal diaphragms attached to a tightly drawn cord. Such instruments were called string telephones and they used a law of nature. It had also been discovered by Faraday that when an armature is moved in front of an electro-magnet which is being magnetized by an electric current passing through its coil, the motion modifies the current and that those modifications correspond to the movements of the armature in duration, direction and strength. It was also known that the electric current thus modified would cause corresponding modified movements in the armature of another electro-magnet. In 1876, Dr. Graham Bell invented his telephone with which we are all familiar. That invention consisted in mounting two diaphragms upon two armatures, arranged, combined and movable and enabling one of the armatures to transmit and the other to receive such minute vibrations as those caused in the air by the human voice, and it also consisted in the process of transmitting sounds by causing electrical undulations to occur upon the conducting wire. The Supreme Court held this to be a patent for a process as well as for an apparatus and held the process claim to be valid.

The point it is desired to emphasize is that in the several cases cited, each produces a process which utilized several laws of nature and each of them claimed the entire process he produced, including the use of all those laws, in the order and method described.

What Constitutes an Invention

By far the greater number of patents are for machines and improvements of machines, and these are combinations of mechanical parts or elements; all of the parts of a machine may be old, while the machine as a whole as also the sub-combinations which are contained therein are proper subjects of patent. An improvement in a machine may consist of an addition thereto or a subtraction therefrom, or in substituting for one or more of its parts something different, or in so re-arranging the parts as to make it work better than before.

The distinction between what is a machine and what is a manufacture cannot be stated so that its application will be clear and satisfactory to every mind. However, if an inventor is uncertain, no evil need result, as he does not require to state or know whether the thing he invents is a machine, a manufacture or a composition of matter. It may be laid down, generally speaking, that if a new combination and an arrangement of known elements produces a new and beneficial result never attained before, it is evidence of invention.

There is a distinction between elements in a legitimate combination and what is known as aggregation. A good example of aggregation is the rubber on the end of a lead pencil. While this article was sold by millions, the patent which was obtained was held by the courts to be void, because there was no joint operation performed by the pencil and the rubber.

It is not invention to combine old devices into a new machine without producing any new mode of operation, although, on the other hand an old combination with a new mode of operation may be invention. In Canada and the United States, an applicant must swear that he invented the invention, so that he cannot file an application for a patent on something he did not invent, even though it may be entirely new in the country. In Canada, the applicant must be the first inventor throughout the world and not merely in Canada, and an invention is not new if it has been known or used by any person, and such prior user need not have been in public, nor is publication necessary.

In Great Britain, in so far as novelty is concerned, the question is whether the invention has before the patent been used or published in such a way that it must be said to be in the possession of the public. In the United States novelty is not negatived by prior knowledge and prior use in a foreign country, provided the invention has nowhere been patented to another person, and has nowhere been described in a printed publication. An invention must also have utility, that is, it must be capable of producing a result and that a good result. The patent offices do not enter into the question of efficiency in its ordinary meaning.

Filing an Application

The above gives a brief outline of what constitutes an invention, and in order to protect an invention an inventor has to prepare and file his patent application in the country in which he desires protection.

The application consists of a petition, a specification describing the invention fully and clearly in connection with the drawings, if it can be illustrated, together with a statement of claim, which latter in the average case embodies elements in combination. An oath is also filed, the oath being the same in substance for every inventor, and stating that the applicant is the inventor of the invention and that certain other conditions, as required by the patent act, are true.

There is nothing to prevent an applicant from filing and prosecuting his own application, but unless he is very familiar with the procedure he should employ a competent attorney. The patent office will not select an attorney for an applicant, although a register of attorneys is maintained in the patent office, and in the rules and forms of the patent office the department suggests that the services of an attorney should be obtained.

The fee for filing in Canada is now $15.00 which must be forwarded with the application, and after the patent office has examined the application and the case is ready to be issued, a notice of allowance is sent calling for the final fee of $20.00, which can be paid at any time within six months from the date of the notice. After the final fee is paid, the patent issues in six weeks.

Examination

In the patent office, there are a number of different examining divisions with competent examiners in charge, and the filed application is given a serial number and a filing date and is turned over to the examiner in the division where it logically falls. The examiner's principal business is to see that the applicant obtains no claim for anything which is not new, and any application may accordingly have one or more claims thereof rejected in view of certain earlier or prior patents which are cited. These issued patents are considered by the applicant or his attorney, and if any claim is obviously old, it is withdrawn. However, amendments are permitted in which the claim or claims can be modified to distinguish from the prior cited art and cover what is actually new, and in the amendments, arguments are advanced in support of the claims.

If the examiner finally concludes there is no invention whatever, he rejects the application, and the applicant can then appeal if he so desires. In Canada, the appeal is from the decision of the Commissioner of patents to the Governor-in-Council. In the United States, it is first to the Board of Examiners-in-Chief, then to the Commissioner of Patents, and then to the Court of Appeal of the District of Columbia.

Government Fees, Taxes and Other Obligations

At the present time when one pays the final government fee in either Canada or the United States, the patent is paid up for the full term, that is eighteen years in Canada and seventeen years in the United States. The life of a patent in Great Britain is sixteen years, in Germany eighteen years, in Spain and Belgium twenty years, and in the remaining important foreign countries fifteen years. In some cases the expiration of a patent in one country shortens the life of a patent in another country.

In most European countries there is also a tax payable to the government to maintain the patent in force. In Great Britain one has to pay taxes on the fifth and following years. In France and Germany taxes are payable yearly throughout the life of the patent, and it should be noted that in the latter countries, the patent dates from the date of filing, so that in France and Germany one may have to pay a tax even before the patent has issued.

Outside of these taxes some of the countries impose other requirements relating to manufacture and importation in order to maintain a patent in force. A United States patent once granted has no restriction in this regard. In Canada, until recently, a patent became null and void at the end of two years from the date thereof unless the patentee within that period, or an authorized extension, commenced and after such commencement continuously carried on in Canada the construction or manufacture of the invention in such a manner that any person desiring to use it could obtain it or cause it to be made for him by some manufacturer or establishment in Canada, and further it became void if after the expiration of twelve months from the granting thereof, or an authorized extension of such period, the patentee imported the invention. The extensions mentioned could be obtained by filing a petition setting forth satisfactory reasons for not manufacturing or for importing, and the petition had to be filed within a fixed period. It will be observed that in so far as manufacturing is concerned, the condition which would satisfy the clause was rather indefinite, and the question as to what constituted manufacturing was always a more or less debatable one and rather unsatisfactory to the patentee.

The above mentioned manufacturing clause was a hardship when considered in connection with some types of inventions, such as telephone attachments, street car fenders, attachments to locomotives and other such devices controlled by large public or private corporations, where, obviously, it was useless for a man who had, say, invented a street car fender, to be compelled to manufacture it within a fixed period or lose his rights. Relief was obtained under the compulsory license clause, which permitted any such patentee on an application within six months from the issue of his patent, to file a petition requesting, for reasons set forth, that his patent be brought under the conditions of the said clause. If favourably considered, the commissioner could order that the patent, instead of being subjected to the conditions of the manufacturing clause, could be subject to the following conditions:

"Any person at any time, while the patent continued in force, could apply to the commissioner by petition for a license to make, construct, use and sell the patented invention and the commissioner, hearing the person applying and the owner of the patent, and concluding that the reasonable requirement of the public in reference to the invention had not been satisfied, could make an order under his hand and the seal of the patent office, requiring the owner of the patent to grant a license to the person applying, in such form and upon such terms as to the duration of the license, the amount of royalties, the security of payment and otherwise as he, the commissioner, under the circumstances, deemed just. If the owner of the patent refused or neglected to comply with the commissioner's order within three months, the patent became null and void."

Protection of Inventions Which are Not Perfected

In Canada, one can protect an invention which he has not perfected by filing a caveat, which embodies a description of the invention as far as it has been developed, with or without plans, and by paying a small filing fee. This caveat is preserved in secrecy. Having filed a caveat, the Commissioner of Patents has to advise the applicant if anyone else makes an application for a patent for an invention which would interfere with his claim, and the applicant within three months is required to file a patent application. If it is then found that the applications are conflicting, they are submitted to the arbitration of three skilled persons, each applicant choosing one and the commissioner the third, and the decision of such arbitrators is final in so far as concerns the granting of the patent. The arbitrators can summon any person to appear and compel him to give evidence.

If the caveator does not file a patent application within one year from filing his caveat, the commissioner is released from the obligation of giving notice, and the caveat then remains as a matter of proof as to novelty or priority of invention, if required.

In practice it is found that the greater number of inventions presented have been sufficiently developed, in so far as the basic idea is concerned, to warrant filing a patent application instead of a caveat, as the development required is usually that which one familiar with the art to which the invention appertains could readily suggest in order to make the article better from a manufacturing standpoint, while not adding anything new or patentable.

The average inventor, having filed a caveat, does not usually develop his invention with dispatch, relying on the caveat protection, and obviously this is bad policy, for the reason that he leaves himself open to conflicting applications and the incidental expense and trouble. There are no doubt certain cases which have not been sufficiently developed to warrant a patent application, but caveat protection should be used with discretion. It is interesting to note that caveat protection was available in the United States until a few years ago, when it was withdrawn, and the reason may have been that it was an abused privilege.

Fluctuation in Number of Patents Issued

For a considerable number of years prior to the Great War, there had been very few important changes in the Canadian Patent Act, and from shortly after Confederation up to the year 1914 there had been a steady increase in the number of patents annually taken out in Canada. During the period of the war, there was an initial falling off, as would be expected, then a slight recovery due to war inventions, and then a gradual falling away, which in 1919, the year after the war, had placed the number of patents taken out approximately the same as in the year 1904. In 1921 provision was made by a special act, whereby no patent in force on the 1st day of August 1914, or subsequently granted, should be void through failure to construct or manufacture, or by the importation of, the invention covered by the patent between the said date and the 10th day of January 1922, and further by this act fees which had become payable since the first of August 1914 could be paid at any time until the expiration of a period of one year from the coming into force of the act with the same effect as if paid within the time prescribed. Further, the time for filing applications was extended.

The above concessions naturally resulted in a comparatively large increase in the patents granted in 1921, and when the term for these special privileges expired in 1922, there was a natural rapid falling off in the number of patents issued that year.

In the Act to amend the Patent Act of 1921, a change was made in regard to the payment of the government fees, and the term patent (6, 12 and 18 years) was done away with, the filing fee, previously $20.00, was reduced to $15.00, and when the application was found to be allowable, a notice of allowance was given and the applicant could then pay the final fee at any time within six months; the patent would subsequently issue, and was paid up for the full term of eighteen years. The holding back by applicants of their final fees resulted in a large number of patents being issued in the year 1923, and from 1923 to 1924 there was an apparent falling off but it was really a return to normal.

Residence of Inventors

As regards the countries from which application for Canadian patents originate, it may be noted that from the years 1911 to 1924, United States inventors account for 65 to 78 per cent of the total issue. The percentage of British, German and French inventors filing in Canada is relatively small, so that approximately 15 to 17 per cent are Canadians. Residents of Great Britain, its colonies and possessions, account for 8 to 10 per cent, and the remaining small percentage comes from inventors in some twenty-five other countries.

In 1924 resident Canadian patents were divided as follows:—

Ontario	44 per cent	Manitoba	6 per cent
Quebec	20 per cent	Nova Scotia ..	3 per cent
British Columbia	11 per cent	New Brunswick	1 per cent
Alberta	8 per cent	Prince Edward Is.	a few
Saskatchewan ...	7 per cent		

The question is often asked, how many patents actually make money? The questioner possibly has in mind some person who in his lifetime only took out one patent, and is not thinking of the manufacturer or other business man who is, from time to time, protecting by patent the valuable inventions which are discovered in his business and which really form the foundation on which that business is built.

In the year 1924, the Canadian Consolidated Rubber Company obtained thirty-seven patents; the Canadian General Electric Company, one hundred and three patents; the Canadian Westinghouse Company, one hundred and thirty-one; the International Western Electric Company, one hundred and twenty-five; the International Cash Register Company, thirty-one; the Northern Electric Company, one hundred and one; the United Shoe Machinery Company, fifty-nine. Taking it for granted that the smaller manufacturers are doing likewise, one can conclude that the greater percentage of patents are valuable, and it is accordingly hardly fair, as some do, to judge patent values by the opinion of the casual person, of whom one possibly hears most about, but who represents only a small proportion of the patents actually granted.

In regard to perpetual motion, a considerable number of such devices continue to be presented, and most of them are rather complex. The applicant for this type of patent is usually illiterate, of foreign extraction, and distrustful, and is one of the hardest individuals to convince, as he has usually small knowledge of fundamental mechanical laws. Both the Canadian and United States patent offices will accept applications for such devices, but no patent will be granted until a working model is furnished.

Early Patents

The first Patent Record published in Canada, covering the period from 1824 to 1872, lists the Canadian patents from the beginning of the patent office in June 1824. In this book there are two series of patents, the first series from number one to number 3325, being those in force prior to Confederation. The second series, after Confederation, are numbered from one on and the numbers of the patents at the present time are of this second series.

Generally speaking these earlier patents were what would be expected of individuals working out their destiny in a new country. We find many patents for threshing machines, churns, spinning machines, various farm implements, stoves, boats, water wheels, grist mills, saw mills, fanning mills, cider presses and so forth. Patent No. 12 was the first for a steam engine and was dated June 25th, 1830. Another steam engine occurs in 1839, a rotary steam engine in 1843, a furnace or hot air generator in 1846, an electro-magnetic telegraph in 1847, a hydraulic cement in 1854, a rotary pump in 1857, a Portland cement in 1863, crystallized sugar from Indian corn or other cereal, grain or roots, in 1865, peat fuel in 1865, the manufacturing of peat into coal by process of steam in 1867, a steam injector in 1868, a steam turbine and rotary engine in 1868 and many other interesting devices as time goes on.

From the number of patents taken out on the manufacture of pulp in the earlier days, say between 1854 and 1868, the pulp and paper industry was an important issue even at that time. One by the name of J. Taylor, of Toronto, took out the first patent in 1855 which was a method of manufacturing printing paper from the straw of wheat, oats and the like or from any other kind of straw.

Trend of Inventions 1924

It may be interesting at this time to refer to the report of the Commissioner of Patents relative to the year 1924 wherein he states, "Inventions relating to transportation were more numerous than any other, but land vehicles and accessories, which is the largest single class of invention, declined nearly 30 per cent. Railway appliances and rolling stock were about the same as last year, with the exception of a large increase in draft gear and buffer applications. There were decreases in air and water navigation. Inventions pertaining to agriculture and animal husbandry declined nearly 20 per cent. Applications relating to dyeing, bleaching, chemicals, medicines, fertilizers, metallurgy and electro-chemistry were slightly in excess of last year."

"The interest in wireless communications, especially in the development of vacuum tubes, was well maintained, but there was a marked decrease in telephone applications."

"Woodworking machinery and tools were somewhat greater than last year."

"Printing press and typewriter applications increased. Many of the typewriter applications were directed to the lessening of noise, folding portable machines and bookkeeping machines."

"Pulp and paper making machines and processes increased nearly 50 per cent."

"Steam engines increased slightly but internal combustion motors declined nearly 20 per cent. In this class there was a larger number of inventions for the diesel and semi-diesel type of engine."

"In some other classes such as wooden buildings, metal founding, hoisting machinery, dish washing machines, liquid fuel burners, weaving, cordage manufacture and life preservers there were substantial gains."

Relations of Employee to Employer Regarding Inventions

With regard to the rights of employees in respect to inventions which they have made, it may be stated that employees are entitled to their own inventions and to patents granted therefor, so that in the absence of a contract to the contrary, an employee is entitled to a patent for an invention which he makes even though it may relate to the business of his employer. If he develops the invention in the time and at the expense and with the tools and materials of his employer, then the latter will have an implied license or shop right to use such invention in his business, but he cannot demand an assignment of the patent.

Employers who wish to secure inventions relating to their own business, which are made by others while in their employ, should have a contract with the employee. Even with such a contract the employer cannot apply for a patent in his own name, as it must be applied for by the employee and assigned to the employer. Many large corporations employ regular staffs of experimenters and inventors, and most of these concerns have contracts with these employees which provide that the latter are to assign to the company all inventions made by them in the regular course of their employment. If the employee makes an invention at home or away from the company's plant and out of hours or on something not connected with his regular employment with the company, it belongs to him unless perhaps he has contracted absolutely to assign to his company everything he invents for a certain period. If there is no contract and if the employee has taken out a patent, the employer cannot prevent him from licensing other parties to make, use and sell the patented device, or from selling the patent outright, or from making, using and selling the device himself.

If an employee really invents something of value to his employer, the latter should not feel that he is being "held up" because that employee invokes his legal rights to secure the best advantage from his creation. It should be gratifying at least that the improvement has been made by the employee rather than a competitor.

Recent Important Changes in Act

On September 1st, 1923, the existing Patent Act was, for the greater part, repealed, and in the new Patent Act, which came in force on September 1st, 1923, there were some important changes.

Under the old act, in applying for patent, the applicant had to state that the invention had not been in public use or on sale with his consent or allowance as such inventor for more than *one year* previous to his application for patent therefor in Canada. This now reads *two years*. Previously also one had to make the application within one year from the date of issue of the first foreign patent for the invention. Now, by a recent judgment of the Exchequer Court, sections 7 and 8 of the new act have been interpreted as permitting the filing of an application for patent within two years from the date of issue of the first foreign patent, the other conditions of section 7 being met. It has not been decided whether to appeal from this judgment to the Supreme Court or to amend the section to bring it into accord with the patent office's construction thereof. In the meantime, however, applications coming within the terms of the judgment will be accepted, and will be proceeded with in due course.

The new Act contains a section covering the case where an applicant has agreed in writing to assign a patent, when granted, to another party or to a joint applicant, and refuses to proceed with the application, or a dispute arises between the joint applicants as to proceeding with an application. In such a case the commissioner, upon hearing the parties and concluding that one of them ought to be allowed to proceed alone, can permit this to be done and grant a patent to him.

A further section was added in connection with inventions relating to substances prepared or produced by chemical processes and intended for food or medicine, and it provides that in such cases the specifications shall not include claims for the substance itself, except when prepared or produced by the special methods or processes of manufacture described and claimed, or by their obvious chemical equivalents.

Further, in the case of a patent for an invention intended for, or capable of being used for, the preparation or production of food or medicine, the Commissioner of Patents shall, unless he sees good reason to the contrary, grant to any person applying, a license limited to the use of the invention for the purposes of the preparation or production of food or medicine, but not otherwise, and in settling the terms of the license and the royalty, the commissioner shall have regard to the desirability of making the food or medicine available to the public at the lowest possible price consistent with giving to the inventor due reward for the research leading to the invention. This section, however, only applies to patents granted after the passing of this act.

The previous two-year requirement relative to manufacturing, and the one year permitted for importation, have been done away with, and the act now states that every patentee shall satisfy the reasonable requirements of the public with reference to his patent and to that end shall adequately manufacture the patented article or carry on the patented process within Canada. Anyone, however, may present a petition to the commissioner contending that the requirements of the public have not been satisfied and asking that the patentee be ordered to supply the patented article at a reasonable price, or grant a license for the use of the invention at reasonable terms. If the parties cannot come to an arrangement between themselves, the commissioner shall proceed to hear and determine the matter, and if he concludes that the reasonable requirements of the public have not been satisfied, he can order the patentee to supply the article within reasonable limits at such price as may be fixed by him. There is a provision, however, that the commissioner shall not make such an order before the expiration of three years from the date of the patent. The act also sets forth under what conditions it may be considered that the reasonable requirements of the public have not been satisfied.

Under the present act any one interested, and at any time not less than three years after the date of a patent, may apply to the commissioner for the revocation of the patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside Canada to supply the Canadian market with the invention covered by the patent. The commissioner again has the right to hear the parties, and decide the matter, and unless the patentee proves that he is manufacturing to an adequate extent in Canada or gives satisfactory reasons why such is not done, the commissioner may make an order revoking the patent forthwith, or after such reasonable time as may be specified in the order, unless in the meantime it is shown to his satisfaction that the invention or process is being manufactured or carried on within Canada to an adequate extent. If, however, within the limited time set in the order, the manufacturing is not carried on to an adequate extent and the patentee gives satisfactory reasons why it is not, the commissioner can extend the period, but such extension shall not exceed twelve months.

There is also a section which permits the patentee to apply to the commissioner for the restoration of a patent which has become void through the non-payment of fees or failure to construct or manufacture, or on account of the importation of the invention, provided the application is made within two years from the date of such voidance.

If a patent is so restored any person who has constructed, manufactured, used or sold the invention in

Canada during the period of voidance may continue to construct, manufacture, use or sell the invention in as full and ample a manner as if the patent had not been restored and revived.

On September 1st, 1923, Canada's adherence to the International Convention for the Protection of Industrial Proprietory Rights was secured. One of the principal articles of this convention is, that in those countries belonging to the Union, which includes most of the principal countries of the world, a period of priority of twelve months is given, that is to say, where an application is filed in a convention country, twelve months is given in any of the countries belonging to the convention in which to make application for a patent, notwithstanding any publication or use in any country. The benefits of the convention, however, must be claimed when filing the application.

Engineers as a body should give the inventor a kindly hearing, consider his problems and encourage rather than discourage him, for no other group of persons owes so much to inventors as does the engineering profession.

Discussion on The Design of East York Sewers and Their Construction by Contract and Day Labour

Discussion of paper presented by R. O. Wynne-Roberts, M.E.I.C., Consulting Engineer, Toronto, Ont., and Grant R. Jack, A.M.E.I.C., Engineer, Township of East York, before the Annual General Professional Meeting of The Engineering Institute of Canada, Toronto, Ont., January 28th, 1926.

Mr. A. G. Dalzell, M.E.I.C.

Mr. Dalzell remarked that it is the function of the engineer to use the right materials in the right way and place, and in the most economical manner, and that it would some day be realized that it is also his function to see that his fellowmen are rightly and economically placed when new communities are formed, so that they reap the greatest advantages at the lowest cost.

The citizens of the township of East York and the citizens of Toronto forming essentially one community, it was impossible to distinguish the boundary line that formed the political division, but because of this division the citizens of the township had been forced to construct a combined sewer system against the natural drainage flow, and to take their sewage for treatment and disposal to a site miles away from the logical outfall.

It was well known that the designers of the system did all they could to find a better solution, but because the authorities that govern the separate communities, comprising what should be the Toronto Metropolitan district, had been unable to establish one joint authority to construct and maintain the larger public utilities, each separate authority had gone its own way. Thus the community would always carry a greater burden of taxation because of the failure to co-operate.

In too many instances new and growing communities that are favoured with easy means of sewage disposal embarked on sewer construction without proper plans, or study of the whole area. Inefficient sewers and futile expenditures were the inevitable result. In this case the whole area had been carefully studied, and a system of sewers designed and largely constructed which appeared to be entirely adequate.

The methods of construction appeared to conform to the best modern standards, though the designers had perhaps been obliged to concede some points to satisfy the desire of the authorities to encourage local labour and local manufacturers. The details of construction showed careful consideration of points that are often overlooked. Manholes were too often regarded as mere peepholes to be used to see if a sewer is working. It was often forgotten that, if they are to serve the purpose of cleaning or clearing a sewer, they should be large enough to allow two men to work, and to stand upright when at the bottom.

The authors' design afforded sufficient headroom but he considered three feet as a better minimum width. In his opinion the horseshoe pattern of manhole step gave a very uncomfortable and insecure hold for the hand, and the staggered placing made footing very precarious. In small manholes a ladder could easily and cheaply be constructed by placing short lengths of galvanized pipe across one angle, giving a better hold for hands and feet, and no obstruction to the dropping of buckets or tools down the manhole.

Consideration should be given in the design of manholes as to the possibility of their being used for the disposal of snow. In many instances the use of sewers was justified, but manholes should be designed and allocated for the purpose. Drop manholes were particularly effective for snow removal.

Drop manholes required to be very carefully constructed or they might be very dangerous traps even for experienced sewer workmen. For large and important manholes he would favour side entrance chambers with access from the sidewalk, particularly in locations where the street car lines intersect.

Mr. Dalzell had had experience with day labour forces, and whilst he did not recommend that all sewer construction should be done in this manner he considered that every municipality is justified in maintaining at least one efficient gang. He had never placed any reliance on cost subdivision as made out by foremen. A forman had quite sufficient to do to supervise his men and keep them working without booking whether a man is pumping or backfilling. A record of the total time spent on the work is all that should be expected.

Cost records would be best secured by employing special cost clerks, or student engineers, and moving them from job to job. Municipal authorities often objected to such an addition to the engineer's payroll, but have proved amenable to reason if it is shown how small is the cost compared to the total expenditure of the work.

He congratulated the authors on the preparation of a concise and interesting paper.

Mr. Geo. Phelps, A.M.E.I.C.

Mr. Phelps remarked that the City of Toronto had had experience of annexing adjoining areas, which had been sewered, but not adequately sewered for ultimate purposes. Should the time arrive when East York becomes a part of the city, there was no reason to fear a repetition of this unsatisfactory condition. East York must necessarily remain for a long time chiefly a residential area, and the run-off curve used by the authors practically parallelled the Toronto curve for residential areas, but was about 30 per cent higher.

Raymond's zone principle was no doubt satisfactory for calculating sewer discharges, particularly if the drainage area were approximately a sector of a circle with the discharge point at the centre. Not infrequently, however, an area was so shaped as to be more nearly a sector with the point of concentration at, and the flow towards, the circumference. In the latter case, the maximum discharge in the sewer would occur near the beginning of a storm, and that part of the area at the upper end of the sewer would have little effect on the maximum discharge.

The direction of travel of a storm in relation to the line of the sewer, which is usually, and almost necessarily, ignored, had a considerable bearing on the rate of concentration, and with such an unknown factor involved, refinements in calculating composite co-efficients of run-off would not appear to be of great value. Storms were often observed to travel in a certain direction, and return in the opposite direction with about equal intensity, perhaps half-an-hour later. If this movement were down the line of sewer in the first case, and up in the second, at the rate of say 10 miles per hour (about 14 feet per second), the maximum rate of flow would be far greater in the first than in the second case.

He was of opinion that an even simpler method of calculating run-off than that adopted by East York and described as Raymond's zone principle, might be adopted for designing such a system with equally reliable results.

In Toronto heavy thunderstorms of about 5 or 10 minutes duration were found to give the worst conditions, and a storm was considered as covering the whole contributory area at a given intensity according to the length of duration, the impermeability being varied for the class of district. The rate corresponding to time of concentration multiplied by the co-efficient of impermeability was taken as the run-off.

In designing trunk sewers the flows were checked at different points on the sewer for different periods of concentration, and the maximum run-off at any point governed the size of the trunk from this point down, irrespective of the total time of concentration from the most remote point of the sewer.

This method, giving a run-off curve for residential areas, following closely at 30 per cent below the East York curve, had been used in Toronto for about seven years and closely checked by gaugings, both of rainfall and sewer discharges, and he was of the opinion that the results given in this way are as near actual conditions as would be obtained by the Raymond or any other method.

As a basis of design, the rainfall rate allowed was:—

Time of concentration		Rate per hour	
0 - 15	minutes	2	inches
15 - 20	do	1.7	do
20 - 30	do	1.5	do
30 - 40	do	1.3	do
40 - 60	do	1.1	do

The co-efficient of impermeability varied from .35 for residential areas to .75 for areas in the centre of the city. In calculations, instead of using a rainfall curve, he had found that stops in the rainfall rates were simpler in application and quite sufficiently accurate, as, in computing run-off, all that could be hoped for was an approximation to actual conditions, which are extremely uncertain and variable.

Mr. H. S. Philips, M.E.I.C.

Mr. Philips had been particularly interested in the solution of the sewerage problems of the East York area, since he had laid out the sewers in the adjacent portion of the city of Toronto.

From a brief examination of the general outline it would appear that the engineers' original scheme of a single westerly treatment plant and a pumping station for the Danforth Park Area was the logical one. He believed that the additional cost of land for a disposal work site would be outbalanced by the saving on deep tunnels constructed northerly through difficult ground.

The authors had accumulated a vast amount of data in determining the intensity curve for use in East York, and he would like to know the probable storm interval covered by this curve. From published records of rainstorms which have occurred in Toronto since 1895, he found that for durations of five to twenty-five minutes the East York curve had been exceeded on two or three occasions. For longer durations the precipitations have been a little greater.

The rainfall intensity for Hamilton, Ont., was represented by the equation of 20-T°-65, with inlet times varying from five to fifteen minutes according to the character of the district, this being considerably higher than the one used by the authors. A Friez rainfall recording gauge had been installed in 1918, and since that time two gauges had been added. The curve adopted had been exceeded once during the last eight years.

The authors did not state the impervious percentage of the district in connection with their run-off per acre, and probably the run-off co-efficients for the pervious and impervious areas which were used in designing the county of York sewers some years ago were adhered to.

Would the authors state whether Y or Tee branches were used on pipe sewers for house connection stubs? While there are some advocates of the Tee branch method, he believed that with pipes properly bedded the Y branch is the better.

He would also ask whether a vitrified brick invert was included in the brick sewers, as a paving brick invert was specified for the monolithic concrete sewers. In the city of Hamilton some of the large sewers which had been constructed recently were of brick work and in some cases of monolithic concrete. Their use had been entirely for storm overflow purposes, and as this entailed only their use on a very small number of days in the year, it had not been considered necessary to build in a special invert to withstand heavy wear. In the combined sewers recently built in Hamilton, some inverts had been lined with a half vitrified pipe and in other cases, with vitrified segment liners.

Referring to the distribution costs for the 15-inch sewer, average 12 feet deep, which was constructed at an average cost of $11.21 per foot in sand and gravel, this cost seemed to be slightly higher than that for sewers in the city of Hamilton, where on Crosthwaite avenue, 1,500 feet of sewer, average depth 11 feet, about one-third each, 12-inch, 15-inch and 18-inch pipe had been laid at an average cost of $7.77 per foot. This work had been done in the winter by relief labour, and about 5 feet of the depth was shale. An adjoining street had been sewered 1,800 feet long by contract in similar ground at a rate of $3.57 per foot; most of the shale in this case had been taken out by a digging machine.

With reference to the design of the standard manhole, he considered that 2 feet 4 inches as the minimum width of manhole was too small, 3 feet being preferable in his opinion. The cities of Toronto and Hamilton were also using frost batter on the upper walls of manholes.

He desired to compliment the authors on their treatment of the difficult problems of rainfall run-off and sewer design, and also on their excellent sewer-cost and design calculation sheets.

Mr. N. MacNicol, Jr.E.I.C.

Mr. MacNicol remarked that the authors had referred to the placing of junctions on trunk sewers at intervals of 25 feet. Where excavation was open cut, connections were encased in concrete and brought to within 12 feet of the surface of ground.

This would appear to be good practice in the particular case referred to in the paper, and also when it is known that a pavement is soon to be laid over the sewer, but that investigation of other situations may advise a different procedure.

When Etobicoke township began laying sewers the matter was given consideration. Some 12½ miles of sewers were to be constructed in the Long Branch district. The survey showed that the average street was 25 per cent built up. Deducting 25 per cent from the total length for street intersection, flankages, etc., the number of junctions which would be required, placing one each way every 25 feet, would be 4,000. Taking 12-inch pipe as average, the cost of a junction was $3.00 and for straight pipe $1.20.

By placing junctions only for existing houses and at every 25 feet fronting vacant lots where sewer was over 18 feet deep, the initial cost had been reduced to $3,050, and an initial expenditure of approximately $4,000 was saved.

After the sewers were completed, connections began and it was found that in measuring for location of junction occasionally both time and junctions were lost. The inability to locate a junction definitely may seem due to carelessness, and this is probably correct to some extent.

Those dealing with the construction of sewers knew, however, that under the best conditions, there are opportunities for errors to creep in, as the records are tabulated by the inspector and pass through the office files.

In his opinion the conditions under which junctions should be installed at the same time as the sewer is constructed were briefly as follows:—

(1) When main sewer is in open cut and over 18 feet deep.

(2) For all depths, when it is known that a pavement is to be laid over the sewer within a year or two.

(3) When the actual location required for a junction can be determined, and it is known that the connection will be used within two years.

In all other cases better results would be obtained, and an economy effected, by tapping the main sewer and installing the connection in the location most suitable to the other portion of the service at the time required.

He desired to submit a few data as regards cost in the Long Branch sewer system in the township of Etobicoke, which as previously stated comprised some 12½ miles of sewer, varying in size from 9 inches to 48 inches.

Work was commenced about May 1st, 1924, and completed early in January, 1925. About 15 per cent of the total length was in sandy soil, and 35 per cent in blue clay. On the remaining 50 per cent of the job boulders and solid rock were encountered, the thickness of rock varying from 6 inches to a maximum of 2 feet 6 inches.

The equipment included one trench excavator, three steam shovels, one mechanical back-filler and one air compressor. Some sections of the work were carried out by hand, so that during the bulk of the contract, six separate pipe-laying gangs were working simultaneously. The contractor completed the work in 8 months.

The following table showed the costs of labour and material for the different sizes for depths under or over 10 feet. From the corresponding distribution sheet given by the authors, it would appear that Etobicoke unit costs are low, but it must be remembered that the figures given in the paper were for "day-labour" winter work.

Mr. A. F. Macallum, M.E.I.C.

Mr. Macallum asked for the authors' opinion as to the percentage of water going to the catch-basins upon grades of say, five per cent on paved streets. He knew of a number of cases where most of the water flows over and past catch-basins on such grades and on to another sewer where calculation had not allowed for it. His experience with different formulae for run-off had been that their accuracy is limited and depends on whether the local conditions fit the assumptions used. Under the conditions existing in the northern portion of the country a greater run-off occurs during the spring than at any other season of the year because of the greater amount of impervious area. Not only are areas impervious in the spring season that are not so during the summer and autumn, but the water in these areas will reach the sewers more rapidly.

Mr. Wynne-Roberts' Reply

Mr. R. O. Wynne-Roberts in reply observed that Mr. Dalzell had referred to the need for municipal co-operation in the matter of sewers, which need had been advocated for a long time by the suburban municipalities, but they were often unable to wait for its realization.

LONG BRANCH SEWERS—Cost Data

Size inches	Average Depth		Total length feet	Total Cost		Unit Cost		Total unit cost	Remarks
	Under 10 ft.	Over 10 ft.		Labour	Material	Labour	Material		
9	8.7		23,735	$34,466.81	$10,468.60	$1.45	$ .44	$1.89	About half in sand, the remainder in clay and rock. Blasting continuously.
9		10.5	3,864	7,530.47	1,746.60	1.95	.45	2.40	
10	8.7		1,394	1,815.31	857.22	1.30	.61	1.91	Mostly sand.
10		11.0	890	1,489.90	527.20	1.67	.60	2.27	Hard clay, 2′ rock.
12	8.7		12,839	22,686.67	7,878.70	1.77	.61	2.38	Some sand, remainder clay and rock.
12		11.9	8,949	21,010.13	5,544.40	2.35	.62	3.17	
15	8.6		2,099	2,349.01	2,089.10	1.12	1.00	2.12	Stiff blue clay with stones.
15		12.2	5,783	13,733.21	5,704.50	2.38	.99	3.37	Stiff blue clay, boulders and rock.
18		13.1	98	283.97	166.60	2.89	1.70	4.59	Clay and boulders.
21		11.6	1,467	3,474.24	2,370.00	2.37	1.61	3.98	Clay and ledge rock.
24		13.9	612	1,594.11	1,525.00	2.60	2.50	5.10	Clay and ledge rock.
27		15.7	3,337	33,053.90	7,900.00	9.90	2.37	12.27	Segment block sewer, quick sand.
48		13.4	442	4,692.65	2,608.98	10.62	5.90	16.52	Segment block sewer, stiff blue clay, with some rock.

Mr. Philips had stated that the Toronto run-off is apparently about 30 per cent less than that adopted for East York, but he would point out that in the first case overflow outfalls are available as reliefs, while in the latter no such reliefs are possible. An overflow in the major part of East York would flow down hill into the city, which had to be avoided, hence the provision for a larger run-off. The Toronto computed run-off, however, was low when compared with that of other cities. As it was understood that the time of entry is estimated at about eight minutes, it was not clear how a five-or ten-minute storm can cause any serious surcharging of the sewers. The city records of sewer gauging would be most useful information if they were made available, as very little data had been published in Canada on the subject of storm water flows in sewers.

Mr. Philips had referred to the west outfall which was originally suggested, and enquired if it would be more economical than the present north outfall. The difficulty lay in the prospective great cost of land, and, moreover, it was not desirable to locate the outfall in a developed district. The west outfall would have necessitated tunnels in difficult ground but their aggregate length would have been slightly less than was the case for the northern outfall.

The impermeable area was estimated at 25 to 30 per cent and allowance for the time of entry was 8 to 20 minutes, each depending upon locality.

Inverts of brick sewers are of best shale brick, and in monolithic concrete, paving bricks are used.

Mr. MacNicol's contribution to the discussion was instructive, but there was no portion of East York which is strictly comparable with Long Branch with respect to trench conditions. The typical cost-sheet, which represented one week only, was presented to illustrate the method employed, and not as an example of the cost of the work. The cost of a 15-inch sewer in another section of Woodville avenue, at 10 feet deep was $6.03; whilst another 15-inch sewer, 11 feet 6 inches deep, on a street with less constructional difficulties, cost only $2.14 per foot run. The conditions on Woodville avenue were difficult. One contractor who had to build a tunnel sewer under an adjoining street, under compressed air 23 pounds pressure, also had great difficulties to overcome.

With regard to Mr. Macallum's enquiry about the quantity of water entering catch-basins, although investigations had been made, it was not possible to do more than estimate the flow and allow ample inlet capacities as conditions vary.

In general, he might state that the total cost of the scheme would be about $2,100,000, equivalent to about $1,400 per acre, a figure which is almost as low as under pre-war conditions.

Assuming that the capacity of the sewer system was 30 per cent more than in Toronto, the cost would be about 5 per cent greater.

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VOLUME IX JUNE 1926 No. 6

Maritime Professional Meeting

Sydney, N.S., August 17th and 18th, 1926

Amendments to By-laws

The amendments to the By-laws proposed by the Legislation and By-laws Committee in 1925, approved by Council on November 17th, and presented to the Annual Meeting in Toronto in January, 1926, were duly sent out for the approval of members by letter ballot returnable April 30th.

The scrutineers have now reported to Council that the affirmative votes in all cases exceeded 75% of the total votes cast.

In accordance with the regulations of the Institute, the amendments thus carry and become effective immediately. A revised edition of the By-laws is therefore being printed, and will be issued to members of the Institute as soon as ready.

The amendments will be found on page 24 of the January number of the Journal.

The Kelvin Medal

Lord Kelvin held the Chair of Natural Philosophy at the University of Glasgow for upwards of fifty years. During his long scientific career he carried out remarkable mathematical and physical investigations which led to his recognition as the foremost physicist and most influential and accomplished scientist of his time.

He was one of the founders of the dynamical theory of heat. In hydro-dynamics he developed and extended the theroy of vortex motions originated by Helmholtz. His last great memoir was entitled "On the Motions of Ether produced by Collisions of Atoms or Molecules containing or not containing Electrons."

Lord Kelvin's form of compass, introduced in 1876, was generally adopted, and is still largely used, especially in the mercantile marine. He served on a committee of the British Association for collecting and collating tidal observations, and invented or suggested three important tidal instruments: a Tide Gauge, a Tide Analyser, and a Tide Predicter. His invention of the sensitive mirror galvanometer, and later, of the siphon recorder, overcame the difficulties of submarine telegraphy. He introduced the "curb" system of signalling and took an active part in the laying of the 1858 cable, and he directed the electrical arrangements of the "Great Eastern" when laying the successful cables of 1865 and 1866.

A large part of his work related to the theory of Electricity and Magnetism. About 1880, he invented the quadrant electrometer and absolute electrometer, and later, the ampere and watt balances. He also introduced for generating stations a recording feeder-log.

He was president of a commission formed in connection with the problem of utilizing the water-power at Niagara Falls.

The Kelvin Medal, in commemoration of Lord Kelvin's work, is awarded triennially by a committee consisting of the Presidents of eight leading Engineering Institutions in Great Britain, and is a mark of distinction in engineering work or investigation of the kinds with which Lord Kelvin was especially identified. It was awarded for the first time in 1920 to Dr. W. C. Unwin, F.R.S., of London, and to Dr. Elihu Thomson of Lynn, Mass., in 1923, and will again be awarded in 1926.

The Council of The Institute, in common with the Councils of all the leading Engineering Societies throughout the world, has been invited to suggest the name of the person deemed by it most worthy to receive the medal for this year, and will consider the matter at an early meeting.

Meetings of Council

MEETING OF MARCH 23RD, 1926

A meeting of Council was held at eight p.m. on Tuesday, March 23rd, Vice-President K. B. Thornton, M.E.I.C., in the chair, and eight members of Council being present.

The report of the Finance Committee was considered, and in connection with it that committee's recommendations as regards a number of special cases of members whose fees are in arrears, and in which requests for extension of credit were made. The resignations of fifteen members were accepted.

The following matters of special business were considered:—

The desirability of publishing in the Journal notes regarding business transacted at Council.

Suggested improvements in the form of certificates of membership.

Arrangements desirable for representation of the Institute and its branches in connection with the forthcoming visit of the delegates of the International Electrotechnical Commission.

Correspondence regarding the action of the Income Tax Commissioners in disallowing deduction of income tax on members' fees to the Institute.

The draft by-laws of the Cape Breton Branch were submitted to Council for approval, and referred to the Legislation and By-laws Committee for consideration and report.

A request from the secretary of the Montreal Board of Trade was considered for the appointment of a representative of the Engineering Institute of Canada on a committee which is to be formed for the purpose of "taking such action as will consolidate public opinion behind a movement for the protection of our waterways, and the restoration of the levels of the Great Lakes and River St. Lawrence, so seriously affected by the Chicago water diversion and other causes." After discussion it was decided in this case that any action which might appear to anticipate the report of the boards of engineers which are now investigating this matter would be inadvisable.

Council approved the personnel of the following committees:

Gzowski Medal and Students' Prizes,
Library and House,
Legislation and By-laws,

and also the lists of officers of the Calgary and Saskatchewan branches for the year 1926-27.

The following elections and transfers were effected:—

Elections

Members	3
Associate Members	13
Juniors	5
Students	10

Transfers

Associate Member to Member	7
Junior to Associate Member	5
Student to Associate Member	10
Student to Junior	14

Forty-three applications for admission and transfer were scrutinized and classified for the ballot returnable April 27th.

Consideration was given to ten special cases in connection with applications involving requests for special consideration or waiving of the Institute's requirements for the Institute's examinations.

The Council rose at eleven forty-five p.m.

Meeting of April 27th, 1926

A meeting of Council was held at eight p.m. on Tuesday, April 27th, Vice-President K. B. Thornton, M.E.I.C., in the chair, and seven members of Council being present.

The monthly report of the Finance Committee was approved, indicating that the expenditure of the Institute up to date had been within the budgeted amounts.

Recommendations of the Finance Committee regarding extension of credit, and removal from the membership list, were approved in connection with thirteen cases, and the resignations of four Associate Members and two Students were accepted. Five applications for re-instatement were considered.

The following matters of special business were dealt with:—

Scrutineers were appointed for the letter ballot re Amendments to By-laws closing on April 30th.

Correspondence with the Cape Breton Branch regarding the Maritime Professional Meeting to be held in Sydney on August 17th and 18th was considered and noted, and an advance authorized to assist the Branch in regard to preliminary expenses.

Correspondence with the Winnipeg Branch regarding the proposed Western Professional Meeting was submitted, and a suggestion that this meeting be held in Estevan jointly with the local sections of the American Institute of Electrical Engineers and the Canadian Institute of Mining and Metallurgy was not approved. Council, while encouraging joint meetings of the Institute's Branches with sections or branches of allied societies, has not adopted the policy of holding general meetings of the Institute jointly with such branches.

A proposed amendment in the by-laws of the Peterborough Branch was submitted, and discussed, dealing with a change in the mode of election of the Branch Executive Committee. This proposal, not being in accordance with the Institute's by-laws, was referred to the sub-committee of Council, which is at present looking into the matter of the divergencies now existing between the by-laws of the various branches.

Mr. W. P. Dobson, M.E.I.C., of the staff of the Hydro-Electric Power Commission of Ontario, was added to the Canadian National Committee of the International Electro-technical Commission.

On the announcement of the death of Sir Alexander Bertram, M.E.I.C., the following resolution was unanimously passed:

> "The Engineering Institute of Canada has suffered a great loss in the death of Major-General Sir Alexander Bertram, for eight years Treasurer of the Institute.
>
> The country mourns a distinguished and public-spirited citizen, Canadian industry a true leader of men, and the engineering profession an eminent and resourceful engineer.
>
> His organizing skill and intimate knowledge of machine-tool design and manufacture were shown not only by the growth and development of the enterprises he directed, but also by his notable achievement in the production of munitions in Canada at a time when these were vitally needed by Great Britain.
>
> Council, in offering its respectful sympathy to the family, desires to mark its appreciation of the man and his work, and particularly of the unselfish and willing service which he gave to The Engineering Institute of Canada for so long a period."

The question of publication from time to time in the Journal of notes regarding business transacted at Council meetings having been considered, it was decided to authorize the publication of such notes.

A list of officers of the Toronto Branch for the year 1926-27 was submitted and approved.

An invitation having been received for the Institute to take part in the Marcelin Berthelot Centenary in Paris, in October, 1927, it was decided to authorize one of the members resident in Paris to act as the Institute's representative provided that this can be arranged for.

The following elections and transfers were effected:

Elections

Members	2
Associate Members	12
Juniors	4
Affiliate	1
Students	2

Transfers

Associate Member to Member	2
Junior to Associate Member	8
Student to Associate Member	4
Student to Junior	10

Thirty-one applications for admission and transfer were scrutinized and classified for the ballot returnable May 18th.

Consideration was given to eighteen special cases in connection with applications for admission, each case involving a request for special consideration or waiving of the Institute's requirements for examinations for Associate Member or Junior.

A number of members of the Institute who are in considerable arrears as regards payment of fees, having been notified that their indebtedness must be liquidated by April 1st, and having failed to do so, were removed from the list of members as follows:—

Members	11	Students	35
Associate Members	59	Affiliates	2
Juniors	17		

The Council rose at eleven-thirty p.m.

OBITUARY

Thomas J. Brown, M.E.I.C.

Thomas J. Brown, M.E.I.C., of Sydney Mines, N.S., one of Nova Scotia's most prominent mining engineers and until recently Deputy Minister of Works and Mines in that province, died suddenly at the Victoria General Hospital, Halifax, on May 8th, 1926.

The news of Mr. Brown's untimely death comes as a great shock to his many friends in the engineering profession, particularly in eastern Canada, where he had for so many years been an outstanding figure in industrial life.

The late Mr. Brown was born at Sydney Mines, N.S., on January 24th, 1867, and for nearly forty years he was actively associated with the mining industry, commencing his career as office boy at the General Mining Association at Sydney Mines. At an early date he entered the employ of the Low Point, Barrachois and Lingan Company as paymaster, and in 1894 he was appointed manager of the company, later moving to Victoria Mines as manager of that colliery. In 1895 he was appointed manager of the Caledonia colliery for the Dominion Coal Company, and after a few years in that position he returned to Sydney Mines, having been in charge of the sinking of No. 2 shaft and also manager at Princess Colliery. In 1902 he became general superintendent of the collieries of the Nova Scotia Steel Company and then was transferred to New Glasgow, where he retained his position as general mines superintendent. A few years later Mr. Brown became general manager of the Scotia Steel and Coal properties and he held that position for upwards of fifteen years. He severed his connection with the Scotia concern about 1917 and took charge of the Inverness Coal and Railway Company's properties, but when D. H. MacDougall became president of the Nova Scotia Steel and Coal Company, Mr. Brown rejoined Scotia and again became general superintendent of the Steel and Coal properties.

After the formation of the British Empire Steel Corporation Mr. Brown retired as general superintendent at Sydney Mines and he became president of the Indian Cove Company, and in 1922 he succeeded Hiram Donkin, as Deputy Minister of Works and Mines, holding that post until recently, announcement of his retirement having been made but a few days before his death.

During the past few years Mr. Brown took a very prominent part in seeking to adjust the problems which confronted the coal mining industry in Nova Scotia. His services as an adjuster of difficulties were always sought and few, if any, men who held official posts with the coal operators in Cape Breton were held in higher esteem by the mine workers than the late Mr. Brown.

In its editorial columns of May 8th, 1926, the Halifax Evening Mail pays tribute to the work of the late Mr. Brown and concludes its editorial with: "There was only one 'Tom' Brown; he is gone; and we are all the poorer. For he was an individual, if ever there was one. He never copied; he did things his own way. He was a pioneer and a builder. He blazed new trails, but always loved to go back over the old ones. The blazing of new trails was his work; the exploring of old trails his recreation. He sunk the greatest shaft in this country, but he never forgot the old workings. That was 'Tom' Brown and his career—a career that reached the top of modern efficiency, but still had its roots in other times and other methods."

Mr. Brown was admitted to The Institute as Member on October 24th, 1907.

PERSONALS

Raymond Lanctot, Jr.,E.I.C., who graduated from McGill University with the degree of B.Sc. in 1924, is at present with the Aluminum Company of Canada at Arvida, Que.

Dr. Arthur Surveyer, M.E.I.C., past-president of The Institute, was elected president of the Canadian Club of Montreal at its annual meeting on April 26th, 1926.

P. T. Davies, M.E.I.C., commercial manager, Southern Canada Power Company, was elected first vice-president of the Electrical Club of Montreal at its annual meeting recently.

H. C. Seely, S.E.I.C., who graduated from the University of New Brunswick with the degree of B.Sc. in electrical engineering this spring, is now with the Canadian General Electric Company at Peterborough, Ont.

B. P. Rapley, S.E.I.C., who has until recently been located with the Newfoundland Power & Paper Company at Corner Brook, is now with the Imperial Oil Limited at Sarnia, Ont.

Fraser S. Keith, M.E.I.C., manager of the department of development, Shawinigan Water and Power Company, formerly general secretary of the Institute, has been elected second vice-president of the Electrical Club of Montreal.

C. W. Boast, M.E.I.C., who recently was located at Niagara, Wisc., is with the Spruce Falls Company at Kapuskasing, Ont., as maintenance engineer. Mr. Boast received his degree of B.Sc. from McGill University in 1917.

J. E. Jackson, A.M.E.I.C., is manager of the engineering and surveying for Mr. Guy Kennedy of Detroit, Mich. Mr. Jackson graduated from the University of Toronto in 1909, and received his commission as Ontario and Dominion Land Surveyor in 1911.

A. M. Patience, S.E.I.C., of Toronto, Ont., has resigned from his position as lecturer in radio engineering on the staff of the University of Toronto, and has been appointed chief engineer of the Standard Radio Manufacturing Corporation, Limited, of that city. Mr. Patience received his degree of B.A.Sc. from the University of Toronto in 1924.

A news despatch from Shediac, N.B., contains news that a mountain in the Canadian Rockies has been named after Major C. F. Hanington, M.E.I.C., who is a native of Shediac Cape and a son of the late Hon. Daniel Hanington, for years president of the Legislative Council at Fredericton. In this announcement the Geographic Board of Canada states that Major Hanington was assistant engineer to E. W. Jarvis, in the exploration of the Smoky River Pass in 1875.

J. G. MacLachlan, A.M.E.I.C., division engineer of the Kamloops-Kelowna Lumby line of the Canadian National Railways, has been appointed division engineer of construction, operation, and maintenance, of the Hudson Bay Railway, with headquarters at The Pas, Manitoba. In this position Mr. MacLachlan succeeds the late Mr. R. A. Hazelwood.

Stanley A. Neilson, A.M.E.I.C., who graduated from McGill University in 1916 with the degree of B.Sc., has joined the group department, Montreal Division, Sun Life Assurance Company of Canada. Mr. Neilson, who is chairman of the publicity committee and branch news editor for the Montreal Branch, has been associated for the last four years with the firm of Walter J. Francis & Company, consulting engineers, Montreal.

Dr. A. Frigon, A.M.E.I.C., appointed Head of Electrical Commission in Montreal

Dr. A. Frigon, A.M.E.I.C., director of studies, Ecole Polytechnique and director of technical education in the Province of Quebec, has been appointed chairman of the Electrical Commission of Montreal, succeeding the late Dr. L. A. Herdt. Dr. Frigon is a native of Montreal and was born in that city on March 6th, 1888. He is a graduate of Ecole Polytechnique of Montreal and received his degrees of B.A.Sc., E.E. and C.E. from that University. He has had extensive and varied experience in the electric power industry in Quebec, having been connected with the Montreal Light, Heat and Power Consolidated, the Quebec Public Utilities Commission and various other organizations. He was engaged in private practice in Montreal in the capacity of consulting engineer.

B. S. McKenzie, M.E.I.C., appointed Secretary of C.E.S.A.

B. S. McKenzie, M.E.I.C., has been appointed Secretary of the Canadian Engineering Standards Association at Ottawa, which position became vacant on the appointment of R. J. Durley, M.E.I.C., as general secretary of The Institute.

Mr. McKenzie has had a wide and varied experience in engineering which should be of greatest assistance to him in the carrying out of his new duties.

Mr. McKenzie was born at Almonte, Ont., in 1876. He is a graduate of McGill University, having received his degree of B.A. in 1900 and B.Sc. in 1901. Prior to graduation he was for a short period with the town engineer at Brookline, Mass., and later with Messrs. T. Pringle & Sons, Montreal, on hydro-electric development at Shawinigan Falls, Que. From 1901-07 he was with the bridge department of the Canadian Pacific Railway, rising to the position of chief draughtsman on structural steel. In 1907 and for the following year he was assistant chief engineer with the same company, Eastern Division, engaged on railway and maintenance work. In 1909 he was on the staff of the Quebec Bridge Commission on the final design of that bridge. During 1910-12 he was with the Grand Trunk Railway at Winnipeg as assistant engineer of bridges. In 1912 he entered consulting practice in Winnipeg, specializing on hydro-electric power work, foundations, underpinning, cement testing, structural work, and industrial reports and investigations. In 1920 he discontinued his consulting practice and became construction engineer with the Dryden Paper Company at Dryden, Ontario, engaged on the design and construction of the company's hydro-electric plant, houses and mill extensions. From 1921-23 he was with the Manitoba Power Company as field engineer on the Great Falls development on the Winnipeg River, and in 1923 he moved to Montreal and became consulting engineer with the Dominion Engineering & Inspection Company. Since 1925 he was with the Ottawa-Montreal Power Company on investigations and property surveys.

Mr. McKenzie joined The Engineering Institute of Canada as Student on May 22nd, 1902, and was transferred to Associate Member on April 8th, 1911, and to full membership on April 22nd, 1919. He was on the Council of The Institute in 1920 and was the first chairman of The Institute's committee on the Deterioration of Concrete in Alkali Soils.

F. P. Shearwood, M.E.I.C., appointed Treasurer of The Institute

F. P. Shearwood, M.E.I.C., was appointed treasurer of The Institute at the meeting of Council held on April 27th, succeeding the late Major-General Sir Alex. Bertram. Mr. Shearwood has taken an active interest in The Institute for many years.

He joined The Institute as an Associate Member on April 8th, 1892, and was transferred to Member on November 17, 1904, and was elected to Council in 1909 and again in 1921 and the two succeeding years. In 1923, following the death of president Arthur St. Laurent, when the late Walter J. Francis was called upon to assume the office of president, Mr. Shearwood was also called upon to assume the office of vice-president. In the following year he was elected vice-president for a term of two years. Mr. Shearwood has also been on a number of committees of The Institute. He was

F. P. SHEARWOOD, M.E.I.C.

chairman of the Finance Committee of the Council during the years 1923-4-5, and was appointed a member of that committee following the annual meeting this year.

Mr. Shearwood was born in London, England, on September 2nd, 1866, and was for three years engaged on railway work in Brazil. In September 1887 he entered the employ of the Dominion Bridge Company, where he rapidly rose through junior positions to that of assistant engineer and finally to his present position as chief engineer of the company.

Degree of Doctor of Science Conferred upon E. E. Brydone-Jack, M.E.I.C.

The University of New Brunswick at the Encaenia exercises on May 13th, 1926, honoured the engineering profession when the degree of Doctor of Science was bestowed on E. E. Brydone-Jack, M.E.I.C., of Victoria, B.C.

Dr. Brydone-Jack is a native of Fredericton, N.B., where he was born in 1871. He received his degree of B.A. from the University of New Brunswick in 1891, and his degree of C.E. from the Rensselaer Polytechnic Institute of Troy, N.Y. in 1894. Prior to completing his academic studies he was engaged principally on survey and railway maintenance work. In August of 1894 he joined the staff of the Pottsville Iron & Steel Company, Pottsville, Pa., where he remained for nearly a year as draughtsman. In May 1895 he entered the engineering department of the Pennsylvania Steel Company, Steelton, Pa., resigning in 1898 to accept the position of engineer in charge of the Siebert House branch office of the Keystone Bridge Works at Pittsburgh, Pa. In 1900 he was engineer in charge of detail designing for the Fort Pitt Bridge Works, Canonsburg, Pa.

In September 1901 to February 1905 he became Dean of Engineering Faculty and professor of civil engineering with the University of New Brunswick and from May 1902 to May 1905, he was city engineer for the city of Fredericton. For eight months, from February 1905 to September 1905, he was engineer in charge of the draughting department of the Virginia Bridge and Iron Works, Roanoke, Va. In 1905 he joined the staff of the Dalhousie University, Halifax, as professor of civil engineering, continuing in this position until 1907, when he was consulting engineer for the Canadian Northern Railway and at the same time occupied the position of professor of civil engineering at the University of Manitoba. Since 1907 Dr. Brydone-Jack has been supervising engineer for the Public Works of Canada at Victoria, B.C.

Dr. Brydone-Jack has been a Member of The Engineering Institute of Canada since April 19th, 1906, and is also a member of the American Society of Civil Engineers, the Association of Professional Engineers of Manitoba, and a past-president of the Association of Professional Engineers of British Columbia.

Recent Graduates in Engineering

Congratulations are in order to the following Students of the Institute who have recently completed their courses at the various universities.

University of Alberta

Degree of B.Sc.

Grindley, Frank Llewellyn, B.Sc., (Ci.), Edmonton, Alta.
Hunter, Harry Melville, B.Sc., (Ci.), Calgary, Alta.

University of Toronto

Degree of B.A.Sc.

Chorolsky, Eugene, B.A.Sc., (Ci.), Regina, Sask.
Complin, Edward Reginald, B.A.Sc., (Ci.), Toronto, Ont.
Jennings, George Lorne, B.A.Sc., (Ci.), Toronto, Ont.
Menzies, John Ross, B.A.Sc., (Ci.), Brantford, Ont.
Pearson, John Wallace, B.A.Sc., Toronto, Ont.
Sudden, Edwin Alexander, B.A.Sc., (Ci.), Galt, Ont.

Ecole Polytechnique

Special Prize

Mathieu, Albert, Montreal, Que., The Ernest Cormier Prize.

Degree of B.Sc.

Mathieu, Albert, B.Sc., (Ci.), Montreal, Que.
Lalonde, Jean-Paul, B.Sc., (Ci.), Outremont, Que.

Queen's University

Degree of M.Sc. (with honours)

Boyd, Ivan William, M.Sc., (Me.), Kingston, Ont.

Degree of B.Sc. (with honours)

Roney, Gerald Van Luven, B.Sc., (Ci.), Kingston, Ont.

Degree of B.Sc.

Snyder, Horace Hemstreet, B.Sc., (Me.), Orient Bay, Ont.
Stewart, Harvey Weeden, B.Sc., (El.), Kingston, Ont.

University of New Brunswick

Degree of B.Sc.

Carten, Francis Tracey, B.Sc., (Ci.), Fredericton, N.B.
Foulkes, Thomas, B.Sc., (E.E.), Campbellton, N.B.
Gough, Robin William, B.Sc., (E.E.), Fredericton, N.B.
MacPhail, Gordon Miller, B.Sc., (Ci.), Woodstock, N.B.
Seely, Harold Chipman, B.Sc., (E.E.), Fredericton, N.B.

University of British Columbia

Degree of B.A.Sc.

Buchanan, Thomas G., B.A.Sc., (El.), Vancouver, B.C.
Abernethy, Gordon McKellar, B.A.Sc., (For.), Vancouver, B.C.
Timleck, Curtis James, B.A.Sc., (Me.), New Westminster, B.C.

ELECTIONS AND TRANSFERS

At the meeting of Council held on May 18th, 1926, the following elections and transfers were effected:

Members

CURRY, Angus Downes Mathwin, asst. to consulting naval engr. Dept. of National Defence (Naval Service), Ottawa, Ont.

DOBIE, Robert, mech'l supt., Can. Gen. Elect. Co., Peterborough, Ont.

GILMORE, Ross Earlby, M.A. (McMaster Univ), supt., Fuel Testing Laboratories, Mines Branch, Dept. of Mines, Ottawa, Ont.

PEARSE, Langdon, A.B. (Harvard Coll.), B.Sc. and M.S. (Mass. Inst. of Tech.), sanitary engr., Sanitary Dist. of Chicago, member of firm Pearse, Greeley & Hasen of Chicago, Ill.

Associate Members

BRANDON, Harry Elmer, B.A.Sc. (Univ. of Toronto), station structural and mech. engr. with H.E.P.C., Toronto, Ont.

ELLIS, Frank Dormer, B.A.Sc. (Univ. of Toronto), divnl. engr., constrn. dept., Sterling Appraisal Co. Ltd., Toronto, Ont.

LEGG, Harry Gale, engr. to ch. archt.'s br., Dept. of Public Works, Ottawa, Ont.

MADDOCK, Charles Orville, B.A.Sc. (Univ. of Toronto), building valuation engr., Sterling Appraisal Co. Ltd., Toronto, Ont.

MURRAY, Matthew Randolph, field engr. on constrn. power house and dam, Shawinigan Engrg. Co. Ltd., at St. Narcisse, Que.

SAGAR, William Lister, B.A.Sc. (Univ. of Toronto), mgr., Industrial Laboratories Ltd., also instructor in civ. engrg. structural and municipal, Univ. of Toronto, Toronto, Ont.

SPROULE, John Emdon, B.Sc. (McGill Univ.), Layout and inspection of transmission lines, H.E.P.C., Toronto, Ont.

Juniors

DENNISON, George Henry Edward, office and gen'l. dfting., surveying, etc., with Spanish River Pulp & Paper Mills, Sault Ste. Marie, Ont.

POTTER, Charles Edward, B.A.Sc. (Univ. of Toronto), transitman, Wayagamack Pulp & Paper Co., Three Rivers, Que.

TOYSE, Arthur McFarlen, B.A.Sc. (Univ. of Toronto), dfting. and design on reinf. concrete work with Chapman & Oxley, architects, Toronto, Ont.

Affiliates

KELLNER, Hugh, ch. engr., Windsor Water Works, Windsor, Ont.

LOVE, Leonard Vincent, equipment engr., Ont. Dept. of Highways, Toronto, Ont.

For transfer from Class of Associate Member to that of Member

DeHART, Joseph Bertram, B.Sc. (Civil), M.Sc. (Mining), (McGill Univ.), dist. inspr. of mines, Government of the Pro. of Alberta, Lethbridge, Alta.

KIRKPATRICK, Everett Charles, B.Sc. (McGill Univ.), mech. engr., i/c. design of new plant and in charge operation of power depts. for the Steel Co. of Canada's plants in Montreal, Que.

MacDAIRMID, Archibald Alexander, B.Sc. (McGill Univ.), ch. engr., Price Bros. & Co. Ltd., Kenogami, Que.

YORATH, Christopher James, pres. and mng. director, Can. Western National Gas Light, Heat & Power Co., Northwestern Utilities Ltd., and Gas Production & Transportation Co., Calgary, Alta.

For transfer from the Class of Junior to that of Associate Member

TURTLE, Alfred Claude, shop elec'l. engr., Transcona Shops, C.N.R., Winnipeg, Man.

For Transfer from Class of Student to that of Associate Member

HEARTZ, Richard Edgar, B.Sc. (McGill Univ.), gen'l. office work, Shawinigan Engineering Co., Montreal, Que.

REYNOLDS, William Melville, B.Sc. (Queens Univ.), field engr. on power house constrn., Backus-Brooks Co., Kenora, Ont.

For transfer from class of Student to that of Junior

BURBANK, Jerome Douglas, B.A.Sc. (Univ. of Toronto), elec'l. helper, Can. Nat. Elec. Rys., Niagara, St. Catharines and Toronto Ry., Toronto, Ont.

ELEY, Frederick Charles, B.A.Sc. (Univ. of Toronto), engr., i/c. design proposals and pr. sales, Benjamin Electric Co., Toronto, Ont.

FORSTER, Irwin Hickson, B.A.Sc. (Univ. of Toronto), design work on penstocks, surge tanks, etc., Horton Steel Works, Bridgeburg, Ont.

HANNA, Harold Benjamin, B.Sc. (Queens Univ.), office engr. for W. I. Bishop Ltd., on constrn. of Price Bros. & Co. Ltd., Riverbend Paper Mill, Riverbend, Que.

HEATLEY, A. Harold, B.A.Sc. (Univ. of Toronto), chemist on analytical work, research development and production with Roessler & Hasslacher Chemical Co., Niagara Falls, N.Y.

HIGBEE, John Carveth, B.A.Sc. (Univ. of Toronto), engr. of properties with Clayton C. Townes Co., of Cleveland, at present on Lake Sebring Development at Sebring, Fla., U.S.A.

SMEATON, Victor Charles William, computer, valuation dept., C.N.R., Toronto, Ont.

Proposed Canadian Electrical Code

On May 10th and 11th, the special Committee on Canadian Electrical Code appointed by the Main Committee of the Canadian Engineering Standards Association, convened in Ottawa for a discussion of the preliminary draft of the first portion of such a code, covering proposed Rules and Regulations for Electrical Installations in, on, or over Buildings, using Potentials of 10-5,000 volts. This draft has been prepared by two engineers appointed by the above special committee, as authorized at a meeting in Montreal of that committee, held on May 20th, 1924.

Those present at the meeting were: A. A. Dion, M.E.I.C., Ottawa Electric Company, in the chair; W. P. Dobson, M.E.I.C., and A. G. Hall, representing the Province of Ontario; Lt.-Comdr. C. P. Edwards, A.M.E.I.C., Director of Radio, Department of Marine, Ottawa; H. D. Johnson, representing the wire and cable manufacturers; J. W. Hughes, A.M.E.I.C., electrical engineer, Canadian Pacific Railway Company; J. N. Mochon and S. N. Walsh, A.M.E.I.C., representing the Province of Quebec; E. P. Philip, representing the Telephone Association; Wills Maclachlan, M.E.I.C., consulting electrical engineer, Toronto; John Murphy, M.E.I.C., electrical engineer, Board of Railway Commissioners, Ottawa; C. M. Tait, representing the Canadian Fire Underwriters' Association; W. J. Canada, representing the Underwriters' Laboratories of Canada; W. T. Morrison, representing the National Electric Light Association; W. F. McKnight, A.M.E.I.C., and H. F. Strickland, the compilers of the draft code, and B. Stuart McKenzie, M.E.I.C., secretary of the Canadian Engineering Standards Association, were also present.

Since the meeting on May 20th, 1924, copies of the draft code have been submitted to the various provincial sub-committees and comments received from them. These comments were consolidated and distributed in circular form for further criticism. At the meeting recently held in Ottawa, these criticisms were carefully considered, much discussion ensued, and as a result, the draft is now ready for revision.

It was felt that the regulations covering grounding and radio installations required some further study; special sub-committees have been appointed to go into this, and their findings will be incorporated in the revised draft.

Considerable discussion took place as to the advisability of combining rules covering both fire hazard and personal safety, and it was the consensus of opinion that it would be advisable to combine both in one code, for ease of reference and for convenience in practical use. It was considered that this proposed Canadian code should conform, as far as possible, to the National Electrical code and the National Electrical safety code of the United States, but that there were some conditions in Canada which should not be overlooked and which should be taken care of in the Canadian code. It was therefore agreed to proceed with the publication of Part 1 as soon as possible; while Part 2 (covering standards for construction, specifications and testing of electrical equipment), will be published later, as the draft of this is not yet complete.

It is a somewhat difficult matter to harmonize the views of the different provinces in this work, but it was felt that great progress had been made at this meeting and that it would soon be possible to have in operation in Canada, an electrical code which will eventually be acceptable throughout the country.

The representatives of the National Fire Protection Association and the National Electric Light Association, in attendance at the meeting, reported the progress which had been made by American committees working along similar lines.

An International Standardizing Body

The desirability of forming an international body to develop and perfect industrial standards was recently discussed at an international conference in New York. The immediate stimulus to this movement arose out of several international undertakings of basic importance, the majority of which are in the mechanical industries.

Examples of these are the standardization, on a national scale, of ball bearings, (which is now in large measure an accomplished fact); the harmonizing of European and American screw thread systems upon which interchange and replacement of bolts, nuts and other threaded parts depend; unifying specifications for zinc; and the standardization of gaging methods and limits and fits necessary to interchangeable manufacture and mass production generally.

Electrical questions of the kind have for a number of years been effectively dealt with by a technical body of world-wide scope, the International Electrotechnical Commission. Other matters, however, have been without a similar central body to deal with them.

In spite of the difficulties of distance and exchange, no less than eighteen of the existing twenty national standardizing bodies of the world were represented at the Conference. Australia and Hungary alone were without delegates.

Since the war, bodies such as the Canadian Engineering Standards Association, The British Engineering Standards Association, and the American Engineering Standards Committee have co-operated through periodical conferences of their secretaries, and in this way various subjects have been discussed and partly or wholly worked out within the last three or four years, aside from those in the electrical field which, as already mentioned, have been dealt with by the International Electrotechnical Commission. In the absence of more direct means of securing the required co-operation between the several countries in this work, the national standardizing bodies arranged the necessary co-operation in each of these subjects by correspondence and other informal procedure. Now, however, the scope of the work to be done in the way of agreeing upon international standards has grown so much that a more efficient machinery of co-operation is considered necessary.

A few months ago, C. le Maistre, secretary of the British Engineering Standards Association, in co-operation with W. H. Tromp and G. L. Gerard, secretaries of the Dutch and Belgian associations, respectively, presented a definite proposal for the formation of an international body. This came before each of the national standardizing bodies throughout the world, and has been fully discussed by them. The conference just held was an outcome of this discussion, with a view to developing details of the organization which is to be created.

At the early sessions of the Conference, which opened on Thursday, April 15th, the generally favourable attitude of all the nations concerned toward international co-operation was expressed by the several delegates. Recommendations as to the details of a plan of organization, and the importance of the problem of its relation to the existing International Electrotechnical Commission remain to be thrashed out. The decisions of the Conference are in the form of recommendations to the various national standardizing bodies for final decision after consultation with the industries in their respective countries.

In connection with the Conference, which was held in conjunction with the meeting of the International Electrotechnical Commission, informal technical meetings took place looking toward international uniformity in screw threads, bolts, and nuts, limits and fits for interchangeable manufacture, gears and "preferred numbers."

C. F. Skinner, chairman of the American Engineering Standards Committee, presided, and the delegates were:—

AUSTRIA	P. Brettschneider.
BELGIUM	E. Uytborck.
CANADA	R. J. Durley, M.E.I.C.
CZECHOSLOVAKIA	V. List, B. Rosenbaum.
DENMARK	Represented by Swedish delegates.
FINLAND	Represented by Swedish delegates.
FRANCE	G. J. Darrieus, P. Girault, E. Roth.
GERMANY	Otto Kienzle, A. Maier.
GREAT BRITAIN	L. B. Atkinson, R. E. Crompton, Sir Archibald Denny, Sir Richard Glazebrook, P. Good, C. le Maistre, C. P. Sparks.
HOLLAND	W. H. Tromp.
ITALY	N. Ratti.
JAPAN	M. Y. Inomata, Shoji Konishi.
NORWAY	K. Heiberg.
POLAND	P. Drzewiecki, A. Roginski.
RUSSIA	M. Chatelain, M. Lapiroff-Scoblo, M. Zischievsky.
SWEDEN	A. F. Enstrom, A. Kruse, S. E. Osterberg.
SWITZERLAND	C. Hoenig
UNITED STATES	P. G. Agnew, G. K. Burgess, C. E. Skinne

The Two Great Caissons for the New Canadian Government Graving Dock at Esquimalt, British Columbia

In January, 1925, the Department of Public Works of the Dominion government awarded to Yarrows Ltd., of Esquimalt, B.C., of which N. A. Yarrows, A.M.E.I.C., is general manager, the contract for the construction of the two big steel caissons for the $6,000,000 government graving dock being built in Esquimalt harbour.

Two gates are required due to the fact that the dock is divided into sections, so that the whole dock does not have to be pumped out for a small ship, and also that two vessels can dock and leave, independently of each other.

The arrangement of the sills necessitated the caissons being slightly different in dimensions, but only as far as depth was concerned, so that when in position in their respective berths the top decks would come flush with the coping level. At the same time, they are both adaptable to any of the berths, which arrangement provides for the drydocking of each caisson as a ship, or, in the event of damage to one, the drydock is not rendered out of commission. The caissons are both reversible, so that either side can be accessible for painting, which can be carried out on the drydock side when pumped out.

The principal dimensions of the caissons are as follows:—

Length......	138 feet 6 inches	138 feet 6 inches
Beam........	27 feet	27 feet
Height......	46 feet	49 feet

Figure No. 1.—View of one of the Caissons just prior to Launching.

On being awarded the contract, Yarrows Ltd., entered into an arrangement with the Canadian Bridge Company, of Walkerville, Ontario, for the fabrication of the required steel, and at the same time, all the detail and working drawings and general arrangements were prepared and submitted to the government for approval.

As fabrication proceeded, the material was shipped by rail to Yarrows' yard, a distance of over 2,000 miles, where erection was at once commenced.

Owing to the comparatively limited depth of water, the launching of such an unusual structure, which would draw 21 feet in an upright launching position, presented a problem of an unusual character for the builders to solve. This difficulty was successfully overcome by the unique method of building the caissons on an angle of 30 degrees (as shown by the accompanying figure No. 1), which method proved highly satisfactory with regard to both erection and launching.

The 49-foot caisson was the first to be built, and was launched on December 9th, 1925, and behaved, both during the launching and when in the water, in exact accordance with the builders' calculations. The launching weight was 715 tons and, when in the water, the caisson floated with a list of 23 degrees.

For purposes of stability, 500 tons of concrete ballast, with a depth of 10 feet, is carried in the lower sections between the two end bulkheads; 250 tons bringing the caisson into an upright position.

Each caisson has a total of six decks, No. 1 and No. 2 being superstructure decks. The keel and stems on both sides are fitted with Australian iron bark, 5 inches thick and 24 inches wide, which is adopted for the purpose of making a water-tight joint with the masonry face of the drydock sills; no less than 20 tons of iron bark being required for each gate. This wood, among its other qualifications, is impervious to the attack of the teredo, with which the waters are infested. The only other wood employed in the construction is white oak, which is used for side fenders.

The amount of steel used in each caisson is approximately 1,875,000 pounds, the average thickness of the shell plates being ⅝ inch and ¾ inch, and the decks ½ inch; and as a matter of passing interest nearly 200,000 rivets are used in each gate.

The entire exterior and interior steel surfaces of the caissons are preserved with an application of bituminous solution and enamel, the latter applied hot in the usual manner.

The caissons are each equipped with two vertically operated centrifugal pumps of 1,600 gallons per minute capacity, the suctions being carried into a sump in the concrete ballast. These pumps are each operated by a 20-h.p. alternating current electric motor, located on No. 2 deck, the current being supplied by flexible cable from the dock side.

On the same deck, the inclinometer and depth gauge are installed, together with the necessary starters and resistances for the motors. The hand wheels controlling, through vertical spindles, the opening and shutting of the scuttling, or flooding, valves below, are also on this deck, from which will be seen that the entire operation of the caisson is controlled from deck No. 2. This compartment is painted white, for the sake of appearance and cleanliness, and fourteen portholes are placed on each side for light and air.

The flooding valves are so located that, by their manipulation a fore and aft trim can be maintained when sinking into position.

The total weight of each caisson in completed condition is 1,500 tons. Each draws 28 feet 6 inches of water in light condition, and when flooded, the submerged draft is 45 feet 6 inches in the case of the 49-foot gate and 42 feet 6 inches in the case of the 46-foot caisson.

The first caisson was towed from Yarrows' yard to the drydock, a distance of 300 yards, on February 9th, 1926, and the dock was pumped out for the first time on February 17th, when the gate proved a satisfactory, water-tight fit. The second caisson was successfully launched on April 12th, before a large and representative gathering, including the Lieutenant-Governor of British Columbia. It might be of some interest to mention that when the drydock is pumped out, the caisson has to withstand a total water pressure of 4,700 tons.

The graving dock, which is of the most modern character, is 1,150 feet in length and 149 feet in width. It has a depth of water over the sill at high tide of 40 feet. The pumping plant is electrically operated and can empty, in 3½ hours, the 43,000,000 gallons which the dock contains at high tide.

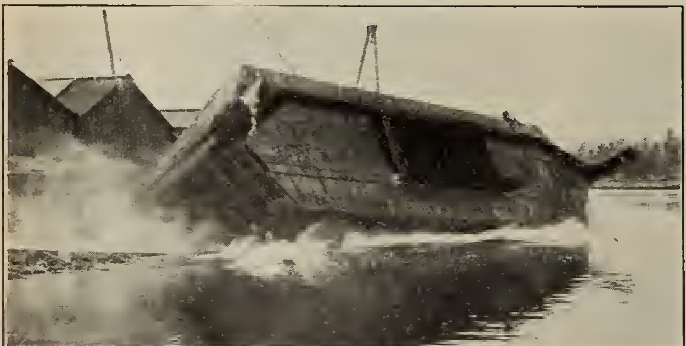

Figure No. 2.—View of one of the Caissons in the act of Striking the Water during Launching.

Figure No. 3.—View of Caisson in place with the Drydock Pumped out.

Lighting and Industrial Efficiency*

The relation between lighting and production is direct and close, for bad lighting hampers output, increases spoilage, leads to accidents, causes eye strain and general fatigue, and leads to irritation, exasperation, and nervous strain. Of the numerous instances which might be quoted of increased output immediately following increased intensity of illumination the following are representative. A study of New York letter handlers showed that in the delivery division, change from 3.3-to 5.9-foot candles resulted in a 19.3 per cent increase in production. Similarly, a production test in an Ohio factory among workers engaged in the inspection of steel parts of roller bearings showed that with 5-foot candles 407 pieces were inspected each hour; with 6-foot candles, 424; with 13-foot candles, 440; and with 20-foot candles, 458. Further, the gain was chiefly net gain for it was estimated that the added cost of current and lamp renewals, etc., took away no more than one-fifth of the increased effectiveness. On this point, the net gain resulting from increased intensity of illumination, a study in certain English factories showed that while the cost of improvement amounted to 1.9 per cent. of the pay roll the increased production amounted to 15.5 per cent. The very conservative conclusion of the Commonwealth Edison Company of Chicago after an investigation of 93 factories was that increased cost of lighting amounting to not more that 5 per cent. of the pay roll would lead to an increased oroduction of 15 per cent. As a corollary to such findings laboratory experiments have shown conclusively that speed of vision is dependent on intensity of light. Just as with the camera dim light necessitates longer exposure, so with the human eye. Thus in operations which are visually controlled the greater the light, within certain limits, the greater the speed.

As regards the relation of light to accidents, the National Safety Council report that a careful analysis of 91,000 accidents showed that 24 per cent were due either wholly or in part to poor lighting.

Natural and Artificial Lighting

Natural lighting is more important than artificial lighting because it is normally available during from 65 to 75 per cent of the working time, and since it involves fewer shadows and less glare. Apart from direct sunlight the greater the quantity of natural light the better. Windows, therefore, should be as many as possible, subject to other considerations, and should be set as close to the ceilings as possible, top light being much more effective than bottom light. Given enough windows, efficient natural illumination depends on three very simple points: First, the windows must be kept clean, since even when far from obviously dirty 50 per cent of light may be being obstructed. Second, they must be free from obstruction by articles piled on the sills. Third, walls and ceilings should be light in colour and should be kept clean so that their reflection value may be utilized. It is a striking fact that the contrast between intensity of light out of doors and light indoors is enormous. Even with good window space, daylight illumination in the middle of a room is only about one-thousandth of the outdoor illumination.

The Main Factors in Good Artificial Lighting

The main factors upon which a good lighting system depends are the following:—

1. Degree of illumination—that is the number of foot candles provided.
2. Brightness, which is dependent both on the degree of illumination provided and the reflecting capacity of the material worked on, and the surroundings.
3. The angle at which light sources are placed.
4. Avoidance of glare.
5. Avoidance of shadows.
6. Maintenance.

In planning any lighting system all these points must be considered together. It is useless, for instance, to provide high illumination but ignore the other factors.

Degree of Illumination

The illumination requirements of different processes vary enormously and ought to be individually considered. There are many codes for industrial lighting which lay down minimum standards for various roughly classified purposes. For example the present New York code sets the following requirements:—

Foot-candles at Floor Level—Modern Practice

1. Roadways and yard thoroughfares	0.05 to 0.25
2. Storage	0.50 " 1.00
3. Stairs, stairways, halls, hallways, passage ways, aisles, exits, elevator entrances, and elevator cars	1.00 " 2.00
4. Work not requiring discrimination of detail	1.00 " 2.00
5. Rough manufacturing requiring discrimination of detail	2.00 " 4.00
6. Rough manufacturing requiring closer discrimination of detail	3.00 to 6.00
7. Fine manufacturing	4.00 " 8.00
8. Special cases of fine work	7.00 " 15.00

In England the Departmental Committee on Lighting in Factories and Workshops has suggested the following standards:—

(a) 5 foot-candles for very fine processes.
(b) 3 foot-candles for fine processes.
(c) 0.25 foot-candles at floor level for other processes.

These are minimum standards only and in practice are frequently and desirably exceeded. Further, it must be remembered that each separate process really requires separate and careful study.

Brightness

Brightness, or the amount of light *returned* from a surface, is the most important factor in industrial lighting, and is dependent on the degree of illumination received by the surface and the reflection capacity. Thus with light coloured and clean ceilings and walls which have high reflecting values the same degree of illumination gives more visibility than with dark or dirty surroundings where the light is absorbed and the reflection ratio is low. Similarly if the material worked on is white it will reflect about 80 per cent of the light received, while black materials, only reflecting 0.8 per cent of the light received, will require 100 times the illumination to reach the same degree of visibility.

The Angle at which Light Sources are Placed

One cause of waste of light, and incidentally of unnecessary glare, is the mistaken assumption that the nearer the light source to the work the greater the illumination. While this is true where the light source is vertically over the work, it is not necessarily true where the light is not vertically over the work. For these cases there is one definite height at which the source will give maximum illumination.

Avoidance of Glare

Glare is a very important and very difficult problem in industry for it necessitates consideration of each light source in relation to every person within a 100 foot radius. Glare may result from any or all of three causes:

(a) from looking directly at a bright source of light.
(b) from reflected light on a shiny surface.
(c) from a bright source of light near but not in the line of vision.

(a) The prevention of glare can be accomplished by two means, either the interjection of something between the eye and the light source, or change in the position of the source relatively to the eye. The light can be kept from the eyes either by opaque screens or by translucent shades. While screening allows of greater concentration of light where needed, it does not give general light and moreover needs to be done very scientifically if it is to be effective for every person in the room. Concerning both the question of shading and the question of position of the source relatively to the eye the English Committee made the following recommendation:

"Every light source, except one of low brightness, (by low brightness is meant an intrinsic brilliance of not more than five candles per square inch), within a distance of 100 feet from any person employed shall be so shaded that no part of the filament, mantle, or flame is distinguishable through the shade, unless it be so placed that the angle between the line from the eye to an unshaded part of a source and a horizontal plane is not less than 20°, or in the case of any person employed at a distance of 6 feet or less from the source, not less than 30°."

For glare from reflected light on a shiny surface screening is unsatisfactory, and the only remedy lies in changing the relative positions of the light and the surface. For certain textile materials, however, both shiny and uneven, this is ineffective and the only way of preventing some of the small surfaces from catching the light is to shade the source until this is accomplished. Tissue paper is especially suitable for this.

Other Factors to be Considered in Connection with Glare

1. Contrast in brightness between the light source and the working surfaces and surroundings. The eye should not be subjected to conditions which necessitate constant readjustment from great light to comparative darkness.

2. Length of time during which the source of glare is in the field of vision. Where an operator is engaged at work which keeps his field of vision fixed for long periods, light sources should be of lower brightness and lower candle power than is necessary for other operators whose field of vision shifts from time to time.

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*R. M. Hutton, Division of Industrial Hygiene, Department of Health, Ontario.

Avoidance of Shadows

The more concentrated the light source the deeper the shadow. Thus indirect lighting where the light is reflected from walls and ceilings is practically shadowless. Where direct lighting is used, however, shadows can be prevented by changing the relative positions of the light source and the shadow-forming object, or by using an extra light to counteract the shadow.

Maintenance

Maintenance is usually the most neglected factor in lighting. It should be taken into consideration from the start, and as it is impossible to keep either light sources or walls and ceilings 100 per cent perfect, allowance for inevitable wastage of light should be made and the illumination provided should at the start be higher than the standard actually desired.

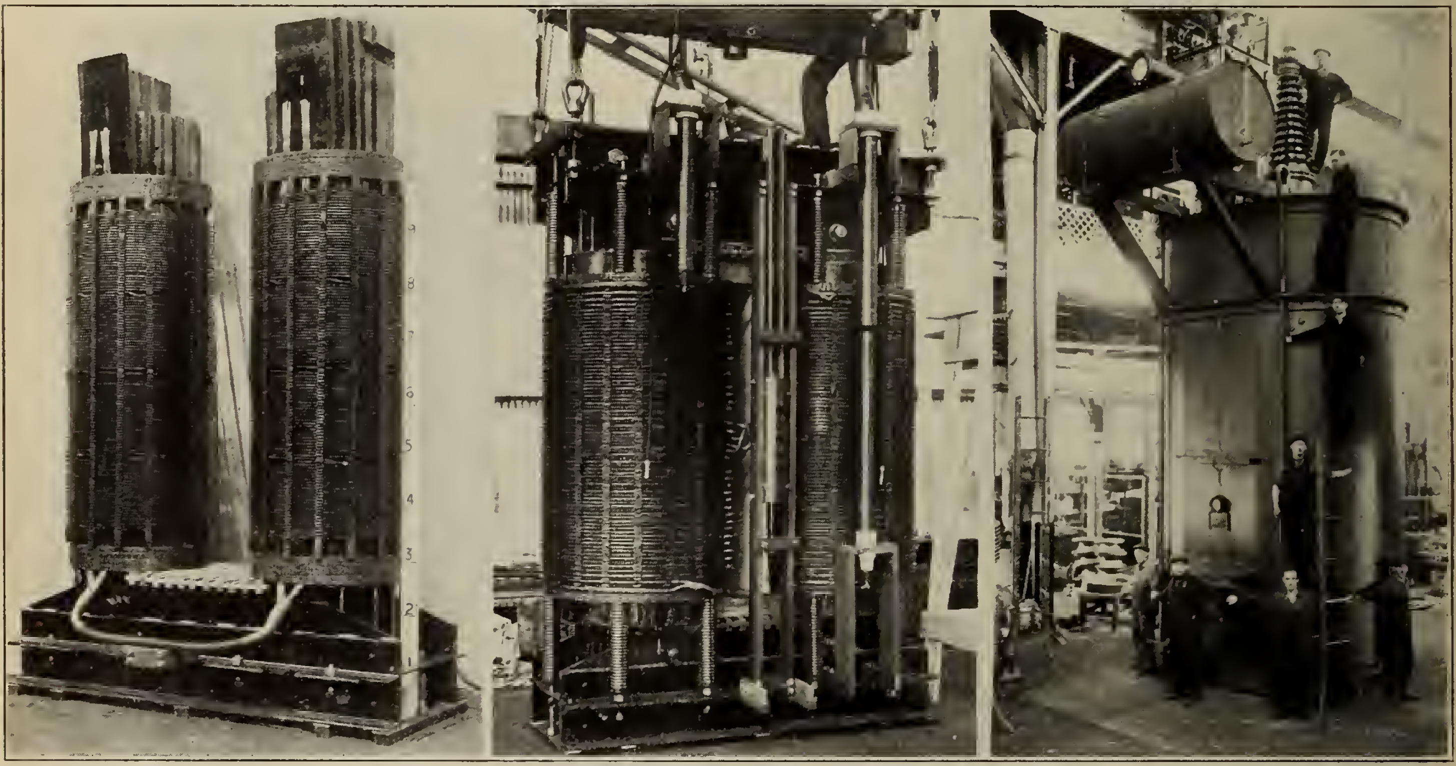
The loss of light caused by dirty walls, ceilings, and windows, and by dirty globes is enormous. Tests have shown that even windows which do not appear dirty may be causing a 50 per cent loss of light. In a study of the loss of light caused by deposits of dust, the American Illuminating Engineering Society found that in a case where nothing was done for maintenance, intensity could be increased 80 per cent by renewing burnouts in multilight fixtures, and 90 per cent by cleaning the lighting units. In a case where there was occasional maintenance, the washing of lamps and reflectors caused a 37 per cent increase in intensity, and the refinishing of walls and ceilings a 40 per cent increase.

The continued use of lamps after they have become blackened is purely wasteful as the amount of current used is out of all proportion to the light produced.

Illumination an Engineering Problem

The reason for adopting a correctly designed and well maintained lighting system is, briefly, that lighting has an enormous bearing on health and efficiency, and that accordingly good lighting directly promotes output. In the attainment of good lighting the appreciation of scientific principles can frequently obviate needless expense. Thus, relatively low wattage lamps correctly placed and correctly equipped with shades and reflectors will produce the same illumination as much higher wattage lamps hanging open and badly placed. In actual practice industry produces many lighting problems which are exceedingly difficult to solve, but their solution is well worth the expenditure of time and money.

One of the Largest and Highest Voltage Transformers built in the British Empire



It is of interest to note that with the completion of the first two units of an order of twelve transformers for the Aluminum Company of Canada in connection with their large industrial development at Arvida, Que., that these transformers are the largest as well as the highest voltage as yet built in the British Empire. Each unit has a capacity of 25,000 Kv.a. and is designed to operate in banks of three delivering power to the transmission line at 154,000 volts. The accompanying illustrations give some idea of the proportions of these transformers which stand 27 feet 4 inches from the floor to the top of the high voltage bushing and weigh 160,000 pounds.

The transformer is lifted directly from the base through four heavy lifting rods which pass up through a projection of the cover.

This base is provided with eight wheels which are set in groups of two and articulated, thus insuring that the load is uniformly distributed on all wheels.

An expansion tank insures that the hot oil does not come into contact with the air, thus practically eliminating oxidation of the oil and to a large extent preventing sludging.

The high voltage leads are of the oil-filled, one-piece porcelain type.

The core, about which the windings are assembled and which constitutes the magnetic circuit of the transformer, also functions as the foundation or tie bolt to the complete assembly. This core, built up of high grade transformer sheet steel, is constructed in a number of sections having oil passages between, the whole being securely bolted together. This permits the oil to circulate up through the core, reaching all points and insuring against abnormal temperatures at any part of the structure.

Heavy structural steel clamps securely keyed to the core form a very rugged support for the windings and insulation. The windings are of the circular coil construction.

The low voltage winding consists of a continuous helix or spiral wound directly over spacing strips on a heavy insulating cylinder which gives mechanical support and at the same time serves as a one-piece barrier between the windings and the core. This construction permits the oil to circulate in and out between all turns of the windings. The high voltage winding consists of a stack of disc coil sections assembled over an insulating cylinder, the whole being impregnated as a unit, thus giving an unbroken film of insulating compound over all parts of the winding.

The insulation between high voltage and low voltage windings consists of a number of heavy insulating cylinders assembled concentrically, thus forming a continuous barrier.

These transformers are being constructed by the Canadian General Electric Company and represent the latest attainments of transformer engineering.

BOOK REVIEWS

Port Administration and Operation

By Brysson Cunningham. Chapman and Hall, London, 1925. Cloth, 5½ in. x 8¾ in., 169 pp., illus., 13/6.

The methods of port administration throughout the world are of so widely varying a character and the classes of authorities administering them are so numerous, that there has been for some time a distinct need for a book giving a review of the various systems and schemes of operation adopted by the different ports, and this need has been ably supplied by Dr. Cunningham in his latest work.

The book first deals with the classification of the different kinds of ports and then goes on to review the various types of government, control and administration, such as Federal, State, City, Harbour Board, Port Trust, Port Authority, Private Ownership, Railway Control, etc. A large number of examples are given in considerable detail, principally of ports in Great Britain and the United States, diagrams of the organization of many ports are included and the advantages and disadvantages of the various systems are discussed. The author points out, however, that local conditions have so much effect on ports that a system of control working in a highly satisfactory manner in one part of the world may be quite unsuitable in another. There is a review of the different methods and systems of tolls by which the ports obtain their revenue from rates, dues, charges, rents, etc., and a discussion of the business of warehousing, customs arrangements and free port areas. The subject of port labour is dealt with, the author indicating that there is room for a great deal of improvement in the organization of port labour, and there is an interesting chapter on Belt Railroad Lines owned and operated by the port to connect up the various trunk railroad systems coming into the port, which are much more extensively used on this side of the Atlantic than in Great Britain or other European countries. The questions of policing and by-laws are also dealt with, and an appendix gives specimen by-laws by way of indicating the principles on which they are drawn up. There are also other appendices and the book is illustrated by a number of photographs of ports in various parts of the world, and diagrams. To any one engaged or interested in port operation the book can be thoroughly recommended as a valuable study, as the information concisely contained therein could only otherwise be procured by a very large expenditure of time and effort.

E. H. James, m.e.i.c.

Concrete Plain and Reinforced

Vol. 1. Theory and Design of Concrete and Reinforced Structures—by the late Frederick W. Taylor, Sanford E. Thompson and Edward Smulski, with a chapter by Henry C. Robbins. 4th edition. John Wiley and Sons, New York, 1925. Cloth, 6 in. x 9 in., 969 pp, illus., $8.00.

Confronted with the problem of dealing with the enormously extended mass of new material on concrete and reinforced concrete, the authors of this work decided in preparing their fourth edition to change it from a one-volume to a three-volume treatise. The preceding edition was about as bulky as it is practicable to make a single volume, and rather than increase its size, or on the other hand deliberately restrict the material to such as might be compassed in a single volume, the decision was made to spread the work out and make it still more ambitious than it had been. While this means additional cost to the purchaser, it probably was a wise decision to have available a comparatively exhaustive work on the subject. Simple one-volume texts are useful for the purposes of students, but the field of the practising enginer must be supplied as well as of that the learner.

The twenty-two chapters of Vol. I deal with the following subjects: Materials and Methods for Making Concrete, Reinforcement, Tests of Reinforced Concrete, Theory of Reinforced Concrete, Reinforced Concrete Design, Design of Flat Slab Structures, Concrete and Reinforced Concrete Columns, Foundations and Footings, Piles, Building Construction, Wall-Bearing Construction, Basement Walls, Roof Construction, Stairways and Other Openings, Steel Window Sash, Structural Plans for Buildings, Architectural Treatment of Exterior and Interior of Reinforced Concrete Buildings, Concrete in Construction of Theatres and Auditoriums, Reinforced Concrete in Different Types of Buildings, Reinforced Concrete Chimneys, Retaining Walls, Tables and Diagrams.

It is thus seen that the first volume deals both with reinforced concrete design and with construction. Volume II will discuss concrete materials and construction, presumably of non-reinforced work, while Vol. III will be devoted to special structures in reinforced concrete.

The present work is not merely a reprinting of the preceding edition with the addition of extra chapters here and there, but is a completely rewritten production. The authors have been by no means restrained by the authority of standard specifications and regulations of technical bodies, but have boldly voiced dissenting views where these appeared well founded. Thus, a column formula different from that of the Joint Committee is recommended for spirally-reinforced columns—being the same in form as for rodded columns—and entirely different limiting proportions for columns are set forth. The portion on flat slab construction is particularly extended, doubtlessly by reason of the special interest of Mr. Smulski in this type of construction. While the S.M.I. system, of which Mr. Smulski was the inventor, is described in detail, the authors very properly refrain from comparing its economy with that of other flat slab systems.

Those who are already familiar with the earlier editions of this work will not care to be without the new and much extended edition. It is a treatise that everyone interested in reinforced concrete design or construction should have at his disposal.

C. R. Young, m.e.i.c.

Les Moteurs à Explosion

Par Edmond Marcotte. Librairie Armand Colin, Paris, 1926. Paper, 4½ in. x 7 in., 216 pp., illus., 7 fr.

This work presents in a condensed form the fundamental principles which underlie the construction and operation of internal combustion engines.

The author first studies those considerations which can be applied to the majority of explosion motors. He discusses successively the principle of operation and the general arrangement of the motors, their working cycles, their valve arrangements, power, efficiency, and methods of test. A description of the various parts of the engine is then given, classified according to their functions; carbonization, ignition, cooling, lubrication, exhaust, regulation and balancing.

The engines are then considered with respect to their particular applications. Two general classes are distinguished, turbines and piston motors, the latter being grouped according to the nature of the fuel used. The peculiarities, advantages and development of each type are well shown, and special attention is given to automobile and aviation motors. A concluding chapter gives general information on construction, operation and maintenance.

The book is remarkable for its systematic arrangement, and can be consulted with advantage by those wishing to acquire sound fundamental ideas on this branch of engineering.

Stainless Iron and Steel

By J. H. G. Monypenny, Chapman & Hall, London, 1926. Cloth, 6 x 10 in., 304 pp. illus., 21/-.

Stainless steel dates from just before the War and is therefore a recent development. Used at first for cutlery it has now many applications in engineering. Essentially it is a low-carbon steel containing about twelve per cent of chromium, which has received a suitable heat-treatment and mechanical finish. Permissible changes of composition as regards chromium, carbon and other elements make possible a considerable range of mechanical properties, so that stainless steel can be made suitable for a variety of uses; "Stainless Iron" is a very low-carbon variety of stainless steel. Mr. Monypenny gives a brief history of the development, the usual range of composition and method of making, working and treating the steel. He explains the influence of chromium on steel and shows how this is related to the composition, heat-treatment and non-corrodible nature of the steel. He describes the mechanical and physical properties, the resistance to corrosion and the applications of stainless steel.

The book is well written and illustrated, and gives in an easily assimilated form the essential information on a subject that must be increasingly important to engineers.

Alfred Stansfield, m.e.i.c.

The Elements of Automatic Telephony

Arthur Crotch. E. & F. N. Spon, London, 1924. Cloth, 5½ in. x 8¾ in., 74 pp., illus., 3/6 net.

Automatic telephony is a difficult subject to write on; it is particularly difficult to explain the manner by which these circuits perform these functions, also the number of different circuit arrangements in use in each system of automatic telephony is very large and there are several different systems in use. Nevertheless, the author has succeeded in giving a fairly good picture of the basic principles underlying the scheme of operation of three systems. The fundamental differences between these systems are explained very lucidly and a limited amount of descriptive matter is included.

The book is well illustrated with circuit diagrams, but some of these have been so much reduced in size that it is difficult to follow out the connections; apparently this was done in order to avoid folded pages.

J. L. Clarke, a.m.e.i.c.

The Ethics of Business

Edgar L. Heermance, Harper & Brothers, New York, 1926. Cloth, 5 x 8 in., 244 pp., $2.00.

This is a very complete record up-to-date of the history and progress of business associations in their efforts to standardize their trading ethics in much the same way as they have standardized their products—thus covering both service and product. The attempts made in the past are reviewed, such as the pool, the combination and the present popular trade associations.

The remarkable growth of this movement is well set forth, the striking results obtained being evident on all sides—it being only necessary to carry the mind back for thirty years to realize the real advancement that has been made in trading methods. While this volume cannot be considered as a text-book or work of reference for engineers, it is probably the most plainly written record of a new business development which has yet appeared, and the continual reference in it to well-known and successful trade associations gives it that social interest which might be lacking if pure ethics alone were under consideration.

R. A. Ross, M.E.I.C.

The Strength of Materials

Ewart S. Andrews, Chapman and Hall, London, 1925. Ed. 2, Cloth, 5½ x 8¾ in., 608 pp., illus., diagrs. 13/6.

This text-book is primarily for engineering students and particularly for those reading for the Assoc. M. Institute of C.E. examinations. It covers the usual ground, starting with simple stresses, etc. The title is a little misleading in that the text deals more with stresses in beams, joints, plates, etc., than with the materials used. I was particularly interested in the section on fixed and continuous beams, and the chapter on springs. The theoretical treatment is exhaustive and complete as would be expected of an overseas authority.

From the standpoint of the engineer trained in North America difference of notation makes the study of certain sections rather laborious, but members of the Institute should find this book a valuable supplement to the usual American texts.

E. O. Turner, A.M.E.I.C.

EMPLOYMENT BUREAU

Situations Wanted

Sales Engineer

Mechanical engineer, A.M.E.I.C., desires to hear from manufacturer or firm requiring the services of a capable representative in the Prairie Provinces and Eastern British Columbia. Sales and consulting experience in municipal, mining, contracting, and power plant equipment, also industrial specialties and supplies. At present engaged. Apply box No. 210-W.

Civil Engineer

Civil engineer, M.E.I.C., with varied experience in constructional and commercial field, and an extensive knowledge of the whole of Canada, except the Maritime Provinces, desires connection as representative or sales engineer for manufacturers dealing with engineers or the construction industries. Apply box No. 211-W.

Situations Vacant

Electrical Draughtsman

Electrical draughtsman wanted. Must have had experience in power plant or substation design. Apply stating experience and salary expected. Apply box No. 154-V.

Members' Exchange

Transit

Cooke-Canadian Transit $125.00; Foster Y Level $40.00 with tripods and boxes. Recently overhauled and in first class condition. $150.00 if taken together. Can be seen at Division Engineer's office, Tunnel Station, C.N.R., Montreal.

Back Numbers of Magazines

In order to complete the library records for The Institute the following magazines are required: Canadian Machinery, Vol. 31, No. 26, 1924, and Construction, Vol. 16, Nos. 2 and 9, 1923. Any member having spare copies of these will confer a favour by forwarding same to Headquarters.

Technical Book

An enquiry has been received for a copy of a book entitled "International Bridge over the Niagara River, Bridgeburg to Buffalo" by C. S. Gzowski. The enquirer wishes to purchase this volume and any member having a copy might communicate with Headquarters.

Recent Additions to the Library

Transactions, Proceedings, etc.

Presented by the Societies:
- Transactions and Year Book of the Toronto University Engineering Society, 1926.
- Year Book of the Franklin Institute of the State of Pennsylvania, 1925-26.
- Calendar of the University of Alberta, 1925-26.
- Annual Report of the Association of Professional Engineers of Nova Scotia, 1925.
- Calendar of the University of British Columbia, 1926-27.
- Engineering Index, 1925. American Society of Mechanical Engineers.

Technical Books

Presented by the National Municipal League:
- Depreciation in Public Utilities, by Delos F. Wilcox.

Presented by Librairie Armand Colin, Paris:
- Les Moteurs à Explosion, by E. Marcotte.

Presented by Chapman and Hall:
- Stainless Iron and Steel, by J. H. G. Monypenny.

Presented by Gauthier-Villars, Paris:
- Combustibles Inférieurs et de Remplacement, by P. Appell.

Presented by McGraw-Hill Book Company, Inc.:
- Bacteriology, by Stanley Thomas,
- Fuels and Their Combustion, by R. T. Haslam and R. P. Russell.

Presented by Harper & Bros.:
- The Ethics of Business by E. Heermance.

Reports, etc.

Presented by the Canadian Bureau of Statistics:
- Central Electric Stations in Canada, 1924.

Presented by the Department of Registration and Education of The State of Illinois:
- Bulletin 21 of the Illinois State Water Survey, 1925.

Presented by the American Association of Port Authorities:
- World Ports, 1926. A compendium of North American Ports.

American Society for Testing Materials

The American Society for Testing Materials has issued a provisional programme for their 29th Annual Meeting which will be held at the Chalfonte-Haddon Hall, Atlantic City, N.J., commencing Monday, June 21st, and continuing until Friday, June 25th.

As usual an extensive programme has been arranged, the first day being devoted to registration and meetings of committees, the latter continuing during the morning of the second day.

The afternoon session on Tuesday, June 22nd, is devoted to the consideration of wrought iron, cast iron and magnetic testing, while on the evening of the same day there will be presented the presidential address and the reports of administrative committees and testing.

On Wednesday, June 23rd, the morning session will include steel, and brick, tile, refractories and fire tests. During the afternoon the Edgar Marburg lecture will be delivered, while in the evening an informal dance and smoker will be held.

The sessions on Thursday, June 24th, will include corrosion and fatigue of metals; road materials, waterproofing, petroleum products and thermometers; non-ferrous metals and metallography; textiles, rubber, coal, timber, insulating materials and slate; a symposium on resin.

On the last day of the meeting, Friday, June 25th, consideration of the following subjects is planned: preservative coatings and naval stores; cement, lime, gypsum and nomenclature; and the final session will be devoted to concrete. Arrangements have been made for recreation on each day and on the last day plans include golf and tennis tournaments.

International Conference on Housing and Town Planning

The next international conference on housing and town planning will be held in Vienna, Austria, in September, 1926. The conference is being held under the auspices of the mayor and council of the city of Vienna and is being arranged by the International Federation for Town Planning and Garden Cities. Previous conferences were held in Paris, 1913; London, 1914; Brussels, 1919; London 1920 and 1922; Paris, 1922; Gothenburg, 1923; Amsterdam, 1924 and New York, 1925.

Map of the Red Lake District

A map of the Red Lake District in northern Ontario has been issued by the Topographical Survey Department of the Interior, Ottawa, in co-operation with the Royal Canadian Air Force. The map has been published on a scale of one inch to two miles and covers an area about forty miles by sixty miles in extent, approximately centred at Red Lake.

BRANCH NEWS

Halifax Branch

K. L. Dawson, A.M.E.I.C., Secretary-Treasurer.

At the regular monthly meeting of the Halifax Branch, Thursday, January 28th, 1926, vice-chairman W. A. Winfield, M.E.I.C., presided and Professor F. R. Faulkner, M.E.I.C., acted as secretary, in the absence of H. W. L. Doane, A.M.E.I.C., branch chairman, who was attending the annual meeting of the Institute at Toronto, and the secretary, who was ill. Twenty-six members partook of the dinner that preceded the meeting. This meeting of the branch fell on the same day and very nearly the same hour as the annual dinner of the Institute at Toronto. It was therefore thought fitting to send a telegram of greetings from the Halifax members at the branch meeting to the Institute members at the annual meeting.

Pulp and Paper Development at Corner Brook, Newfoundland

At the close of the regular business meeting, H. B. Pickings, A.M.E.I.C., and C. St. J. Wilson, A.M.E.I.C., spoke most interestingly on the Pulp and Paper Development at Corner Brook, Newfoundland. Mr. Pickings with the aid of a large number of photographs traced the construction work from its beginning in 1923 to its completion last fall. His talk was replete with facts and figures in development which included not only a town site but the hydro-electric plant and the pulp and paper mill. Mr. Wilson dealt specially with the problem of drainage and water supply at Corner Brook and traced the system installed on a large map, giving particular attention to the question of the pressure in the water mains.

The ensuing discussion brought out many more points of interest and Mr. Pickings gave in more detail the difficulty encountered in obtaining titles. There was considerable discussion on the cost of construction and the probable cost of operation compared with smaller plants in Canada and this brought out some interesting facts regarding labour conditions in Newfoundland.

At the conclusion of the discussion the presiding officers conveyed a hearty vote of thanks to Messrs. Pickings and Wilson.

Regular Meeting

At the meeting of the Halifax Branch on February 17th, 1926, a larger number than usual were present, about 50 in all, because of the local interest attached to the subject for discussion. During the regular supper there was music by an orchestra, of piano, violin and banjo, augmented by two banjos played by the students of the Nova Scotia Technical College for some special numbers.

Chairman's Report on his Visit to Institute Annual Meeting

Chairman, Major H. W. L. Doane, A.M.E.I.C., was in the chair. He reported that he had attended the annual meeting of the Institute in Toronto and that he had enjoyed himself immensely. Among the things that stuck in his mind concerning it were the following: The discussions of the papers were prepared beforehand; students were prominent in the discussions; there were over 400 couples at the dance; the telegram which was sent to the Institute dinner by the Halifax Branch was not read; and the Gzowsky medal was awarded to A. G. Tapley, A.M.E.I.C., of the Saint John Branch for his paper on "Concrete in Seawater." He was very much pleased with the entertainment provided by the Toronto members and he wished to record his appreciation of their efforts on his behalf.

The chairman introduced Mr. F. A. Gaylord, manager of the Albany Perforated Wax Pulp and Paper Company, Ltd., of Sheet Harbor, Nova Scotia.

Pulp and Paper Manufacture

Mr. Gaylord sketched the history of pulp and paper manufacturing in United States and Canada and described the different kinds of paper which were made from the different kinds of pulp. He also told of the kinds of wood which are preferred in the manufacture of each kind of pulp. All chemical pulp requires approximately two cords of wood to the ton of pulp. Mechanical pulp requires one cord of wood to the ton of pulp. Chemical pulp is 80 per cent of the total made. Of the chemical pulps sulphite pulp is the cheapest to manufacture. Large quantities of it are used in the Rayon industry which has grown from the one million pounds made in 1914 to the 85 million pounds made in 1926. The basis is highly refined sulphite pulp of which the cellulose is dissolved to a viscus transparent mass which is forced through a colander-like machine to form threads which drop into a second tank of chemicals and are there fixed. Rayon finds its application in artificial silk hosiery, ladies underwear and overwear, silk ties, etc.

In the manufacture of ground wood pulp, Mr. Gaylord said that three things were essential: abundance of material, power, and pure water. At his plant in Sheet Harbor, 2,000 gallons of fresh water per minute were used in addition to 1,800 gallons of previously used or "white water." This mill is electrically driven by power provided from the Nova Scotia Power Commission plant on East river. At present it is consuming at the rate of 4,500 h.p. and the new contract with the commission will call for 6,000 h.p. The wood from which pulp is manufactured at Sheet Harbor is bought in lengths 2, 4, 8 and 16 feet. In buying wood 12½ per cent on 16-foot lengths is allowed or shrinkage due to cutting. Spruce and balsam-fir are used entirely. Hemlock and pine, although present in the timber areas, are not used.

The A.P.W. Company controls 75,000 acres back of the mill on West river which is all good wood, and is not cut beyond the growth, which is the only sane policy About 75 per cent of their wood comes from the district between Country Harbor and Jeddore, N.S., and is transported by scows, schooners and even steamers, although ordinary barges are preferred because of the greater ease of loading and unloading. The cost of transportation is mainly in the handling of the wood. The old rossers are disappearing and are being replaced by the barking drum. The company has experienced difficulty in getting rid of the bark, and has tried burning it but without success. During the coming year it will be used for filling and subsequently three small barges will be used to dump it off-shore in deep water. The pulp is ground by grinders 27 inches wide, 54 to 60 inches diameter. About 70 h.p. are used per ton of pulp in grinding alone, and 8 stones are turning out up to 83 tons of air-dry pulp per day. Governors which keep the motors working at constant maximum steady load, increase the grinding output by 15 to 18 tons per day. After leaving the grinders the pulp contains 97 per cent of water. Bull screens take out splinters and slivers, while centrifugal screens take out practically all the remaining slivers, and Wesby screens reclaim the pulp from the slivers. In wages and the purchase of wood (the cost of wood is about 90 per cent. of the wages), the A.P.W. company spend $450,000 per year in Nova Scotia, and in the purchase of supplies in Halifax, $170,000 per year. Some 600 men are employed in the mill and in the woods.

The A.P.W. company has installed about 23 miles of telephone wires for forest protection, also two steel towers 80 feet high, at each of which a man is stationed continuously during the day. It is necessary to protect practically the whole country in order to protect their own property. Mr. Gaylord suggested that the province might well adopt a general system of fire protection. In Mr. Gaylord's opinion there is opportunity for two more good sized paper mills in Nova Scotia. He suggested that over-development in the manufacture of pulp should be guarded against. Regarding the embargo on pulp wood he believed that this would right itself as the paper industry was coming this way as fast as it could get here. He predicted that in the future the trend of the manufacture of paper will be towards South-eastern United States due to the fact that wood grows so prolifically in those districts. He did not think that this would happen immediately, and thought that it would be postponed by proper methods of reforestation in Canada. He suggested that because of the suitability of Nova Scotia woods and the comparative rapid growth that Nova Scotia was in a very favourable position to support plants manufacturing pulp and paper.

The discussion was opened by Major H. W. L. Doane, A.M.E.I.C., who described the mill foundation and the manufacture and construction which necessitated a coffer-dam sunk through sawdust and bog on the site of an old saw mill.

H. S. Johnston, M.E.I.C., complimented Mr. Gaylord on his concise review of so extensive a subject. He was very glad to hear Mr. Gaylord say that Nova Scotia could be made essentially a pulp and paper province. He agreed with Mr. Gaylord that there was room for not more than two more good-sized mills in the province, but he thought there might be some opportunity for manufacturing pulp at small mills. These mills could utilize the water-power available in many places in small quantities and could ship their pulp to a central paper mill. He suggested that Mr. Gaylord was very modest in his estimate of the good which his mill has been to the province. His mill has operated very efficiently.

C. H. Wright, M.E.I.C., said that the very life of New Brunswick depended on ground wood pulp. There used to be twelve saw mills on the Saint John river near Saint John. Owing to the competition of British Columbia woods in the eastern American market and in other markets to which Nova Scotia and New Brunswick timber was formerly shipped, these mills are now closed. The outlet for the wood which they used to manufacture is now through the pulp mills of New Brunswick. He mentioned that a good shipping point was a decided advantage, that the matter of reforestation is tremendously important, and the manufacture of rayon silk products is an excellent and growing outlet for pulp.

At the conclusion of the discussion a vote of thanks was moved by F. A. Bowman, M.E.I.C., and seconded by Professor F. R. Faulkner, M.E.I.C., and was extended to Mr. Gaylord by the chairman.

A number of splendid photographs were thrown on the screen from a reflectoscope and a motion picture illustrating the story of a newspaper from the cutting of the trees to the final product on sale by newsboys was exhibited through the courtesy of the Halifax Herald, Ltd.

Moncton Branch

M. J. Murphy, A.M.E.I.C., Secretary-Treasurer.
V. C. Blackett, A.M.E.I.C., Branch News Editor.

Forest Fire Prevention

Each spring, the New Brunswick government conducts a vigorous campaign of public education in the matter of the protection from fire of the most valued asset of the province, its forests. To co-operate with this movement and to further the activities of the Dominion-wide "Save the Forest" week, the branch was fortunate in securing H. P. Webb, M.Sc.F., professor of forestry of the University of New Brunswick, who gave a most interesting illustrated address on "Forest Fire Prevention" at a meeting held in the City Hall Council Chamber on the evening of April 22nd.

In addition to throwing the meeting open to the public, personal invitations to attend were sent to the teachers in the Moncton schools in order that the educational features of the address might be the more readily passed on to the youth of the city.

Professor Webb stressed the care that should be taken in the preservation of our forests. Canada is depleting her timber resources faster than any other nation in the world. The annual fire loss is in the neighborhood of $15,000,000, nearly ninety per cent of this is caused by human agency and so might be prevented.

Forest fire prevention may be divided into three parts, prevention, detection and suppression.

Prevention includes propaganda and the various legislative enactments such as control of slash burning and the travel permit system which compels the taking out of permits before entering the forests during the dangerous season.

The prompt detection of fires is made possible through the use of forest look-out towers. These are placed in commanding positions and during the dry season are manned by observers who are in telephonic communication with each other and with headquarters. It is customary to place each tower so that it may have at least one other tower in view, and, since the position of the towers is definitely fixed, it is possible on the outbreak of a fire to determine its exact location by triangulation. This information is at once phoned to headquarters and measures taken to meet the situation. Experiments have been made with airplane patrols but they are expensive.

The suppression of fires requires, first of all, adequate organization. Sufficient equipment is next in importance. This generally consists of portable gasoline pumps, weighing from 35 to 100 pounds and carried by from one to three men. Unfortunately the class of labour obtainable for fighting fires is often very inefficient. Through fear or laziness men are inclined to shirk their duty.

At the conclusion of Professor Webb's address, lantern slides were shown depicting forestry operations in various European countries and also in the maritime provinces and British Columbia.

Senator C. W. Robinson, former Minister of Crown Lands, was present and spoke briefly on the grave importance of saving the forests.

A vote of thanks for his excellent address was tendered the speaker by C. S. G. Rogers, A.M.E.I.C., chairman of the branch.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
Stanley A. Neilson, A.M.E.I.C., Branch News Editor.

The History of Science

On April 22nd, Dr. L. E. Pariseau, speaking before the Montreal Branch, outlined briefly the history of science up to the eighteenth century, running through the list of scientific philosophers from Thales of Miletus, of whom he spoke as being one of the first, to Galileo and others whose energies were devoted to elucidating and even refuting theories propounded by their forerunners.

The address was illustrated by a selection from the speaker's collection of books dating back from four to five hundred years.

The true men of science ante-date the commencement of the Christian era, Dr. Pariseau declared, other philosophers, coming after the birth of our Lord, having added to the store of knowledge and profited from the experience of their predecessors. There have been many halts in scientific research, he said, during periods when the world was being built up, but there has been a steady development in the scientific field throughout all ages, except during that nebulous period called "The Dark Ages."

Dr. Pariseau showed how many errors have arisen through too much authority having been placed on the pronouncements of the earlier philosophers, and later emphatically declared that authority does not exist in science.

The first philosophers of science, concluded Dr. Pariseau, were giants of genius, but many of their successors have been able to see farther than they, because they have sat on the giants' shoulders.

J. L. Busfield, M.E.I.C., was chairman at the meeting.

Tribute to General Sir Alexander Bertram, M.E.I.C.

The great loss sustained by The Engineering Institute of Canada through the death of Sir Alexander Bertram was given expression at the meeting of the Montreal Branch on April 29th, when members of the branch adopted a resolution setting forth their regret and paying tribute to his services to The Institute in particular and to Canada in general.

"The Montreal Branch of The Engineering Institute of Canada," the resolution read, "places on record the deep sense of loss sustained by the society in the death of General Sir Alexander Bertram, an honoured member of our profession, valued by his friends and business associates throughout Canada for his upright and honourable career; by the Department of Militia of this Dominion for his ready and successful response to his country's appeal in time of stress; by his fellow-citizens for his sympathetic advice and wise action in their philanthropic undertakings and, most of all, perhaps, by the engineering profession of Canada, which this Institute represents. Especially do those of us who were privileged to be associated with him on the council and special committee realize that the institute had in Sir Alexander Bertram a most loyal member who gave ungrudgingly an immense amount of time and talent for the benefit of the organization. As treasurer, he was a tower of strength, and succeeded in bringing the financial department to its present satisfactory condition. His ready assistance to, and sympathetic consideration for, those members who were less fortunate in their careers and had difficult problems to solve was well known, and he always assisted them, if possible, in the solutions.

"We of The Institute, as well as all others associated with engineering work throughout the Dominion, have every reason to be mindful of this attitude and to be grateful to him for his many generous actions, so modestly belittled by himself."

A copy of the resolution was ordered to be sent to Lady Bertram, with The Institute's expression of deepest sympathy.

Belgian State Railways

To the Montreal Branch on April 29th, Dr. Ferdinand Van Bruysell, former Belgian consul to Canada and a railway operation expert, read a paper on "Belgian State Railways." In this paper Dr. Van Bruysell outlined some of the difficulties to be encountered in operating a railroad owned by the state. "What can be done with a government-owned railway that does not pay?" he asked, and proceeded to detail the various replies generally given to the question, from turning it over to private capital to operation at a loss for the public convenience.

Without attempting, because of differing conditions of operation, to draw a comparison between the Canadian National Railways and the state-owned railways of Belgium, Dr. Van Bruysell gave facts and figures of operation of Belgian railways, outlined some of the difficulties brought about by post-war conditions, and told of the measures taken to overcome these difficulties and make the railways pay. He stressed the conclusion of a Belgian railway head who said that "a government-owned railway must have financial autonomy," as a solution of one of the chief difficulties of operation.

Mr. Arthur Surveyer, M.E.I.C., presided over the meeting and introduced the speaker. The meeting was the last to be held this season.

Excursion to the Saguenay District

As a result of invitations that have been received from the Duke-Price interests and the Aluminum Company of Canada, it is proposed to run an excursion to the Saguenay district. The programme as at present outlined is to leave Montreal on the evening of the 25th of June, spend the 26th in Arvida, go over to Isle Maligne to see the developments there, returning to Montreal the following evening.

The Branch executive are at present arranging the details and will communicate with the members in due course. Those who were fortunate enough to make the trip to Shawinigan Falls last year can be counted on again this year and those who did not go last year should not miss this opportunity.

Next Season's Meetings

The Papers and Meetings Committee are still looking for suggestions for next season's programme, particularly for the second term. Send in yours.

Amongst those who are at present on the list of speakers are the following:—

H. R. Wake, A.M.E.I.C., of the Aluminum Company of Canada.
Dr. Howard T. Barnes, M.E.I.C., the eminent ice engineer.
R. Witherspoon, Shawinigan Water and Power Co.
Messrs. Roast and Newell, the bronze experts.
H. E. Pawson, M.E.I.C., Ottawa-Montreal Power Co.
W. H. DeBlois, Mond Nickel Co.
G. P. Cole, M.E.I.C., Dominion Glass Co.

Niagara Peninsula Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

At St. Catharines, on April 21st, a large and representative audience listened with close interest to J. L. Busfield's paper on the "Chicago Water Problem." Situated as this district is, on the main shipping highway between the Great Lakes and the sea, the effect of any disturbance to the lake levels is very keenly noted. Ships coming down the present Welland Canal have little margin to spare in draught, and a lowering of one to two inches will often force them to unload part of their cargo, or else delay until the normal level is regained. These stoppages and the consequent congestion have been frequent in the last year or so, and naturally the local press records each one. Such temporary irregularities in the levels as are directly attributable to the prevailing wind conditions on Lake Erie under ordinary circumstances would pass unnoticed, but due to a cycle of conditions which has made the last few years, years of unnaturally low levels, the problem has become acute, and Chicago has received its full share, or perhaps more than its share, of the blame.

Mr. Busfield's paper was particularly timely, and he gave statistics and engineering data which we, in Canada, should certainly be cognizant of before passing any final judgment.

Anyone who is interested in the question will be well-advised to read Mr. Busfield's paper in the May issue of the Engineering Journal.

Both Mayor Anderson of Welland and Mayor Smith of St. Catharines were extremely cordial in expressing their appreciation of Mr. Busfield's work, and intimated that it reflected great credit, not only upon his own initiative, but upon that quality of the engineering profession which bids its members leave no stone unturned in the search for the truth.

There was considerable discussion, and a number of questions asked at the close of the paper by various members. Norman Gibson, M.E.I.C., wished to know the date of Canada's first protest and also the extent of damage estimated, excluding future power loss. The answer to the first was "that Canada protested to the U.S. Secretary of War in February, 1912." The second question was more difficult to answer and had hardly been studied sufficiently as yet to yield any reliable data. D. A. Andrus, M.E.I.C., made a very pertinent remark to the effect that other large cities on the Great Lakes appeared to be able to handle their sewage and water supply problems without any diversion of lake waters. Mr. Busfield explained that Chicago could hardly be compared with any other such city, not only on account of her size but also because of her peculiar position at the southern extremity of Lake Michigan, where there is very little, if any, natural flow or current. Another member wished to know if Chicago was responsible for the scheme of diverting part of the Hudson Bay watershed into the Great Lakes. To this Mr. Busfield replied that the proposal had first appeared in the "Canadian Engineer"; it had been investigated by Chicago engineers but appeared to be impracticable on account of economic and physical features.

Chairman H. L. Bucke, M.E.I.C., in tendering a vote of thanks to Mr. Busfield also asked as to the effect of a lowering of lake levels upon harbours. Mr. Busfield explained that most vessels were loaded to the last inch of navigable draught and that therefore the slightest variation would mean decreased carrying capacity or else increased harbour dredging. Replying to the vote of thanks, Mr. Busfield committed, in this editor's opinion, the one faux pas of the evening, when he admitted that many of the meetings in headquarters at Montreal were not so well attended as this one at St. Catharines.

Annual Meeting

Annual Meeting and election of officers, May 12th, "The Inn," Niagara Falls. Speaker, Dr. Mackintosh Bell.

Retiring Officers

Chairman	H. L. Bucke, M.E.I.C.
Executive	J. B. McAndrew, A.M.E.I.C.
	T. V. McCarthy, A.M.E.I.C.

New Council

Chairman	Alex. Milne, A.M.E.I.C.
Vice-Chairman	T. S. Scott, M.E.I.C.
Secretary-Treasurer	R. W. Downie, A.M.E.I.C.
Executive	E. G. Cameron, A.M.E.I.C.
	J. C. Street, M.E.I.C.
	L. L. Gisborne, A.M.E.I.C.
	W. S. Orr, A.M.E.I.C.
(ex officio)	H. L. Bucke, M.E.I.C.

Mr. Bucke, in his retiring address, stated that this Branch had been formed mainly through the efforts of engineers employed in the construction of the Queenston-Chippawa power project and the Welland Ship Canal. Now these works were nearing completion and many members would be leaving for other parts within the next few years. He urged therefore, that a special effort be made to keep the Branch active and suggested that all engineers having more or less permanent positions with industrial plants should enter with greater zeal into the activities of the Branch.

Mr. Bucke expressed his thanks for the whole-hearted co-operation given during the last year by the vice-president, the executive, and particularly by Mr. Downie, the secretary-treasurer.

Mr. Milne then took the chair and in a few happy words expressed his appreciation for the honour conferred. He was most anxious that the Branch should continue, and thought that, if the members would co-operate, much interest might be aroused by getting papers from the local membership and assigning to certain other members the duty of preparing discussions on such papers.

E. G. Cameron, A.M.E.I.C., chief assistant engineer of the Welland Ship Canal, then moved that the professional meeting which was proposed for this year, be postponed for twelve months. He explained that certain features of the canal, such as the large steel lock gates and lift bridges would be at the most interesting stage of their construction during the summer of 1927.

Mr. R. Bond of the Victoria Park Commission seconded this motion, saying that certain of the main roads in the Park would be under heavy repairs this summer and that next year they would be in a much better position to show visitors around. Motion carried.

Vice-President T. S. Scott, M.E.I.C., introduced the speaker of the evening, Dr. Mackintosh Bell, as the Managing Director of the Canadian Lorrain, president of the Huronian Belt Mining Co., an eminent geologist and a member of the British Intelligence Staff during the war.

Dr. Bell gave a strictly non-technical but nevertheless highly interesting talk on travel in many lands. He took us with him to the Copper-mine River in the Northwest Territory, to Siberia, to Russian Turkestan, to Manchuria, to New Caledonia, and finally to New Zealand, where he had the unfortunate distinction of poking the Maori heir-apparent in the ribs under the impression that he—or she—was merely a common-or-garden baby.

H. G. Acres, M.E.I.C., expressed the feeling of the meeting when he said that Dr. Bell's address was one of the most interesting that had ever been delivered before this Branch. "A regular Cross Section out of Kipling's Works."

Quebec Branch

Louis Beaudry, S.E.I.C., Secretary-Treasurer.

The Port of Quebec

On Monday, April 26th, Brigadier-General T. L. Tremblay, C.M.G., D.S.O., A.M.E.I.C., chief engineer of the Quebec Harbour Commission, addressed the Quebec Branch on the subject of "The Port of Quebec," at a luncheon-meeting held at the Chateau Frontenac.

After being introduced by A. B. Normandin, A.M.E.I.C., chairman of the Branch, General Tremblay commenced his address by declaring that Quebec had long ago been recognized as one of the most important ports of America. In 1608, Champlain realized its strategic importance, and the Frenchmen chose a particularly beautiful and convenient spot at which to moor their ships, at the foot of Canoterie Hill, so called because it was there also that the Indians kept their canoes.

After the advent of the first French settlers the growth of the port proceeded in proportion to the requirements of increased trade, which in turn brought a greater number of larger vessels. At the outset the wharves were built by private interests without any general direction on the shores of the St. Lawrence and St. Charles rivers, on both sides of what is still known as the Pointe à Carcy.

In 1805, Trinity House, which was the first organization to administer the affairs of the port of Quebec, and which also had authority over the pilots of the district, was incorporated by an act of Parliament. The Corporation of the Harbour Commissioners of Quebec was formed in 1858. These two public bodies functioned together until 1876, when the affairs of Trinty House were taken over by the Harbour Commissioners. In 1912 the number of commissioners, which had been nine, was reduced to three, including the chairman, who was appointed by Order-in-Council and remained in office until he chose to resign. Since that date the chairmen who have headed the Commission have been : the late Sir William Price, Hon. Senator D. O. L'Esperance, the late Major-General Sir David Watson, and the present chairman, Hon. W. Gerard Power, M.L.C.

The limits of the port of Quebec were defined by act of Parliament in 1899 and have not been changed since. According to this act the port extends along both shores of the St. Lawrence river from Deschambault in the County of Portneuf to St. Barnabe Island, opposite Rimouski, a distance of 175 miles; while the Quebec Harbour comprises both shores of the St. Lawrence from Cap Rouge to an imaginary line starting at Montmorency Falls and passing opposite the church of St. Petronille, Island of Orleans, in the direction of the south shore.

The first period of important development of the port commenced a few years before the absorption of the Trinity House by the Harbour Commission, and a scheme of construction was worked out by Messrs. Kinniple and Morris, prominent English engineers. A general plan was developed, including all the wharves of the time, and also considerable enlargements at the estuary of the St. Charles river. These works were largely executed under the supervision of St. George J. Boswell, M.E.I.C., who has been the chief engineer of the Harbour Commission for forty-six years.

General Tremblay outlined the facilities which are now possessed by the port for the handling of ships and their cargoes. The increase in activity in the port during recent years justified the construction of the Wolfe's Cove terminal wharves, work upon which had commenced and would be continued as the need made itself felt.

A. R. Decary, M.E.I.C., honorary-president of the branch, thanked the speaker on behalf of the branch.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

Addressing the Ottawa Branch at luncheon in the Chateau Laurier at noon April 29th, A. H. White, M.E.I.C., of New York, chief engineer of the International Paper Company, told his auditors of the power developments now under way by the company at Chelsea, Quebec.

Mr. White, an abstract of whose address appears elsewhere in this issue, gave some interesting facts and figures relating to the big development at the doors of the Capital.

Chicago Drainage Canal

An extremely interesting address was delivered May 7th, in the palm room of the Chateau Laurier, on the Chicago Drainage Canal, by J. L. Busfield, M.E.I.C., of the firm of Beaubien and Busfield, consulting engineers, Montreal. It was given before a fairly well attended gathering of the Ottawa Branch, Engineering Institute of Canada.

The lecture was plentifully illustrated with lantern slides, showing the many features of the famous canal. The lecturer did not touch so much on the international aspects of the canal, as on the engineering skill that was displayed in its construction.

Mr. Busfield devoted himself practically entirely to constructing a background for a clear understanding of the questions arising out of the Chicago diversion. He did not offer any opinions or advance any suggestions as to what the solution will or should be.

In view of the fact that the Joint Engineering Board has the matter under consideration, that was, of course, amply sufficient reason for confining the paper to an explanation of the problem.

Mr. Busfield's paper was published in full in the May issue of the Engineering Journal.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer

Photography in Science, Industry and Medicine

On April 21st, 1926, the members of the Saint John Branch were addressed by Professor E. L. Harvey, M.A., of the University of New Brunswick, Fredericton, on the subject of "Photography in Science, Industry and Medicine." The address was illustrated by a large number of lantern slides, and by means of blackboard demonstrations; the speaker also illustrated some fundamental principles to observe for obtaining good pictures. As this meeting was being held during the week when the annual Save-the-Forests campaign was in progress some slides describing the loss occasioned by forest fires were shown on the screen. A number of the citizens of Saint John, including some of the medical doctors, were present at this meeting. W. R. Pearce, M.E.I.C., chairman of the branch, presided and on the conclusion of Professor Harvey's address tendered him a vote of thanks on motion of Geoffrey Stead, M.E.I.C., and A. R. Crookshank, M.E.I.C.

Photography in addition to being a hobby of some persons has to-day been developed to such a state of perfection that it is now in general use in many industries and for a variety of purposes. As examples of the degree of refinement attained might be mentioned that photographs can be obtained with a ten-millionth part of a second's exposure; that the aeroplane surveyor can take photographs, through mist, of landscapes almost invisible to the eye; that a microbe, a twenty-five-thousandth of an inch long, can be magnified two hundred million times in area, and that its photograph produced in ultra-violet light will reveal its structure. The progress of photography has been largely due to the extension of the colour-sensitiveness of the photographic plate; the sensitiveness to light of silver bromide and its inclusion in an emulsion of gelatin has been used by the plate chemist to make it sensitive to all the colours of the spectrum, to invisible infra-red and ultra-violet rays, to X-rays, and the shortest wave motions produced by radium.

In pure science the use of photography has been the means whereby many experiments were successfully completed and results obtained which without its aid would have been impossible. The photographing of wave lengths of the ultra-violet has been used in experimental work on sugars and starches and other processes of vegetable life. Spectrum analysis by photography, of spectro photography, has disclosed the constitution of the sun and of stars and is used by astronomers to calculate the velocity of heavenly bodies.

The microscope has been used extensively in conjunction with photography during the past three or four years. This photo-micrography has discovered inherent defects in steel, such as troubles arising through bad ingot pouring, or possibly faults arising in the forging and stamping of steel. Within the past couple of years an apparatus has been designed which permits the magnifications of 25,000 diameters. A new process of seasoning wood in about nine days as against some months of air curing was photographed every ten minutes and the gradual chemical and physical changes recorded. Slow motion photographs of workers on piece work in industries has been the means of discovering lost motions and thus speeding up production.

Photographs have been recorded at the rate of 5,000 per second for scientific research, the actual exposure being that of a spark discharge in a Leyden jar. It has thus been possible to record the flight of bullets and of meteors.

One of the inventions of photographic recording is the sonometer, a machine in which a pencil of light is deflected by a diaphragm vibrated in accordance with the sounds impinging on it, and a fine spot of light makes its record upon a moving plate or band of sensitive paper. It is useful in recording musical and vocal sounds and is applied in engineering work for testing periodic errors in geared machinery.

Probably the most advanced work attained in photography to date has been its application to radio-active phenomena. The bombardment of the nucleus of an atom by an alpha particle of radium and the actual breaking off of a hydrogen atom has been shown. This transmutation of an element being photographed by an end-on collision was only obtained after 21,000 attempts.

The telegraphic transmission of pictures, inaugurated in 1907 and only occasionally used since on account of excessive cost, is gradually gaining ground in the newspaper world. In the early days of X-ray work back in 1896, the time necessary for an exposure was several minutes; it was used extensively during the South African War to locate bullets, and is now in general use in medicine and dentistry and has been so perfected that an exposure is practically instantaneous.

Photography has many practical uses in engineering. The photographing of a blue-print can now be successfully done, thereby ensuring an exact copy without any omissions as possibly might occur in re-tracing. It is also available for reducing or enlarging maps or other plans. Plans, prints or paintings which may have been hopelessly damaged through ink or other stains can be accurately reproduced in the original by having the stain neutralized when the photograph is being taken. The use of photographs of engineering works and in engineering reports is too well known to repeat their value.

Colour rendering or the taking of photographs in their natural colours without re-touching is one of the advances of photography along artistic lines. This work is used largely in photographs of landscapes and of sunsets.

Annual Meeting

Again the members of the Saint John Branch observed the completion of another successful season by a combined dinner and annual meeting. The affair was held on the evening of May 5th at the Admiral Beatty hotel and was presided over by W. R. Pearce, M.E.I.C., chairman of the branch during 1925-26. Guests included Honourable J. B. M. Baxter, N.L.A., premier of New Brunswick; Dr. W. W. White, mayor of Saint John; O. J. Fraser, C. F. Sanford, K.C., of Saint John; A. P. Theuerkauf, M.E.I.C., and E. L. Martheleur, M.E.I.C., of Sydney, N.S.

After disposing of a very fine meal an item of educational entertainment was provided by the screening of a picture showing the manufacture of carbide as produced by Canada Carbide Company.

The toast to the King was observed in the usual manner. Major W. J. Forbes-Mitchell, D.S.O., M.E.I.C., as a newcomer to the branch, proposed the toast to the Province of New Brunswick; this was replied to by Premier Baxter, who dwelt at considerable length on the proposed hydro-electric development of Grand Falls, N.B., to be done soon under an agreement with the International Paper Company. The toast to the City of Saint John was proposed by J. L. Feeney, A.M.E.I.C., and replied to by Mayor White. Dr. White was recently elected to office and had not previously made any announcement as to the policy he intended following in office; his remarks were closely followed as he mentioned a number of ways the engineer might assist in improving the city, including extensive harbour developments. The toast to Our Guests was introduced by J. N. Flood, A.M.E.I.C., and fittingly replied to by O. J. Fraser. The Press was proposed by A. A. Turnbull, A.M.E.I.C., as chairman of the Publicity Committee of the branch, and replied to by K. E. MacLaughlin, a press representative. Councillor A. G. Tapley, A.M.E.I.C., proposed The Engineering Institute of Canada, which was replied to by J. L. Holman, JR. E.I.C.

An innovation adopted by the chairman was his insistence that practically all speakers on the toast list be those who do not generally have much to say at branch meetings. All members took their parts well and received good practice in speaking in public. Someone said one time—don't know exactly what time or who said it—that "Engineers can't speak in public"; but anyone who says so should have been at this dinner in order to be convinced that this statement is wrong. Any engineer who does not speak well in public, does not speak well because he does not speak often enough—that's all.

The report of the auditors was submitted by E. J. Owens, A.M.E.I.C., and the report of the executive was read by the secretary.

Reports were submitted by the chairmen of various committees on the year's work as follows:—

Committee Report	*Submitted by*
Papers and Meetings	Geoffrey Stead, M.E.I.C.
Entertainment	E. A. Thomas, A.M.E.I.C.
Civic Building and By-Laws	C. C. Kirby, M.E.I.C.
Concrete in Sea Water	Alex. Gray, M.E.I.C.
Fuel	Prof. John Stephens, M.E.I.C.
Publicity	A. A. Turnbull, A.M.E.I.C.
Employment	J. A. W. Waring, A.M.E.I.C.

J. R. Freeman, M.E.I.C., on behalf of the scrutineers, reported the election of A. R. Crookshank, M.E.I.C., as chairman; S. R. Weston, M.E.I.C., as vice-chairman; J. D. Garey, A.M.E.I.C., as member of executive. The present secretary-treasurer was re-elected to office.

A vote of thanks was passed to the New Brunswick Telephone Company for having made available its assembly hall for holding branch meetings.

A. R. Crookshank, M.E.I.C., was escorted to the chair and briefly thanked the members for his election to office. The other members elected to office also spoke in reply to insistent demands from the members. All present voted the meeting as a very interesting and instructive affair and a suitable finish to a splendid season's programme.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

A regular meeting was held on April 30th, at the Y.W.C.A. rooms. Major Thompson and Major Clayton of the Provincial Forestry Department were the guests at the dinner.

C. H. Speer, M.E.I.C., chairman, called the meeting to order and dispensed with the regular business. The telegram announcing the death of Sir Alexander Bertram, M.E.I.C., the treasurer of the Institute, was read and received with an expression of regret by all the members present, also an expression of sympathy was extended to the family.

At 8 p.m., under the guidance of Major Thompson and Major Clayton, a visit was made to the local hangar of the Provincial Forestry Department, on Church street. The delegation consisting of about thirty-six were divided, with Majors Thompson and Clayton each acting as guide and instructor to a party.

The wood-working room, the paint room and all the various departments were visited in turn, and it was most interesting to see the different parts of the machines. After viewing the disassembled parts and noting carefully their lightness of construction, the members were much impressed with the stability of the fully assembled machines which were inspected next.

The two hours spent going through the hangar were very instructive as well as interesting, and the members of the executive wish to express their appreciation and thanks to Major Thompson and Major Clayton for the courtesy shown and the trouble taken by them to make the inspection a successful one.

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

Launching of Drydock Caisson

On April 12th, on the invitation of N. A. Yarrow, A.M.E.I.C., a number of the members of the branch attended the launching of the second of the large drydock caissons constructed by Yarrows Limited. The lieut.-governor of the province, the Hon. R. R. Bruce, and Miss Helen Mackenzie were escorted to the launching barge by Piper-Major Wishart, playing "The Cock o' the North" on his pipes. Miss Helen Mackenzie, chatelaine at Government House, touched a button, a bell rang, and amidst the shrieks of factory and steamship whistles and sirens, the 720-ton drydock gate started slowly down the skidway, gaining increased speed as it neared the water, then with a graceful plunge it made its maiden dip, entering the water on its side at an angle of about 30 degrees. Following the launching, Miss Cynthia Yarrow, 5-year-old daughter of Norman A. Yarrow, presented Miss Mackenzie with a beautiful bouquet of flowers.

Some 700 invited spectators witnessed the launching ceremony, with an additional 200 interested onlookers who occupied vantage points in the surrounding neighbourhood.

The description of the two gates appears on another page of this issue of the Journal.

Building the Cariboo Road

On April 14th, P. Philip, M.E.I.C., deputy minister of public works of the province of British Columbia, spoke on the building of the new Cariboo road.

The description of Simon Fraser of the Fraser canyon was as follows:—

> "This country is a series of cascades, interrupted with rocks and bounded by precipices and mountains that seem to have no end, I scarcely ever saw anything so dreary and so dangerous. Whatever way I turn my eyes, mountains upon mountains, whose summits are capped with eternal snow, close the gloomy scene."

Further on he says:—

> "As for the road by land, we could scarcely make our way even with our guns. We had to pass where no human being should venture. Yet in those places there is a regular footpath impressed or rather indented upon the very rocks by frequent travelling. Besides this, steps which are formed like a ladder by poles hanging to one another crossed at certain distances with twigs, the whole suspended from the top, furnish a safe and convenient passage to the natives down these precipices, but we, who had not the advantage of their education and experience, were often in imminent danger when obliged to follow their example."

That was in 1808. Half a century later road building began in earnest. In 1862, the Cariboo road was started by the Royal Engineers north of Yale, and by 1863, in the month of June it had been completed to Cook's Ferry (Spence's Bridge), a distance of 80 miles.

The suspension bridge at Spuzzum was constructed by Joseph W. Trutch, and in February 1864, Thomas Spence replaced Cook's Ferry with a bridge that gave his name to this place.

In the early days construction looking toward a road connecting coast and interior was started along three routes, the Harrison, Hope-Princeton, and the Cariboo. The same three have been the object of much examination these last few years, and at length the government decided to relocate and rebuild along the old Cariboo route, the original road having been largely obliterated by the advent of the railway, which followed the old trail.

The location of the Old Cariboo road required 45 level crossings between Hope and Spence's Bridge, but by skilful relocation 33 of these were eliminated, and of the remainder it is probable that only six grade crossings will be necessary for the present. The proximity of the railway added greatly to the difficulty of carrying out the work in the canyon, as every precaution had to be taken to prevent rock falling on to the track, and also to prevent rock being dumped into the Fraser river to the detriment of the passage of salmon.

The new Cariboo road has a road-bed of 16 feet, widened to 18 to 20 feet on curves, and has a maximum grade of 8 per cent except at Jackass mountain.

The bridges, particularly those over Cisco and Stoyoma creeks, and Anderson river, will be of interest to motorists. These bridges cross canyons at an average height of 160 feet above the bed of the stream.

The new Alexandra suspension bridge has been designed with a view to preserving, as far as possible, the historic features of the old bridge at this point, but at the same time providing for modern traffic requirements.

Mr. Philip paid tribute to the engineers past and present who had carried out their work on the old and new roads, and also to the efficient and expeditious work of the present contractors, and urged all Institute members to visit the road not only for its scenic charms, which were unequalled, but that they might acquaint themselves with the outstanding engineering features of its construction.

A number of lantern slides were shown covering the construction of the road, and at the conclusion of Mr. Philip's talk he was accorded a very hearty vote of thanks.

Trade Publications

The selection and application of centrifugal pumps to mine pumping is the subject of a twenty-page leaflet distributed by the De Laval Steam Turbine Co. of Trenton, N.J. Instructions are given for the design of piping, and the calculation of friction head power required. Details of construction which should be looked into when selecting pumps for this service are also discussed at length. This publication should be useful not only to mine owners and engineers but to anyone using pumps for irrigation, general water supply, and similar service.

The Construction of the Gatineau River Power and the West Templeton Paper Mill

A. H. White, M.E.I.C., Chief Engineer, International Paper Company, New York.

Ottawa Branch, April 29th, 1926.

Mr. White said that soon after the Riordon properties were taken over by the Canadian International Paper Company, the president, Mr. A. R. Graustein, set in motion the establishment of power plants and a paper mill to make use of the lumber and powers which were part of the Riordon properties. In this development the Canadian International Paper Company is making use of Canadian talent, manufacturing facilities and labour to the greatest extent possible. The engineering designs for the power plant are being executed by Canadian engineers in Canada. The general engineering and construction work is being done by a Canadian company. In addition to this Canadian consulting engineers are being employed. Water wheels, generators, paper machines, etc., are bought in Canada. In short the company is making these developments Canadian.

Physical Features of the Gatineau River

The Gatineau river has a drainage area above Chelsea, Quebec, of 9,600 square miles. The high level of the lake to be formed by the construction of the Bitobee dam is 750 feet above the water. The water level below Farmers rapids, the lowest fall in the river, is at elevation 157, making a total fall of 393 feet in a distance of 120 miles. All this fall cannot be used. There are several points at which the fall is concentrated enough and the character of the country is such as to make developments feasible both from an engineering standpoint and commercially. The four principal points for development are: Maniwaki, Paugan falls, Chelsea and Farmers rapids; the two latter being now in the progress of development.

The storage dam to be built at Bitobee, a short distance below the mouth of the Gens de Terre, will impound 82,000,000,000 cubic feet of water, which, with the natural run-off below the storage dam, will give a regulated flow at Chelsea of from 8,000 to 10,000 cubic feet per second depending upon the precipitation in any given period. The fall at Paugan falls is 115 feet, Chelsea 95 feet and Farmers rapids 65 feet, a total of 275 feet.

Available Power

At 8,000 cubic feet per second and unity load factor, these three head will develop 220,000 h.p. on water wheel shafts. Higher flows will, of course, yield proportionately greater powers. Of course unity load factor never obtains and the developments will utilize more than the absolute minimum flow of 8,000 cubic feet per second. The average commercial load factor may be placed at 60 per, cent and this load factor will require a total installation at the points named above of 360,000 h.p. on water wheel shafts. Since the records show the average natural flow in the river to be 10,000 cubic feet per second most of the time, and as there are additional storage possibilities, developments will be made on the basis of at least 10,000 cubic feet per second regulated flow, which, at 60 per cent load factor, will require an ultimate installation of 450,000 h.p. If we allow 10 per cent for losses from water wheel shafts to the point of delivery of electric current, we will have 405,000 h.p. delivered for 60 per cent of the time. These statements apply to Chelsea, Farmers and Paugan sites.

In addition to the above, there are other heads capable of development which should bring the total of 60 per cent load factor delivered power up to the neighbourhood of 600,000 h.p.

Bitobee Storage Dam

At Bitobee a storage dam is to be built under the direction of the Quebec Streams Commission, of which O. O. Lefebvre, M.E.I.C., is chief engineer; the construction to be performed by the Foundation Company of Canada, Limited, of which F. E. Chadwick, M.E.I.C., is vice-president and general manager. The crest of this dam is to be at elevation 750, possibly 755. Three cut-off dams are necessary, at Castor lake, Lacroix creek and Philemon creek. Work has already commenced on this dam, cement and other necessary materials to the extent of some 10,000 tons having been taken in over the snow during last winter. The distance from the railway to Maniwaki is about 28 miles. It is intended and expected to have this work finished by January 1st, 1927, at a cost of approximately $3,000,000.

Numerous surveys and studies have been made on the development at Paugan falls, but the work there has not commenced.

Chelsea Power Development

At Chelsea, about eight miles above Ottawa, the construction of a dam and power house is well under way. The crest of the spillway at this point will be at elevation 315. Flashboards will hold the water at periods of low flow at elevation 318. This dam will set the water back about to the village of Wakefield and will necessitate moving to higher ground some six miles of tracks of Canadian Pacific Railway, and also of the highway. The power house will be between the island and the west shore of the river. The dam between the island and the east shore of the river is to contain flood gates and across the island will be the spillway before mentioned, carrying flashboards. The power house has been designed for five turbines of 34,000 h.p. each at 95-foot head, the turbines running at a speed of 100 r.p.m. The turbines will be of the Francis vertical type and will each drive a 36,000 Kv.a. Canadian Westinghouse generator. Turbines will be built by the Dominion Engineering Company of Montreal. Draft tubes are of the Moody type, and the tailrace will extend 1,200 feet from the power house through the channel between the island and the west shore. The generators will produce current at 6,600 volts which will be stepped up to 110,000 volts for transmission.

At Farmers rapids, about 7,000 feet below Chelsea dam, the company is building an hydro-electric plant to contain five turbines of 24,000 h.p. each, directly connected to generators to be built by the Canadian General Electric Company. On account of the short distance between the two plants the Chelsea and Farmers rapids plants will be run in synchronism, that is to say, each plant will use the same amount of water at the same time.

The Chelsea and Farmers rapids plants are being designed by the Fraser Brace Engineering Company, Ltd., in co-operation with the Power Engineering Company, Ltd., of Montreal. Construction at Chelsea, Farmers rapids and the paper mill is being executed by Fraser Brace Engineering Company, Ltd., Major James H. Brace, M.E.I.C., vice-president, being in direct charge.

While the matter has not yet been fully decided, it is quite likely that there will be both 60-cycle and 25-cycle units in both plants. Power from these plants will be used at the paper mill now building at West Templeton, about four miles below Ottawa on the Quebec side of the Ottawa river, and by others as the demand may require. It is planned to sell the 25-cycle current from these plants to the Hydro-Electric Power Commission of Ontario and also to develop Paugan falls at 25 cycles. This 25-cycle current from all three plants would be transmitted to the province of Ontario over a 220,000-volt transmission line.

The entire power and storage development will cost in the neighbourhood of $50,000,000.

Paper Mill at West Templeton

The paper mill building at West Templeton will be called the Gatineau mill. The first unit will contain four paper machines, capable of producing a sheet of newsprint paper 256 inches wide at a rate of 1,200 feet per minute. These machines will be the largest single producers so far installed in the world. The paper mill will require some 39,000 h.p. for grinding wood and for miscellaneous needs about the mill. In addition electric boilers will be installed to use surplus electrical energy until such time as the demand for such energy no longer warrants its use for making steam. The paper machines, wood pulp grinders, sulphite digesters and practically all other machinery used in the mill will be of Canadian manufacture. Paper machines will be furnished by the Dominion Engineering Works, Limited, the steel by the Dominion Bridge Company, Limited, and so on down the line, including brick and cement. It is intended to have the power plants and paper mill finished by the first of the year 1927, and by July 1st, 1927, to be producing upwards of 450 tons of newsprint each twenty-four hours, six days per week. The mill is being laid out so that its capacity can be doubled or trebled if conditions in the future warrant.

In conclusion, let me say that the ability and spirit of co-operation shown by all engaged in this vast amount of work and by the business men and others with whom we come in contact, are gratifying and surely conducive to economy and efficiency. Furthermore, the Provincial and Dominion authorities have shown us the utmost consideration, and we believe that these developments will prove of great benefit to both the province and the Dominion.

Quebec

An interesting and handsomely illustrated booklet, entitled "Quebec," has been issued by the Department of Roads, of the Province of Quebec. This booklet is intended for the use of tourists contemplating visiting the province. While it is not intended as a guide, it contains a great deal of very interesting information regarding the province.

Geological Formations of Manitoba

An interesting bulletin of the geological formations of Manitoba by R. C. Wallace, professor of geology and mineralogy of the University of Manitoba, has been issued by the Natural History Society of Manitoba. The bulletin contains a summary of the extensive information on the geological formations of the province and contains also a bibliography of literature on the subject.

Map of Calgary and District

Topographical Survey, Department of the Interior, has issued a new map of Calgary and district which covers an area of roughly sixty-five miles north and south by fifty-five miles east and west and is on the scale of one mile to three inches.

Preliminary Notice

of Applications for Admission and for Transfer

May 19th, 1926.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in June, 1926.

R. J. Durley, Secretary.

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*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council, shall be required to pass an examination before a board of examiners appointed by the council The candidate shall be examined on the theory and practice of engineering with special reference to the branch of engineering in which he has been engaged. This examination may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the first year in such a course, shall be required to pass an examination in the following subjects: geography, history (that of Canada in particular), arithmetic, geometry, euclid (books I, IV and VI), trigonometry, algebra up to and including quadratic equations.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed successfully an examination equivalent to the final examination of a high school or the matriculation of an arts or science course. He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination equal to that prescribed for admission to the grade of Junior in the foregoing section and he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BAILIE—EDWARD LEONARD, of Stellarton, N.S., Born at Bridgeport, Conn., May 24th, 1902; Educ., B.Sc. N.S. Tech. Coll. 1926; 1923-24 engrg. staff of Brit. Emp. Steel Corp. of Stellarton, as ch. of party on topographical survey, also drafting and blotting notes in connection with same dept.; June to Sept. 1925, asst. engr. on highway constrn with N.S. Highway Board.

References: F. R. Faulkner, K. E. Whitman, J. H. Reid, W. F. McKnight, D. W. Munn, K. L. Dawson, J. J. Sears.

BARBER—HERBERT CAMPBELL of Toronto, Ont., Born at Toronto, Nov. 19th, 1885; Educ., B.A.Sc. Univ. of Toronto, 1910; 1908-10, Toronto Hydro-Electric System, design of substations and dist. system; 1910-12, Hamilton Hydro-Electric System, design and supt. dist. system; 1912-13, Toronto Hydro-Electric System, asst. to gen. mgr.; 1914 to date, Standard Underground Cable Co., mgr. of Ont. district.

References: E. T. J. Brandon, R. B. Jennings, T. H. Hogg, A. B. Cooper, P. E. Hart.

BOXER—ARTHUR of Toronto, Ont., Born at Bristol, Eng., Sept. 15th, 1897; Educ., Lower Can. Coll. and Wykeham House, Montreal, Mech. Engrg. I.C.S., diploma, 1925; mech. dftsman, E. J. Fetherstonhaugh, Montreal; 1916, Dom. Bridge Co., Lachine, Que.; 1917, studied and practised designing, building and erecting of Fairbanks scales such as railroad track, automatic grain and coal, coal hopper, motor truck type scales, in Scale div. of Can. Fairbanks-Morse Co. Ltd., Montreal; 1923 to present time, mgr. of Scale div. with headquarters at Toronto.

References: J. W. Orrock, H. B. Stuart, C. E. Osler, W. H. Bonus, R. W. Angus.

BUTCHART—HAROLD TREMAYNE of Calgary, Alta., Born at Guelph, Ont., May 18th, 1895; Educ., B.Sc. Univ. of Alberta, 1922; 1914, 5 mos. as chainman on mtce. and constrn., Edmonton, Dunvegan & B.C. Ry.; 1916-19, overseas; 1920, 1½ mos. instrman Alta. Gov't. road survey, 3½ mos. instrman, Irrigation Br., Dept. of Public Works, Dom. Gov't.; 1921, 5 mos. Hillcrest Collieries Ltd., surveyor's helper and gen'l. experience in mining; 1922-25, asst. fuel engr. for Alta. Gov't. Winnipeg; at present time, fuel engr. Wilson Coal & Coke Co. Ltd., Calgary.

References: G. R. Pratt, E. Stansfield, R. S. L. Wilson, C. A. Robb, A. C. Wright, R. W. Boyle.

COTHRAN—FRANK HARRISON of Isle Maligne, Que., Born at Millway, South Carolina, Aug. 28th, 1879; spec. courses Clemson Coll. S.C. 1895-97; U.S. Army 1898; 1899, rodman, S. Ry. and rodman, instrman and dftsman, S.A.L. Ry.; 1900, land surveys; 1901, primary levelman U.S. Geol. Survey; 1902, asst. to mining engr. Cranes Nest Coal Co. Va.; 1902-03, res. engr. South & West. Ry.; 1903, res. engr. Va. Pocahontas Coal Co. Coalwood, W. Va.; 1903-04, asst. locating engr. i/c constrn. of Coalwood plant; 1904-05, res. engr. Clover Fork Tunnel residency; 1905-06, locating engr. Coal & Coke Ry. W.Va.; 1906-07, asst. engr. i/c locating parties; 1907-08, locating engr. proposed Bristol & Kingsport Ry., and other lines; 1908-10, mem. firm Cothran & Cothran, Greenwood, S.C.; 1910, engrg. and contracting, locating engr., Coal & Coke Ry., reconnaissance engr. Va. Carolina Ry.; N.C. and Va.; 1910-12, locating engr. i/c constrn. 2nd and 3rd divs.; 1914-15, engr. i/c field surveys, topographic tests ry. and land, Quebec Development Co.; 1915-16, engr. i/c field surveys, Southern Power Co., Charlotte, N.C.; 1916, res. engr. i/c additions, Lookout Shoals dam; 1916-20, res. engr. i/c Bridgewater development, West. Carolina Power Co.; 1921-22, div. engr. Southern Power Co., Bridgewater, N.C.; i/c work on viaduct, bridge, pumping plant, and steam plants; 1923 to present time, vice-pres. and gen. mgr. Alma & Jonquiere Ry., vice-pres. Duke-Price Power Co. Ltd., and Quebec Devel. Co.; since Aug. 1925, gen. supt. of constrn. for Aluminum Co. of Canada Ltd., i/c constrn. Aluminum plant and Shipshaw Hydro-Electric plant.

References: W. G. Mitchell, A. A. McDiarmid, F. P. Shearwood, W. S. Lee, O. Lefebvre, C. N. Shanley.

COX—ARCHIBALD of Estevan, Sask., Born at Southampton, Eng. Dec. 10th, 1872; Educ., Auckland Coll. and Grammar School, 1888; apptceship engrg. 1888-93; Polytechnic Southampton, courses, graphic-statics, thermodynamics and steam, 1893-94; 1894-97, marine engr. Union Castle S.S. Co.; 1897-1900, erecting engr. for Tangyes Ltd., on goldfields in S. Africa and New Zealand; 1900-02, war service S.A. War; 1902-94, erecting engr. Tangyes Ltd.; 1905-08, supt. marine engine constrn. W. I. Thornycroft at Naples, Italy, and supt. of plant in B.C. 1908-14; 1915-18, production officer on aircraft constrn. during war; 1918-20, works mgr. and mtce. engr. No. 1 aircraft, Nat. Depot, Liverpool; 1921-24, supt. engr. City of Regina Light & Power plant; 1924-25, supt. engr. constrn. and operation, Winnipeg Standby and Gen. Heating plant; at present, town engr. and supt. of utilities for Estevan, Sask.

References: R. N. Blackburn, D. A. R. McCannel, J. G. Glassco, J. W. Sanger, N. M. Hall, C. H. Gunn.

DEBLOIS—WILLIAM HOWARD of Westmount, Que., Born at Halifax, N.S., Dec. 13th, 1875; Educ., B.Sc. McGill Univ. 1901; 1901-03, head chemist Nichols Chemical Co. Capelton, Que.; 1903-08, with General Chemical Co. as asst. supt. at Camden, N.J., supt. at Pulaski, Va., asst. supt. at Edgewater, N.J. and Bayonne, N.J.; 1908-24, supt. Nichols Chem. Co., Sulphide, Ont., 1924 to date, mgr. chem. div. Mond Nickel Co. Ltd., Coniston, Ont., designed and erected new sulphide acid plant to utilize waste sulphur gases at smelter of same company at Coniston.

References: C. K. McLeod, J. R. Donald, J. L. Busfield, R. J. Durley, A. Surveyer, F. S. Keith, A. A. Bowman, J. P. Anglin.

SILLCOX—LEWIS KETCHAM of 205 Herrick Rd., Riverside, Ill., Born at Germantown, Penn. Apl. 30th, 1886; Educ., M.E. & E.E. Univ. of Brussels, Belgium, 1903; 1903-06, apptce. N.Y. Central Rd.; 1906-09, asst. shop supt.; 1909-12, shop engr. Can. Car. & Fdry. Co.; 1912-16, ch. dftsman C.N.R.; 1916-18, mech. engr. Illinois Central Ry.; thence to present position, vice-chairman, mech. div. Am. Railroad Assn., chairman committee on shops, Am. Ry. Engrs' Assn., chairman, Elect. Rolling Stock Committee, Am. Ry. Assn., gen. supt. motive power, i/c design, mtce. and operation locomotives, steam and elect., passenger cars, freight cars, power plants, shops and motor cars of Chicago, Milwaukee & St. Paul Ry. Co.

References: W. S. Atwood, J. M. R. Fairbairn, H. T. Hazen, S. J. Hungerford, M. H. MacLeod, A. F. Stewart, Sir H. W. Thornton, H. H. Vaughan, W. H. Winterrowd.

STAPLES—NORMAN WHITNEY of Montreal, Que., Born at Montreal, Sept. 18th, 1897; Educ. maths. and applied mechs. at Comm. and Tech. High School, Montreal; 1914 to present with Can. Vickers Ltd., Montreal; 4 yrs. apptce. as ship dftsman and with naval architect, also classes conducted by Co. in naval architecture, steam engrg. and applied mechs.; 1918-23, asst. to naval arch. involving design of ships' hulls, and calculations relating thereto, inc. estimating of costs; 1923 to present, in Industrial Engrg. Dept. on estimating and design.

References: J. J. York, R. Ramsay, G. Agar, A. Dawes, C .O. Thomas, P. Stokes

WHYTE—ANDREW of Three Rivers, Que., Born at Dollar, Scotland, Mch. 30th, 1889; Educ., 7 yrs. at Dollar Acad. Sci. Side 1898-05; 1906-11, Brit. Electric Plant Co. apptce. and evening tech. classes; 1911-12, Paisley Dist. Tramway Co. shift engr.; 1912-14, James Nimmo & Co., Scotland, asst. to ch. engr.; 1914-19 in army, corporal, 1914, 2nd lieut. 1915, lieut. 1917, capt. 1918, now capt in the Reserve of Officers; 1919-20, electrician i/c Aithen Colliery of Fife Coal Co. 1920-25, colliery engr. i/c all plants at two collieries, MacNeill & Co., Calcutta, India; at present, electrician in constrn. dept. Can. Int. Paper Co. Three Rivers, Que.

References: J. A. Shaw, K. O. Whyte, L. E. McCoy, A. I. Cunningham, C. N. Shanley.

FOR TRANSFER FROM THE GRADE OF ASSOCIATE MEMBER TO THAT OF MEMBER

JENNINGS—ROBERT BERNARD of Montreal, Que., Born at Paris, Ont., June 29th, 1888; Educ., 2 yrs. faculty of Applied Science, Univ. of Toronto; 1904-05 (summers), chainman, Niagara Power Co. and C.P.R.; 1906 (summer), rodman, Can. Northern Ont. Ry.; 1907 (summer), rodman and leveller, G.T.P. Ry.; June 1908 to May 1909, instrumentman and acting res. engr. G.T.P. Ry.; 1909-14, with Can. Northern Ont. Ry. as, 1909, leveller and res. engr. Toronto-Ottawa line, 1911-14, res. engr. Sudbury-Port Arthur line, Toronto-Ottawa line, and Hawkesbury-Montreal line; 1916-19, overseas as Major 10th Batt. Can. Ry. troops; 1919 to present time, div. engr. C.N.R. Toronto div., Ottawa div. and 1922 to date, Montreal div.

References: C. B. Brown, H. T. Hazen, R. A. C. Henry, J. E. Armstrong, G. R. MacLeod, R. M. Hannaford.

SMYTHIES—REGINALD ERIC of Toronto, Ont., Born at Portsea, Eng. Sept. 18th, 1888; Educ., 7 yrs. Christ Church Coll. Horsham, Eng.; 1904-09, apptce. with Day, Summers & Co. Ltd., Southampton, Eng., through various shops and depts., incl. drawing office, design of marine engines and boilers, etc.; served 2 yrs. at sea as engr. i/c watch on S.S. Garryvale; 1911, obtained Brit. Board of Trade 2nd engrs. certificate; during apptceship attended classes at Hartley Univ. Southampton, and passed exams. in applied mechs. machine constrn. drawing and practical maths.; 1912, joined staff of Clapham & Walker Ltd., Toronto, and shortly became mgr. of electric motor dept.; 1914, started the Lincoln Electric Co. with partner; 1916-19, overseas with R.N.V.R. as sub-lieut., 1917, lieut,. 1918, passed exam. in navigation and seamanship and was appointed to command of flotilla of trawlers and drifters; 1919 to present, vice-pres. and ch. engr. of Lincoln Electric Co. of Can. Ltd., i/c design and mfr. of induction motors and arc-welders.

References: H. G. Acres, M. V. Sauer, J. M. Oxley, W. P. Dobson, D. M. Fraser, A. V. Trimble.

FOR TRANSFER FROM THE GRADE OF JUNIOR TO THAT OF ASSOCIATE MEMBER

ADAM—JOSEPH A. of 488 Old Orchard Ave., Montreal, Que.; Born at Montreal, Que., June 1st, 1889; Educ., 2 yrs. McGill Univ. 1908-09; 1908, to present time on Public Works Dept. as follows: 1908, asst. engr. on hydrographic surveys; 1909, asst. engr. Richelieu River improvements; 1910 in the dept at. Montreal; 1911-12, tsfd. to Sherbrooke office; 1913 to date, asst. engr. at Montreal, i/c surveys, designed wharves, crib and concrete and supervised constrn., supervised dredging operations, i/c river improvement works, prepared plans for locks and dam, inspcn. ry. bridges, reports, etc. at present i/c constrn. works for Sorel Harbour.

References: K. M. Cameron, A. R. Decary, A. Surveyer, A. E. Dubuc, A. G. Sabourin.

STAVERT—REUBEN EWART of Montreal, Que., Born at Kingston, Jamaica, Oct. 3rd. 1893; Educ., B.Sc. McGill Univ. 1914; 1912 and 13 (summers) course at Gen. Electric Co. Peterborough, Ont., and Westinghouse Co. Hamilton; 1915-19, overseas; 1919-20, test course Can. Gen. Elect. Co., Peterborough; Apr. to Oct. 1920, mgr. repair dept. same Co.; 1920-21, Gen. Elect. Co. in Montreal; 1922 to date, with Brit. Metal Corp. Ltd., 1924-25, asst. in mining and milling in production of lead and zinc concentrates, 1925 to date, gen. mgr. responsible for mining and milling of lead and zinc in the company's operations in the Prov. of Quebec.

References: P. S. Gregory, C. K. McLeod, J. R. Donald, C. E. Sisson, A. B. Gates.

FOR TRANSFER FROM THE GRADE OF STUDENT TO THAT OF JUNIOR

COLES—ERIC MORRELL of Vancouver, B.C., Born at London, Eng., Dec. 2nd, 1895; Educ. B.A.Sc. Univ. of B.C. 1922; 1916-19, pilot in R.F.C.; 1920-21 (summers) surveying; 1922 (summer) machine shop work, Coast Quarries; 1923 and 24 (summers) Can. Westinghouse, Hamilton, test bed, and engrg. office, transformer dept.; 1922 to date, instructor of elect'l engrg. Univ. of B.C.

References: W. H. Powell, W. Smaill, G. A. Walkem, H. P. Archibald, A. J. Matheson, A. McG. Young.

DESBARATS—GEORGE HENRY of Ottawa, Ont., Born at Ottawa, Ont., Nov. 20th, 1900; Educ., B.Sc. McGill Univ. 1922, grad. Royal Naval Coll. of Can.; May to Sept. 1920 and Aug. to Sept. 1921, junior radio engr. and on operation and mtce. of radio station with Can. Govt.; May to Aug. 1921, jr. engr. at Youville shops of Montreal Tramways Co.; 1922 (summer) English Electric Co., St. Catharines, test elect'l apparatus; 1922-25, apptce. course of Can. West. Co., Hamilton, constrn. and testing of elect'l apparatus and design work; 1924 and 25 (summers) engr. lieut. R.C.N.V.R. i/c when on watch of operation of boilers and auxiliary machy.; Jan. to Mch. 1926, electrician on mill constrn. at Templeton with Fraser, Brace Co.; at present, journeyman electrician with Can. Comstock Co., on installation of elect'l apparatus in pulp and paper mill of Can. Int. Paper Co.

References: C. J. Desbarats, C. P. Edwards, T. C. Phillips, C. V. Christie, W. F. McLaren.

FARRAR—NORMAN of Montreal, Que., Born at Montreal, Aug. 27th, 1900; Educ. B.Sc. McGill Univ. 1925; 1923 (summer) constrn. work with Southern Can. Power Co.; 1924 and 25 (summers) chainman and instrman. Mtce. Dept. C.N.R., Montreal Dist.; Sept. 1925 to date, instrman, Riordon Pulp Corp. Ltd., topographical work for dam sites and power plant locations, chiefly surveying contours for flooded land areas.

References: H. M. MacKay, W. E. Blue. G. H. Frith, C. G. J. Luck, J. Weir.

GALBRAITH—REGINALD ARTHUR HARVEY of Fort Simpson, N.W.T.; Born at Toronto, Ont., May 28th, 1898; Educ., B.A.Sc., 1923, M.A. 1924, Univ. of Toronto; R.M.C. one yr. afterwards commissioned in Royal Engrs.; overseas as lieut. R.E. Signals; 1920, jr. receiving officer at Louisburg with Marconi Co. of Can.; 1921 (summer) jr. transmitting engr.; 1922 (summer) in radio lab. of Can. Indep. Tel. Co.; 1924 to date, officer i/c R.C.C.S. radio station, Fort Simpson, erected station and i/c operation for over a year.

References: A. G. L. McNaughton, E. Forde, W. A. Steel, O. S. Finnie, T. H. G. Clunn, P. Earnshaw.

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Diesel Engines

Their Early History, Development and Present Application

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Paper presented before the London Branch of The Engineering Institute of Canada, December 9th, 1925

The Diesel oil engine, the original patents of which were taken out in the year 1892, is named after its inventor, Dr. Rudolph Diesel, who, with the engineering firms associated with him, spent the following three or four years on tests and experiments.

Early Development

The first engine was constructed without a water jacket, and coal dust was used as fuel, the temperature for the combustion of fuel being obtained by compressing air to a sufficiently high pressure in the cylinder before injecting the fuel. Mechanical difficulties were experienced and also troubles from ash and grit remaining as products of combustion. Various features of the original invention were abandoned and modifications of others adopted, until, about the end of the year 1896 satisfactory results were obtained from an engine using oil as fuel and a compression pressure of about 470 lbs. per square inch.

In 1897 the first British-made Diesel engine was constructed in Glasgow. This engine was also the third Diesel engine in the world, and is still operating. The original Diesel engines were of the four-cycle, air-injection type, and the name of the inventor is therefore only strictly applicable to this type. However, the term " Diesel engine " is usually used to cover the two-cycle, and the mechanical or solid injection and other recent modifications as well.

The four-cycle engine having air-injection of the fuel, that is, the oil is carried into the combustion chamber in a stream of highly compressed air, and thereby resulting in a fine state of atomization, is probably the most popular yet. However, both the two-cycle principle and the mechanical means of fuel injection have been rapidly gaining ground during the last few years. Strong arguments are entered by supporters of all these principles, and we are probably far from standardizing any one type.

The reasons behind this gradual change from the original Diesel engine are the large power units required now; the necessity for the conservation of space; and the limit in cylinder capacity; all of which account for the substitution of the two-cycle for the four-cycle engine. It will be readily seen that of two engines, one of each type, having similar dimensions and running at the same speed, that the engine having only one power stroke in four will not develop as much power as the engine having one power stroke in two. One of the difficulties in the design of a two-cycle engine is that, because there are more power strokes per revolution, more heat is generated per unit of area of cooling surface which results in higher stresses in the cylinders and cylinder covers. However, in favour of the two-cycle engine there is also the argument that for marine work and other uses, in which the engine must be reversible, the two-cycle engine can be made directly reversible with fewer cylinders than the four-cycle engine, which, to be directly reversible, must have at least six and preferably eight cylinders.

The mechanical injection of fuel owes its place to the desire to do away with air compressors, which are apt to be a source of trouble and also consume a considerable portion of the power developed. The supporters of air injection, however, say that compressors are required in any case for the purpose of starting the engine. The value of this argument has been reduced more or less by a lowering of the starting pressures required. A typical pressure in the cylinder of an engine using air injection is 480 lbs., whereas 600 lbs. is frequently exceeded when mechanical or solid injection is used. Consequently for a cylinder of any given dimension using solid injection, the working parts should be larger and stronger than for a Diesel engine.

The latest development is the double-acting engine. In the first engine mentioned, the four-cycle, a power stroke occurred only in every four. In the two-cycle engine a power stroke took place in every two, but in the two-cycle double-acting engine every stroke is a power stroke, just as in a steam engine. The principal advantages of this type are obvious. The material used in its construction

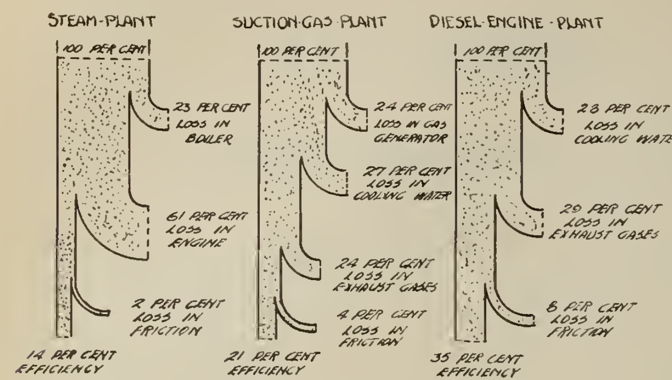

Figure No. 1—Comparison of the Thermal Efficiency of the Fuel for Steam, Suction-gas and Diesel Engine Plants.

is utilized to develop power more continuously than in other types, which reduces weight and first cost; two very vital matters. Another characteristic is that it may be made directly reversible with any number of cranks from two or three to eight, which enables any one size of unit to be adopted for a very wide range of powers, facilitating standardization and mass production to an extent much greater than has been previously possible with any type of marine prime mover. For example, a double-acting two-cycle cylinder developing 450 b.h.p. may be used in directly reversible engines of from 900 b.h.p. for a single screw to 7,200 b.h.p. for twin screws. The North British Diesel engine is of the two-cycle double-acting type. There are no piston rods and the cylinders reciprocate synchronously with the piston; the cylinder covers being stationary but separate from the cylinders.

Diesel engines are being made up to 12,000 h.p. There does not appear to be any practical limit. The power of the engine is dependent only on the size of the cylinders and the number of them.

Advantages of the Diesel Engine

In considering the advantages of the Diesel engine over other prime movers, the following points should be mentioned:—

1. No smoke.
2. No chimney.
3. Freedom from noise.
4. Small space occupied because of absence of boilers and other auxiliaries.
5. No deterioration of fuel such as occurs with soft coal or gasoline.
6. No carting of fuel or ashes.
7. Immediate starting from cold.
8. Neat and convenient storage of fuel.
9. Suitable for the most fluctuating loads.
10. Fire risks minimized, as only high flash point fuel used.
11. Absence of boilers or gas producers and their heavy up-keep.
12. No fuel consumed when engine standing by or not running.
13. No lamp, hot bulbs, sparking device, carburetor or vaporizer.
14. Fuel consumption controlled entirely by governor; does not depend upon skill of driver.
15. Contrary to the principle adopted in gas or oil engines of the ordinary type, the piston compresses pure air and not a mixture of air and fuel. This allows the use of a much higher compression as there is no danger of premature firing. The thermal efficiency of the engine increases in ratio with the compression; the Diesel engine, therefore, has a higher thermal efficiency than any other prime mover.

    The Diesel engine operates on a constant pressure system which means that when the fuel enters, instead of burning with explosive violence, as in the gasoline engine, it burns gradually and a constant pressure is maintained in the cylinder during that time. This means lower pressure and consequently lighter construction.

    Therefore the true province of the gasoline engine is in the lower powers, leaving the field of high power for the Diesel engine.

British manufacturers have not yet attempted a Diesel engine for the automobile. The various accessories to a Diesel engine such as compressors, starting bottles and piping, in addition to a fuel tank and cooling medium, would, no doubt, make this difficult.

A number of French and German manufacturers are working on it and recording satisfactory progress. Higher speeds than in the case of the aeroplane type are required and great flexibility in speed and power is essential. Speeds up to 2,500 r.p.m. have been attained and maintained for lengthy periods. The fact that fuel costs are reduced to one-sixth when using oil in place of gasoline, or as much as one-tenth on a light grade fuel oil, the advantages of an automobile type oil engine can be readily appreciated.

In the case of aeroplane engines, the use of non-volatile liquid is an important and most valuable asset. It makes this aspect of the problem of oil engine application particularly attractive. There are, however, many difficulties. The lowest possible weight, together with high engine speeds, does not introduce easy conditions under which the combustion of heavy oils is accomplished. Not much work has been done on this. There is one engine still in the experimental stage, which weighs three pounds per brake horse power for a total of 600 b.h.p., and operates at a speed of about 1,300 r.p.m. Some type of mechanical injection of the fuel is used.

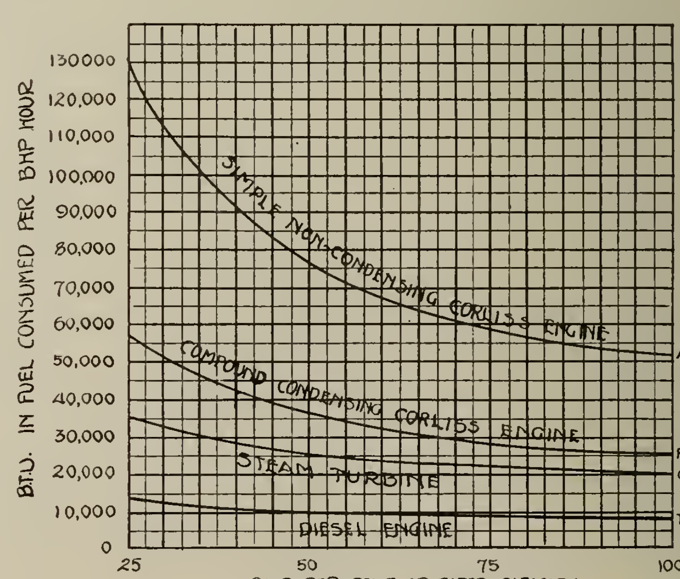

Figure No. 2—Average Consumption of Heat Units (neglecting stand-by losses.)

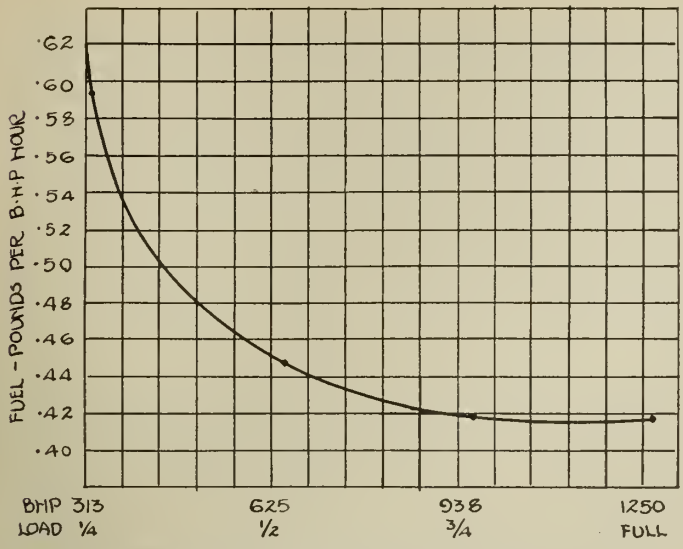

Figure No. 3—Curve showing Fuel Consumption— 1,250 B.H.P., 2-Cycle Marine Diesel.

The Diesel Electric Locomotive

In view of the recent activity of the Canadian National Railways with the Diesel electric locomotive, this function of the oil engine is particularly interesting at this time. The application of the oil engine to locomotive design is one of the few fields where, despite the promising scope, very little progress has been made so far, particularly in America. In Sweden, however, this type of locomotive has been used since 1913, and in 1923 there were twenty units up to 250 b.h.p. in service there. At that time it was calculated that, in proportion, the United States should have five hundred and sixty in service. British firms are devoting much time and money to experimental work. The starting torque embraces the crux of the matter for a successful and practical solution, and it has been suggested that a combination of oil and steam plant would further matters.

In the Canadian National Railways Diesel cars the difficulties of starting torque have been overcome by means of a Diesel engine electric drive. Two types of car are in use at the present time, one type a single car 60 feet long; the other type, called the " articulated type," consisting of two bodies on three trucks and 102 feet long. The engines used on these cars were manufactured by William Beardmore and Company, Ltd., of Glasgow. They conform to a modified Diesel cycle of the solid injection of four-stroke cycle type, and are arranged with four cylinders in line for the small unit, and eight in line for the large unit, and develop 185 b.h.p. at 700 r.p.m. in the small unit, and 340 b.h.p. at 650 r.p.m. in the large unit, with engine weights of 2,750 lbs. and 5,450 lbs. respectively.

One of the special features of this engine is its very low weight per horse power, which has been obtained entirely by a scientific use of materials. The thickness of the materials has been reduced to a minimum consistent with the required strength, using high tensile steels and special alloys throughout. The crank case is cast steel; the cylinder liners, forged steel; cylinder heads, cast aluminum; valve seats, alloy steel; pistons, forged aluminum; crank shaft, special forged alloy steel; sump cover, sheet steel; connecting rods, special forged steel. The aluminum pistons are fitted with six cast iron rings and one oil scraper ring. The exhaust from each cylinder enters a manifold on the side of the engine from which one exhaust pipe for every four cylinders is carried vertically up through the roof.

A centrifugal-type governor, driven off the crank shaft, is coupled to the fuel pump controls and so arranged as to increase or decrease the oil supply to the fuel distributing system. It is fitted with an emergency device to cut the fuel pumps out of action should the speed of the engine, for any reason, increase above that for which it is designed.

The electrical equipment on the two cars is quite different, and will, therefore, be described separately. That on the articulated car consists mainly of a 200-k.w., 600-volt, d.c., generator mounted on a common bedplate with the engine, and connected to it by a fast flexible coupling. The generator is differentially compound wound, the shunt field being excited from a 300-volt battery. The motors are railway type 548-C-8, 600-volt, 145 amperes (one hour rating), connected permanently in parallel and mounted two on each of the front and rear trucks and connected to the axles by helical gearing at a 24:65 ratio.

The engine is started by the generator driven as a motor from the 300-volt battery, this starting position being obtained from the controller by moving the operating handle contrary to its operating direction. The engine starting position is also the battery charging position when the car is standing. The 300-volt battery, by motoring the generator, brings the engine to a speed of about 200 r.p.m., at which speed it fires on the first compression, the starting current for about two seconds being a maximum of 480 down to 230 amperes at 150 volts. The battery voltage is applied to the generator through resistance steps, and at the same time the engine throttle is moved by an electrically controlled air cylinder to full fuel position.

Both cars have attained a speed on level track of approximately 60 miles per hour, and show a low fuel consumption. Both cars have sufficient power to handle a trailer over an average profile at a proportionally reduced speed.

Two world's records were broken on November 4th, 1925, when one of the new oil-electric cars of the Canadian National Railways completed a run from Montreal, Que., to Vancouver, B.C., a distance of 2,937 miles, in 67 hours. Not only was this the fastest run on record for such a distance, but it is the longest non-stop run in the history of rail transportation, as during the whole of the trip the engine of the car did not once stop running. From first to last the trip demonstrated the superiority and great possibilities of the oil-electric car, an entirely new type of transportation

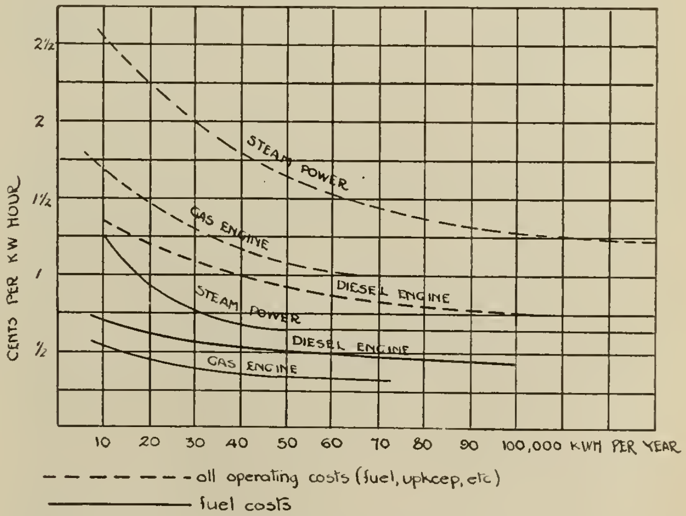

Figure No. 4—Comparison of Yearly Operating Cost for Various Companies.

TYPE	DESIGN				CONSTRUCTION				HORSE-POWER
	BRITISH		FOREIGN		STROKE		INJECTION		
	ORIGINAL	ARRANGE-MENT	LICENCE	ARRANGE-MENT	4	2	AIR	MECH.	RANGE UP TO
MEDIUM PRESSURE	1	—	—	—	1	—	1	—	320 (4)
	14	1	1	—	—	16	—	16	600 (6)
HIGH PRESSURE	2	—	6	2	10	—	10	—	8000 (8)
	3	5	7	—	—	15	15	—	3500 (6)
	1	—	—	—	1	—	—	1	2700 (8)
	3	2	—	—	—	5	—	5	3000 (4)
	24	8	14	2	12	36	26	22	
	48				48		48		

Figure No. 5—Magnitude and Capacity of British Manufacturers—Marine Type Diesels.

Note:—Low-pressure engines include all types using no higher compression pressures than 150 lbs. per sq. inch.

Medium-pressure engines—all types using compression pressures from 150 lbs. to 300 lbs. per sq. inch.

High-pressure engines—all types using a higher compression pressure than 300 lbs. per sq. inch.

evolved by the motive power engineers of the Canadian National Railways to solve branch line problems and to meet bus line competition. Arranged primarily as an endurance test for the engine, not only did the run prove this point but it also showed the speed possibilities of the car over long distances which had not previously been proved. At one point in western Canada the car covered twenty-two miles in less than 22 minutes and one of the steepest grades in the Rocky Mountains was climbed at an average speed of 40 miles per hour. The average speed for the entire trip was slightly under 43½ miles per hour.

The only American locomotive development of note recently is a 1,000-h.p. Diesel locomotive which was built this year by the Baldwin Locomotive Works.

The Diesel Engine in Marine Service

The Diesel oil engine has shown to best advantage in marine service. As a result rapid progress has been made, and manufacturers, having realized the scope for the oil engine as the main propelling agent of a vessel, at once set to work and so developed a plant meeting the varied requirements of the mercantile marine. The screw propeller operates most efficiently at speeds of from 100 to 120 r.p.m., and for this reason a direct-connected oil engine is eminently suitable. One of the difficulties in connection with turbine engines for ships is that the turbine runs most efficiently at high speeds and, therefore, for direct connection a compromise has to be made between the efficient turbine speed and the efficient propeller speed.

It has been stated, on good authority, that oil fuel in the dearest ports for Diesel engines compares favourably with coal fuel in the cheapest ports for steam engines. Again, Diesel engine ships which have shown a speed of 13½ knots on trial runs have maintained higher average speeds on actual voyages than steam ships showing 15 knots on their trial runs. The higher average speed in the case of the oil engine being accounted for by the fact that there are no fires to clean. It is interesting to note the flexibility of these marine engines for the purpose of manoeuvring. Engines of 2,000 h.p. running at full speed ahead can be reversed in seven seconds. The saving in space and tonnage is demonstrated by the statement that in a 12,000-h.p. ship the weight of machinery and fuel for a twenty-day voyage, when equipped with an oil engine, is 2,840 tons, and for a coal-fired steam engine is 6,180 tons. Statistics published in June of this year show that 50 per cent of the horse power of ships under construction is represented by Diesel engines. It is also interesting that to date 50 per cent of the marine oil engines in use are of the four-cycle type.

Various Uses on Land

Diesel engines are serving under a great variety of conditions on land. They are used extensively in electrical power stations, not only on single generators, but also on machines in parallel, which requires a very fine degree of governing. They are also used in districts remote from the central station to build up load until such time as it becomes profitable to extend the transmission lines. Later they can be moved into another new district, or tied in with the extended lines from the main station. In some cases it is profitable to install a Diesel engine for use on "peak load" only.

A case of this kind is now being worked out for the Public Utilities Commission of the city of London, Ontario. The Public Utilities Department is purchasing power at $25.00 per h.p. per annum on a "peak load" basis, and supplying the city with light and power, and also supplying power for street railway and waterworks. By the installation of a 1,500 h.p. engine developing 1,000 k.w. it has been found, from examination of the load charts, that it is only necessary to operate 200 hours per year to reduce the "peak load" by 1,000 k.w. or 1,330 h.p. This would mean a net saving on the bill for the bulk power purchased of $33,000 per annum. It has been assumed that as the human element would enter materially into the operation of such a stand-by engine, that it would only be safe to

TYPE	DESIGN				CONSTRUCTION				HORSE-POWER
	BRITISH		FOREIGN		STROKE		INJECTION		
	ORIGINAL	ARRANGE-MENT	LICENCE	ARRANGE-MENT	4	2	AIR	MECH.	RANGE UP TO
LOW PRESSURE	13	—	—	—	13	—	—	13	160 (4)
	2	—	—	—	—	2	—	2	35 (2)
MEDIUM PRESSURE	6	—	—	—	6	—	—	6	320 (4)
	24	2	1	—	—	27	—	27	500 (6)
HIGH PRESSURE	6	—	1	—	7	—	7	—	1000 (8)
	—	1	1	—	—	2	2	—	1500 (6)
	13	1	1	—	15	—	—	15	900 (6)
	1	—	1	—	—	2	—	2	600 (6)
	65	4	5		41	33	9	65	
	74				74		74		

Figure No. 6—Magnitude and Capacity of British Manufacturers—Stationary Type Diesels.

figure a saving of half the above amount, or say $16,500. The cost of operating the engine for 200 hours a year, taking the operation costs at 1.35 cent per k.w.hr., would be only $2,700. Deducting this amount from $16,500 leaves an amount of $13,800, which is sufficient to pay the interest and depreciation charges on an investment of $150,000. The result of such an installation would be that the public utilities of this city, such as waterworks, street railway or street lighting, would be afforded a stand-by to the hydro-electric system at no additional cost.

For street railway service with heavy, variable loads and long hours, the Diesel engine is particularly suited, as the full benefit is obtained of the high fuel economy at light as well as heavy load.

Many oil engines are used to drive, by gears, a high pressure plunger pump on pipe line service. It is a very strong recommendation of the reliability of Diesel engines that so many of them have been chosen for this service where reliability is so essential. Two 1,500-b.h.p. engines are direct-connected to large fans used for ventilating the longest railway tunnel in North America. When no traffic is passing and the tunnel has been cleared of smoke, the fans are shut down, but it is very necessary that the fans can be put in service at any time at full power in a very few minutes. The Diesel engine is especially well suited for this work. A buzzer in the station signals when a train comes into the block at either end of the tunnel, and by the time the train reaches the tunnel, the engine-driven fans are in operation at full power. It is apparent that in such service there will be considerable periods between trains, when the fans will be shut down, and the fact that Diesel engines use no fuel whatever while not in operation was one of the important reasons for choosing this type of engine.

Diesel engines are often employed in cement mills. The making of cement is a continuous process and requires operation of the power plant continuously at practically full load. In this service the savings made by the oil engine, due to its superior fuel economy at this high load factor, are so pronounced as to seriously challenge any other kind of power.

The fact that the Diesel engine eliminates the usual boiler room with its accompanying soot and smoke, makes it a desirable prime mover for use in flour mills, both from the viewpoint of cleanliness and saving in space.

For an ice plant the compressors require a great deal of power continuously, and an interesting thing about such a plant is that it was in seeking to produce more efficiently the large amounts of power required for this service, that Dr. Diesel originated the principles on which the Diesel engine works.

The comparatively small space requirements of Diesel engines make it a desirable engine to drive a low lift centrifugal pump in an irrigating plant. As the suction lift of a centrifugal pump is limited, the whole unit in some cases has to be placed in a well and this engine allows the well to be of moderate size. These plants are often in out-of-the-way places, and the fact that the fuel transportation problem is simplified is important.

Among the other locations where the Diesel engine is working to advantage is the cotton seed oil mill, sugar plantation and mill, the quarry and the mine.

The Development of the Outside Plant of the Bell Telephone Company of Canada

Historical Facts, with a Review of the Development, Field Engineering, Construction and Maintenance

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Paper read before the Montreal Branch of the Engineering Institute of Canada, February 25th, 1926

As a matter of historical interest, a reference in regard to the invention of the telephone may not be out of place.

We, as Canadians, are proud that a great deal of the constructive work leading up to the invention of the telephone was carried out in Canada prior to the result on March 10th, 1876, at Boston, when the first connected sentence was transmitted, thus enabling Professor Bell to file his patent papers. That Canada should be always linked with any statements made in regard to the invention of the telephone, is borne out by Professor Bell's father, who, in an address to a Canadian audience on the telephone in 1878, the original manuscript of which is in existence, said:—

> "It will not lessen your interest in the telephone to be informed that the birthplace of the invention is Canada. It was here that the theory of the instrument was explained and it was here that the first constructive experiments were made—the first public introduction of the completed telephone was made in the United States."

The statement made in 1878 was corroborated by the inventor, Professor Alexander Graham Bell, who, in his address at the unveiling of the Telephone Memorial at Brantford, Ont., in October, 1917, made the statement, "The telephone was conceived in Brantford, although born in the United States."

The first outside telephone plant in Canada was undoubtedly the wire erected on a fence from Professor Alexander Graham Bell's residence to the residence of a Mr. Henderson nearby, at Brantford, Ontario, in the summer of 1876 and used for constructive experiments in the transmission of speech.

Development of Outside Plant

Broadly speaking, "outside plant" as referred to in this paper comprises all structures, apparatus and appurtenances required to connect the central office with the subscribers' stations and to connect the various central offices with each other.

The outside plant is broadly divided into two main classifications, toll and exchange. Toll plant may be defined as that portion which is used for toll service, *i.e.*, service which carries a charge in addition to that covered by the contract for local service. Exchange plant consists of all plant used principally for exchange or local service.

A limited development of outside telephone plant took place between 1877 and 1880. In 1880, The Bell Telephone Company was organized and absorbed a number of small exchanges operating at various points in Ontario and Quebec. In subsequent years the company operated exchanges in the Maritime and Prairie provinces for a time;

now their field of operation is confined to the provinces of Ontario and Quebec. At the time of the organization of the company, and for a number of years later, there were no written methods or specifications for the construction of outside telephone plant. The only people who had experience in construction of wire lines were those who had been employed in the telegraph service, and it, therefore, naturally followed that the telephone outside plant was modelled after the ideals followed by the telegraph companies.

With the rapid increase in the use of the telephone, necessitating many wires, modifications of the telegraph practice had to be developed, such as increasing the size and capacity of crossarms to 8 wires, then to 10 wires. With the increasing demands for telephone service, it became very difficult to carry the large number of wires. Galvanized iron wire No. 12, New British Standard gauge, had been adopted as a suitable conductor for telephone service, and is still largely used for short lines where open wires can be maintained and other conditions are suitable.

With the ever-increasing number of wires, the number of crossarms on the poles necessitated very long poles, many being over 50 feet in height. To provide greater capacity per arm, insulators were attached under the crossarms which allowed the carrying of 16 wires on an eight-pin crossarm and 20 wires on a ten-pin crossarm. Iron wire, in addition to having a comparatively short life in cities on account of smoke and gas, was also found to be too heavy for the crossarms, which were at this time attached to the poles by 2 or 3 spikes. No. 16 steel was used extensively to reduce the weight, but as its life was unsatisfactory, No. 17 bronze wire was used in cities and gave excellent service. All lines were single with earth return. Where the lines were of short length and in open wire the crosstalk, though objectionable, was not serious, but as the number and length of lines increased, crosstalk also increased.

Difficulties arose as to supports for the wires, more particularly near the central offices, as many pole lines were now carrying from 10 to 18 arms, with 10 to 20 wires per arm, and in many sections of the cities roofs of buildings were used on which large frames were placed as supports, as poles could not be placed, particularly in narrow streets, such as in the business sections of Montreal. The solution of this problem was realized to be in the use of cable, but as the manufacturing of cable was in its infancy, it was difficult to obtain and this only in comparatively short lengths.

Among the first cables used in Canada were those made by The Bell Telephone Company, and were composed of No. 18 annunciator wire, wrapped together by hand and then drawn through an ordinary lead water pipe. It is needless to say that this type of cable did not improve the crosstalk situation.

Up to the time when the twin or twisted pair conductor cable was developed there were placed on the market by foreign manufacturers various types of cables with different so-called induction and anti-crosstalk killers; a favourite was tinfoil, spiralled outside of the jute or cotton insulation around each conductor. Someone had the theory that the voice would follow a spiral, but the induction would get whipped off by following the spiral. In some cases such cables were augmented by a large-sized bare conductor in the centre of the cable, which when grounded was supposed to overcome crosstalk.

During this period of development the cable terminal apparatus largely consisted of a plain wooden box with binding posts, consisting of wood screws or washers, brass binding posts, with a wooden screw, then wooden terminals and later iron terminals in which cable was ended and the terminal filled with hot paraffine. Protectors were gradually developed, the first in use followed the telegraph practice made up of saw tooth plates on line and ground.

With the installation of electric lighting, a serious noise problem developed on the telephone lines. Many telephones were practically useless during the time the electric light plant was in operation. Fortunately the lighting systems for some time were only operated at night.

The scheme of using a common return ground was developed and used extensively. This return consisted of a W.P. covered copper wire ranging from No. 9 to No. 4 B. & S., according to the number of telephone lines. This return was carried on a bracket with an insulator, and generally located as near as possible to the centre of the mass of telephone lines.

Each telephone was connected to the common return, the earth connection removed at the subscribers' station, and the return was connected to the ground at the central office.

This system gave considerable trouble, but was more or less satisfactory until the electrification of street railways. In Montreal this change in railway operation took place some time about 1892, after which there was no alternative but to convert all telephone lines to full metallic operation.

The first underground conduit system in Canada was installed in Toronto in 1889, when 63,360 feet of duct was laid, and which has now grown in that city to 4,695,504 feet. The construction of a conduit system in Montreal followed in 1890, and was laid on St. Catherine street, from Mountain to Bleury streets, and consisted of 75,191 duct feet; the system now has 4,817,736 duct feet. The first duct used was creosoted wood, and is still in use and apparently in as good condition as when laid. Vitrified clay duct has been almost exclusively used by The Bell Telephone Company of Canada, whose underground system in Ontario and Quebec, the territory in which it operates, now contains 3,042 miles of duct in 703 miles of subway.

The cables available for placing in the first underground ducts constructed in 1889 and 1890 were lead covered 50 wire No. 19 B. & S. gauge with cotton insulation boiled in paraffine.

During the subsequent years, continued development of cable was carried on by the American Bell Telephone Company and the Western Electric Company, and during this period dry core paper insulation was developed.

Step by step, gradually and steadily, the No. 22 and No. 24 B. & S. gauge cable development has progressed, and, as a result, cables with 400 pairs, 600 pairs and 900 pairs were successively designed, and to-day it is now possible to place in a single lead sheath, 2⅝ inches in diameter, as many as 1,200 separately insulated metallic circuits.

In 1902 the first telephone cable was manufactured in Canada by The Wire and Cable Company (now The Northern Electric Company), the largest size at that time was 100 pair and at the present day 1,200 pair.

There was a real demand for development in cables to carry more conductors. The first conduit system was built for cables carrying 50 lines, and estimates for growth were based on that capacity per duct, later on a duct capacity of 100 lines, then for a duct capacity of 400 lines.

During this period we built for the future better than we knew, as the development of cables with a larger number of conductors and approximately the same size of sheath has provided the possibility of replacing in an existing duct system the cables having a small number of wires by cables having a much greater number of wires, which has offered opportune solutions to many critical demands for more wire facilities without reopening the streets to add ducts.

To-day The Bell Telephone Company of Canada has 1,530 miles of cable in its exchange underground system, in which there are 1,115,093 miles of wire. Of this amount, Montreal has 481 miles of cable, containing 344,187 miles of wire, and Toronto has 505 miles of cable containing 425,409 miles of wire.

With the development of stranded steel messenger wire, cable clips and brackets, together with cable terminals to keep pace with the increasing size of cables, aerial units of cable up to 400 and 600 pairs can be economically erected and maintained. Types of terminals with distribution facilities, combined with splicing design of the underground cables, has increased the flexibility in use of the conductors, thus deferring at many points the necessity of constructing an expensive underground conduit system.

To-day The Bell Telephone Company has 3,260 miles of cable in its exchange aerial system, of which there are 424 miles in Montreal and 708 miles in Toronto.

The Bell Telephone Company of Canada use northern cedar poles exclusively, which are more or less plentiful in its territory. The company has 840,221 poles in its exchange and long distance system. From a survey, the supply of cedar timber within reasonable shipping distance will no doubt equal their demand for some years for the class of pole now largely used. The annual requirements heretofore for the class of poles used will not materially increase, although the system will continue to expand, for the following reasons:—

With the increased use of aerial cable, the average size of pole for telephone purposes has been considerably reduced; the trend for conservation of poles by public utility companies entering into agreements for joint use means the use of one pole in place of two, and also the efforts now being made to prolong the life of poles by butt treatment of those already in service and those to be placed in use will in time effect the requirements for annual replacements. As the source of the cedar supply becomes more distant, requiring higher freight rates, with the possible difficulty to obtain, the use of other classes of treated timber with a much longer estimated life, such as jack pine, particularly for lines in the country, will no doubt extensively replace the use of cedar in the future.

The close association and working agreement with The American Telephone and Telegraph Company gives The Bell Telephone Company the advantage of the extensive study and tests of materials by that company, and from the information obtained specifications and standards have been adopted for material and supplies required to make up the various component parts of the outside plant. The specifications and standards required by the various Canadian companies using pole line hardware unfortunately lacks uniformity, therefore the consumers do not obtain the advantage of mass production by the manufacturers. It is hoped that the work of the Canadian Engineering Standards Association, who have already issued standard specifications for galvanized wire for telegraph and telephone, steel wire strand, poles, etc., will be extended to include items of pole line hardware which will be satisfactory for all users.

Complete and comprehensive engineering specifications are now in the field covering the various standard requirements for construction, embracing the following:—Pole lines, aerial wire, guying, aerial cable, drop wires, cable terminals, block wires and cables, underground conduit, underground cable placing and cable splicing.

The specifications provide for various classes of construction suitable for the particular requirements of the service in any locality, that is to say, the standard to be used is controlled by the type and size of the units to be constructed immediately, as also the units and time of future or ultimate requirements. In the telephone industry the obligation is to be prepared to give service as required and deliver it when and as it is required. Furthermore, regardless of the remoteness of the territory or of the physical and climatic conditions involved, that a way be found as far as practicable to construct and maintain the plant and safeguard the service to the public.

To meet these exacting requirements calls for ingenuity and foresight in the design of the plant, and involves careful study of various plans for plant extensions and rearrangements with a view to the solution of the most economical and desirable plan.

Estimates of Future Requirements

It was early recognized that one of the most important engineering problems of The Bell Telephone Company was the formulation of estimates of expected future telephone business, both as to quantity and expected location, and the development from these estimates of basic plans of procedure, which plans must, of course, be flexible and capable of modification from time to time as changing conditions show them to be advisable.

The first step in determining the estimated future telephone requirements is to prepare a " commercial survey " covering the requirements 15 to 20 years ahead. These studies include an analysis of the existing market for telephone service, facts as to the present sale of telephone service, of classes of service and users and forecasts of the market for service at future date or dates. Consideration is also given to the growth and distribution of populations and assumptions of the amount of business that must be sold in each area on the future dates selected under assumed rate conditions. Having thus determined from the " commercial survey," the requirements for various parts of a city at the future date assumed, the next essential to develop is a comprehensive plan to serve as a basis for the layout of the plant to meet these requirements.

A so-called " fundamental plan " is made for the community covering the conditions as estimated 15 to 20 years hence. The importance of such a plan is obvious.

In laying out a plan for a city, the engineer might, as an extreme case, centre all the subscribers' lines at one building, which would give high efficiency in operation in some respects, as the switchboards would be grouped together, but outside plant costs would be abnormal and other disadvantages would be experienced. As the other extreme, the engineer might place many buildings throughout the city, thus placing the outside plant costs at a minimum, but increasing the difficulty and expense of operating so many centres.

Obviously there is some arrangement between the two extremes cited which would provide an economical and satisfactory layout of the plant. Therefore, several test plans must be set up, and those which in the judgment of the engineer seem promising are therefore studied and the most economical and satisfactory plan determined upon. In completed form, the " fundamental plans " furnish us with the following essential information upon which to proceed with the more detailed studies covering plant extensions:—

(a) The number of central office districts which will be required to provide the telephone service most economically and their boundaries.
(b) The number of subscribers' lines to be served by each central office.
(c) The proper location for the central office in each district to give service economically with regard to cost of outside plant, land, buildings and the economical number of switchboard units in each building.
(d) The proper streets in which to build underground conduit in order to result in a consistent and economical distributing system reaching every block to be served by underground cable.
(e) The most economical number of ducts to provide in each conduit run as it is built.

Experience has shown that fundamental plans reduce guesswork to a minimum by utilizing the experience of years in studying expected telephone growth in order to make careful forecasts. The fundamental plans, together with related studies, provide a general programme of plant extension to be followed throughout the period for each of our cities. Both the ultimate plan and programme must have flexibility to meet unforeseen requirements and must work in satisfactorily with the existing plant, meet immediate service requirements and permit advantage being taken of new developments in the telephone art.

Owing to the complexity of the problem of suitable advance planning for growth in the telephone plant, study and selection must generally be made between a choice of arrangements. It is usually necessary, therefore, that two or more practical plans or programmes for construction be prepared so that the most advantageous plan may be selected.

An important factor in the selection is a study of the relative economies of the different plans, that is to say, a comparative cost study. The cost study requires analysis and consideration of the cost and resulting annual charges for different amounts and types of plant, and also losses on plant removed included under each plan. This is important in assisting to reach a decision as to the most desirable plan, but requires, in addition to all the definite facts that can be brought to bear on the question, the exercise of sound judgment and experience in weighing the results of the study with all related factors bearing on the problem. Factors in these studies are often of a character which do not permit of expression as a direct charge against a given plan, but must be considered on a broader basis, such as the difference in quality or dependability of the service. Finally, throughout all the work of preparing fundamental plans and a construction programme, the fact to be kept foremost in mind is that the telephone system exists for the purpose of furnishing service to the public, and the results of the effort should insure a service which is satisfactory from the subscribers' viewpoint.

Development and Construction

The commercial survey, fundamental plan and construction programme having been developed by the general commercial and engineering departments covering a relatively long period picture of the situation, it then follows for the division plant engineer to keep in close touch with the growth of telephone lines and with all major building operations and developments of or changes in the character of the various areas of the city and undertake the preparation of construction plans as required, so as to keep at all times sufficient outside plant facilities to meet the demands of the public for service.

The specific or detailed plan for each major project of plant extension must be started early enough so that adequate time is allowed for completion of the construction work before the new facilities are required. The complete interval between starting on such a project and getting it into service can seldom be less than a year.

In the early days of the telephone business, when the plant consisted chiefly of a combination of aerial wires and poles, the problems were comparatively simple and there was no great need for pre-arranged plans and intensive engineering study. The rapidly growing complexity of the situation is, however, constantly introducing many difficult problems which can best be met, and, in fact, can be satisfactorily met, only if a broad plan, giving full consideration to the future possibilities in their relation to the existing plant, is developed and adhered to.

In designing the plant, the future extensions must always be considered, as if a cable is placed to-day in a conduit or a cable placed on a pole line, its design must be such that it can be adapted to meet future changing conditions with the minimum expenditure for changes. The detailed plans, which may comprise conduit, underground and aerial cable, block cable, pole lines and open wire necessary to meet the service requirements in an orderly and economical manner, presents a real problem in the process of fitting together the piecemeal extension into a homogeneous and well-balanced plant capable of providing satisfactory service and earning a reasonable return on the investment.

It might be of interest to discuss briefly some of the problems requiring cost studies which are encountered by those engineering the outside plant. We have a plant consisting of poles, wires, cable, conduit, etc. It must be expanded in some respects to meet service requirements for the immediate future; certain portions are deteriorating to some extent and others, because of improvements and changes in the art, are becoming more or less obsolete. It is estimated that it will be necessary to spend considerable money to be able to continue to meet promptly the public demands for service. How shall this money be spent? Shall the poles carrying cable and wire be replaced by conduit and underground cable, or would it be more economical to continue over a period of years, to bring the pole lines up to satisfactory strengths and reinforce the existing aerial cables?

Of course, there are numerous features to be considered in this problem, among which would be the transmission requirements involved, the future central office locations and possible changes in class of service, all of which would have a very direct and important bearing upon the design of the plant.

A problem might be cited where a particular cost study would involve the question of placing additional aerial cable to reinforce an existing one as against replacing the existing aerial cable with one of suitable size to meet the requirements for a given period. Such a study might indicate that it would be cheaper, both in point of new money required and in the present worth of annual charges over the period, to reinforce the existing cable. In consideration of the known facts and such assumptions as were made with regard to the probable growth, etc., this answer might theoretically be the correct one. However, before making a final decision, there are many pertinent questions to be answered with regard to numerous items which are difficult to evaluate and which surround practically all studies of this nature. In problems of this kind, intimate knowledge of the plant and the picture of potential possibilities tempered by past experience and the exercise of good judgment is required to design piecemeal additions to the plant, so that they will contribute towards making for an economically sound investment.

The work of design and development of the outside plant also involves, to a large extent, relations with other wire-using companies, more particularly with electric power and electric railway companies, as important problems of safety and of service arise due to the proximity between their electric circuits and the telephone circuits. These problems involve provision not only for the protection of the plant and employees against the danger of contact with the wires of other companies, but also include co-ordination of the two systems to prevent excessive inductive effects which often become important where electric power lines or electric railways and telephone lines run parallel to each other.

The electric companies and the telephone company often find it advantageous to enter into arrangements for the joint use of pole lines, which in general has, by long years of experience, been found to possess advantages and economies of great benefit to the wire-using utilities. If the principles and practices which have been developed to cover joint use of poles are adhered to, there is every reason to believe that safety, good service and economy will be insured and that the most efficient and economical use will be made of the poles required for distribution service in the plants of the power and telephone company.

Another problem in the design and development of the outside plant is the desire of municipalities to have the streets cleared of poles and wires. The Bell Telephone Company has always been sympathetic, and in the study and design of plant extensions this feature among the many discussed, is taken into serious consideration.

The company's relations with the municipal corporations of the various cities and towns of Quebec and Ontario bear out that every endeavour, when economically possible to do so, has been made to improve the appearance of the streets.

In the foregoing, some of the major considerations affecting the design of the exchange outside plant have been referred to, which also, to a more or less extent, applies to the design of the outside toll or long distance plant.

In 1925, The Bell Telephone Company of Canada spent $5,356,240 on outside plant, with estimated expenditures for the years 1926-1930 of $27,723,000, or an average of $5,544,000 per annum. The average of the two large cities, Toronto and Montreal, is about $1,000,000 each. Obviously, with a programme of this magnitude and of such diversity in the character of its related units, careful advance planning and careful designing is necessary to insure economical and satisfactory development and performance.

In the cable distribution plan it is important that the arrangement of the pairs of conductors at the several terminals be so ordered that the distribution may be as flexible as possible. Access to each wire in every cable is made possible by terminating the wires separately on the main distributing frame in the central office, from which point the cable is extended in the underground as a main cable, portions of which are then bridged for distribution as required. Provision is made for connection between the underground cable from the central office and the aerial cable, by means of a protecting lateral pipe from the manhole to the pole in which the cable is carried to a cross connecting terminal, containing fuse post chambers for the underground cable conductor termination and binding post chambers for the aerial cable conductors. This terminal provides electrical protection for the cable and central office equipment. The cross connecting feature between the underground and aerial conductors also makes for a high degree of flexibility. The plan for the main underground cable having provided for bridging at various points with pairs of wires multiplied at two or more underground and aerial junction terminals, a similar plan of multiplying conductors in two or more aerial cable terminals is also provided for, all of which gives flexibility and greater use of the cable plant. This is important, as even in the best designed telephone cable plants there is always a large percentage of copper conductors which cannot be used.

The cabling of the average city block may not appear to present features involving any great amount of study on the part of the engineer, yet it is rarely the case that requirements for any two blocks are sufficiently alike to apply the same plant layout. Generally speaking, each block must be given careful and individual engineering consideration in order that cable may be provided and the necessary terminals, etc., located as to care economically and properly for present and future developments.

Very closely associated with the features of design are those involving construction of the plant. To accomplish the best results, the design must be engineered to meet the limitations of current construction practice and methods and according to the various standard specifications which have already been mentioned.

Beyond the telephone instrument on the subscriber's premises, a very complex and extensive telephone plant is necessary with which the public in general are unfamiliar, and it is the construction of the outside portion of this plant which will now be briefly described.

From the protector placed in the subscriber's premises, except where cable is carried direct to a terminal inside a building, such as an office or apartment building, connection is made by what is known as a " drop wire " made up of twisted pair rubber insulated conductors to a cable terminal, or direct to open wire on the pole where open wire rather than cable is maintained as the feeder.

" Drop wire " connection with the cable plant is made by means of a distributing terminal mounted on the pole at a convenient location.

In closely built-up sections, both residence and business, where there would be a considerable number of wires involved, a block cable is often installed on the building walls and terminals placed at frequent intervals care for the distribution. In this type of construction, the cable is secured to the walls of the buildings by clamps. " Block wires," which are similar to drop wires, are used for entering the premises.

In aerial cable construction the placing of the steel supporting strand preparatory to installation of the aerial cable is a problem of considerable importance. For determining the proper tension in supporting strand, an ingenious method based upon the theory of the oscillating pendulum has been devised. This method for practical application has been reduced to a simple direct reading table from which the tensions under varying conditions of cable load can be predicted. It is important that the tension in the strand before placing the cable be predetermined, so that when the cable is in place the final tension in the strand and the sag of the cable will be within the allowable limits of safe construction. After the strand has been erected a lineman rides it and places the rings at proper intervals to support the cable. As the rings are placed a drag line is drawn through them to which, upon completion of a section, a pulling-in line is attached and drawn into the rings for use in connection with the actual installation of the cable.

The cable, having been made fast to the pulling-in line, is pulled through the rings usually by a winch-equipped truck which under ordinary conditions operates at about 200 feet of cable per minute.

The aerial cable when unnecessary to provide for local distribution can be placed in sections ranging from 600 to 1,500 feet, depending upon the size of the cable. It is then spliced and connected into the underground cross connecting terminal and to the various distributing terminals already mentioned. In placing underground cable in conduit the operation is quite simliar to that previously outlined for aerial cable, except that the speed of installation is considerably reduced. Underground cable is generally pulled in at a rate of not over 90 feet per minute, the speed largely depending upon the size of the cable, condition of the duct, number of bends in the run, length of section, etc.

The splicing of cables presents quite a complicated operation, as a very large number of joints have to be made and separately insulated by cotton sleeving in an extremely restricted space. For example, in a straight splice of a twelve hundred pair cable, twenty-four hundred joints are encased in a lead sleeve 4½ inches in diameter and 20 inches long. In addition, bridged splices of varying sizes are necessary for distribution purposes, also splices for connecting loading coils, which adds considerably to the complicated operation.

Under favourable conditions a maximum of 150 pairs of conductors per hour can be spliced. Each conductor splice is made by hand. Cable splices are boiled out with hot paraffine at intervals during the operation, and also when the splice is completed, after which the lead sleeve is drawn over the splice and the joints wiped.

In the larger central offices a cable vault is usually provided in the basement of the building into which the cables are extended from the nearest manhole. From the vault the cables are extended to the main distributing frame. In those cases where the main frame is located on the floor directly above the cable vault, lead covered silk and cotton insulated cables connect with the paper insulated cables in the vault and are extended to the main frame and terminated thereon. Where the main frame is not so well situated the paper cables are extended through conduits and connected at some convenient point with silk and cotton insulated cable for the termination at the main frame, on which access to each wire in every cable entering the office is made possible. The main distributing frames vary in capacity per terminating strip from 200 to 400 pairs. Where 300- or 400-pair frames are used a mezzanine floor is generally provided in order that it will be possible to reach any pair without the use of a ladder. The individual cables in such cases are terminated either all above or all below the mezzanine, in order that any pair of a cable will be available from that point.

There is another interesting phase of the telephone development: the outside plant of the toll or long distance system of the company.

In 1880, when The Bell Telephone Company of Canada was organized, there were only two places, Hamilton and Dundas, connected by telephone. In 1881 the development of the long distance system was initiated by the construction of lines between Hamilton and Toronto, Windsor and Amherstburg, Montreal and Lachine and a submarine cable connecting Windsor with Detroit, amounting to 70 miles of poles and wire. The system now consists of 122,326 miles of wire and 9,590 miles of poles.

In the early days of long distance communication, with only the tradition of the telegraph to emulate, the ground return iron wire circuit was used, but what worked well for telegraph was soon found to work poorly for the telephone on account of interference from telegraph and earth currents. It was also found that when more than one circuit was required that it was impossible to use them simultaneously. It was recognized that induction was the source of these troubles. It is strange, as we see it now, that the ground return was used, but the telegraph influence was strong. It took considerable courage to try the metallic circuit, and the successful solution of which it gave promise had to wait for the development of hard-drawn copper wire. Iron wires could support themselves on pole lines, but with them the metallic circuit still had limitations. With the coming of hard-drawn copper wire, the metallic circuit came into its own. There were still problems of crosstalk from neighbouring circuits, which was overcome by the use of wire transpositions. Crosstalk and other extraneous influences have always offered serious problems, and the success of a telephone circuit is not assured until these are solved.

Prior to and for some time after the above refinements were made in the telephone line the ground return iron wire circuit rendered fair service in a number of towns. With the early difficulties of the telephone circuit fairly well solved, lines were built here and there with ever-increasing public demand for more facilities and greater distance. These increasing demands presented important problems; more wires had to be provided and distance had to be increased. Furthermore the existing wire facilities had to be used more effectively.

The Phantom Circuit, Loading and Quadded Toll Cable

The problem of more communication channels without more wires brought about the development of the " phantom " circuit. The " phantoming " of circuits calls for one pair of wires to be used jointly as one wire together with another pair of wires used jointly as the other wire to form a third circuit and so three telephone conversations are carried by four wires. Where this system is applied to open wires, special transposition plans must be carried out in addition to the regular physical wire transpositions.

A considerable stride in increasing distance talking was brought about by the development of the " loading " coil for telephone circuits. By applying these coils to cable conductors and open wire lines of moderate size, transmission efficiencies even higher than those attained with large conductors could be secured and the heavy expenditure for large copper wires avoided.

The increasing use of long distance service between important points and the problem to provide for future growth with open wires has been met by the development of quadded toll cable. The toll cable development based on the use of repeaters, loading coils and many other technical improvements now make it possible to give satisfactory service for long distances over toll cable circuits of such small gauge conductors that about 300 circuits can be included in a sheath 2⅝ inches in diameter. The same number of circuits would require four or five heavily built pole lines of open wire.

This company placed in service its first long toll cable extending from Toronto to Hamilton, 40 miles, in 1924. The cable is carried underground at the Toronto and Hamilton ends and on poles for the balance of the distance and replaces three heavy pole lines of open wires. It may be of interest to state that in the designing of this toll cable provision has been made for the extension of a toll cable west and south of Hamilton at the time when the open wire facilities will have to be supplemented or replaced by cable.

Maintenance

Having followed the development and construction of the outside plant through various stages, perhaps a few words regarding maintenance would be of interest.

Maintenance may be divided into two main classes, corrective and preventative. The average unit of plant, regardless of how well it may have been designed and installed, is subject to wear damage or may develop defects during its period of usefulness. These defects, while they may not in themselves either seriously impair or affect the service life of the plant, will, if allowed to accumulate, result in a gradual lowering of the quality of the service and will in general tend to shorten the service life of the plant.

One of the very important elements in the giving of good service is to insure that the proper grade of transmission is maintained, first in the toll plant, and second in the exchange plant which also serves as the terminal for toll connections.

A high grade of maintenance is required on the outside plant to meet the demands for operation of the complex apparatus and equipment now used on telephone lines. Testing apparatus, routines, practices and records have been developed for periodic tests so that corrective or preventative measures may be applied which will give assurance that all the features which go to provide good telephone transmission are being maintained. Furthermore, testing equipment, records and efficient methods for quickly and accurately locating the various troubles to which a telephone plant is subject has been developed to a very high degree.

A few years ago if a break in a long distance circuit was located by the tester within a mile or so of where it actually was it would be considered good work. To-day with the modern toll test board equipment, a large percentage of interruptions are located by the tester within a few hundred feet. With the development of cable testing equipment at a central locating bureau in multi-office exchanges, efficient methods have been developed of quickly locating cable troubles. The bureau is connected by circuits extending to the various central offices within the bureau's operation and equipped with records of the cable plant, thus enabling the results of loop tests to be readily associated with the cable maps and diagrams to show the location of the troubles with respect to poles or manholes. Upon completion of the location, particulars are referred to the cable department and repairs are immediately undertaken. In this way cable troubles are cleared with a minimum of expense and so quickly after detection that a complete failure of a cable is unusual.

This paper gives some historical facts of the manner in which the outside plant has been developed. Also in a sketchy manner the various field engineering steps for present and future requirements, and the construction and maintenance of the outside plant.

In closing, it might be added that it is a tradition and has been the policy of The Bell Telephone Company from the beginning to have the best apparatus and methods for giving service and at the same time study, constantly, how to improve the service and to meet the telephone needs of the public and develop new means and methods for meeting the requirements. This policy has brought about a development, beginning with a few small isolated telephone exchanges with 2,100 stations in 1880, to an up-to-date telephone system second to none of 592,000 exchange stations and long distance facilities to interconnect with 17,000,000 telephones throughout Canada and the United States, an achievement of which any builder may be justly proud.

Influence of Personnel on Industry

The Necessity of Studying the Personnel in Industry and Possibility of Creating Better Relationship between Employer and Employee

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Generally speaking, the functions of the engineer group themselves into three categories:—(1) design of works; (2) development and construction of works; and (3) maintenance and operation of works. In all these contact is had with the human element, and to this extent it is important that the engineer should appreciate the importance of and study the question of personnel.

Apart altogether from this, however, there is a growing tendency in industry to recruit executives from the ranks of the engineering profession, and no executive is properly equipped to deal with the problems involved in the operation of the modern industrial structure who has not studied carefully this very important question.

Products of Industry

In preparing a budget intended to represent the estimated results of operation in any industry, from the cost side, one encounters in ordinary every-day business the following factors:

(1) Labour;

(2) Material; and

(3) Interest upon investment, including depreciation.

The purely operating costs consist of the first two, the third being an income charge. The proportion of the total operating expenses absorbed by labour and material respectively will undoubtedly vary considerably and depend upon the character of the particular industry under consideration.

In the transportation field it will generally be found that something in excess of fifty per cent of the operating expense consists of wages paid to employees.

"The Canada Year Book" for 1924, published by the Dominion Bureau of Statistics, shows that for the year 1922 the value added to materials in process of manufacture was

$1,159,316,000, of which $497,113,000, or 43 per cent, represented salaries and wages paid.

"The Commerce Year Book," published by the United States Department of Commerce, for the year 1924, shows that the value added to materials in the process of manufacture amounted to $25,867,000,000, and that of this amount $11,000,000,000, or 43 per cent, represented wages paid.

Material

If one were going to construct a building or a bridge, one would first prepare a plan showing the general layout and dimensions of the structure, and would next prepare detailed plans, descriptions and specifications covering every detail entering into the construction of the structure. The specifications would go into great detail as to the quality, chemical and physical characteristics of the various materials which are to be used, and would also prescribe the manner in which these materials would be inspected to insure that the specifications had been lined up to; all of which demonstrates the care which is exercised in making sure that the proper combination has been obtained for the purpose desired. After the structure is completed, great care is usually exercised in its maintenance during its economic life.

This is what is done in the case of the materials used in industry, which usually represent no greater percentage of the cost of the products of manufacture than labour.

Industrialism

What has been the situation with respect to labour? Let us consider the problem somewhat in retrospect.

A century ago there occurred what is known as the "Industrial Revolution." The development of the steam engine and the numerous other inventions which have followed one another with great rapidity since that time resulted in the development of industry on an entirely new scale and wrought miraculous changes in the processes of manufacture.

Previous to this time manufacture was greatly diversified and performed principally by the artisan in his own home assisted by members of his immediate family or apprentices indentured to the artisan for the purpose of learning the trade. This method had the advantage of developing an all-round artisan capable of performing all the processes necessary, from the laying out of the patterns to the final completion of the finished product. Naturally, this resulted in close contact between the master workman and his assistants, and a realization of community of interest amongst them all.

With the industrial revolution the individualistic character of the worker changed and he was drawn into the vortex of large industrial structures. The production of the individual was multiplied many times. The labourer found himself getting a larger share of the material things and, as a natural consequence, the industrial population increased enormously.

Yet, in spite of this increase in real wealth, the attitude of the worker towards his work was rapidly changing. The old interest in his work was decreasing and there was a positive and widespread unrest among employees generally, which in many cases showed itself in an absolutely direct hostility to the employees' own industry and especially to the management of that industry. Worse than that, there was growing up among employees an idea that they belonged to a class in industry entirely different from the class to which the management belonged. Industry was rapidly becoming a house divided against itself; harmony was disappearing.

This condition of affairs was due to the fact that in this period of the rapid development of machinery and the attendant improvement in processes, the management of industry had been devoting itself exclusively to the machinery and methods. In the course of time the management of industry began to realize that, notwithstanding the great progress made in machinery and processes, something was radically wrong with the industry as a whole, and when they began an intensive study of the situation, they found that the human factor had been neglected.

It developed that the owners, or the executive officers operating on behalf of the owners, had lost contact with the people actually doing the work; that there had been built up between the executive officers and the workers a line of intermediate supervision which had failed to interpret on the one hand the executives to the general forces, and on the other hand the general forces to the executives.

It was found that instead of there being only two human factors in industry as had been generally assumed, and as actually was the case prior to the industrial revolution—namely, the owners of the industry and the working forces; this new development had interjected four human factors into the problem of modern industry—namely, the owners or stockholders, the executive, the intermediate supervisory organization, and the general working force. The realization of this fact forced the executives to the conclusion that the time had come when the human element in industry required more careful study and intelligent attention. Hence we have the personnel problem.

Personnel Problem

If this problem be examined from the standpoint of the worker, it is found that, due to the lack of that contact and intimate relationship between employee and employer which was found to exist under the new industrial structure, that the employee naturally became disturbed by certain considerations affecting his personal relations with the industry in which he was engaged.

He had before him always the fear of the loss of his job, as it became evident that in the development of the industrial structure his services were actually becoming nothing more than a commodity which he had to sell, due to the fact that he often came in contact with arbitrary executives lacking in consideration for anything but their own conception of the immediate interests of the industry. As an individual employee selling his commodity and lacking the force necessary to bargain with a strong industrial institution, he felt forced to consider the joining of his interests with those of others with similar services to dispose of.

There was also the fact that he saw around him individuals in the same industry enjoying greater remuneration. He sometimes failed to realize the difference in the intellectual requirements or the relative value of services rendered. From his point of view, these others have leisure while he himself appears to be tied to unceasing labour, is the thought foremost in his mind, and the feeling was that his personal welfare, education and recreation were left largely to be provided by fortuitous circumstances. In an attempt to improve his condition he perforce became a member of an organization in which, as an individual, he had little or no control. It appeared a case of collective action and, for his self-preservation, he found himself forced to follow the dictates of his fellow-workmen.

It is not to be wondered at that considerations such as these often produce in the minds of men, whose opportunity for education has been limited, an unhealthy and mistaken view of the social relations as well as an antagonistic attitude towards not only their employers, but to their own duties in industry and even their own real good. One must remember that man is an active animal. He is not content to be simply passive; he desires to have some say in his destiny, or what he thinks is his destiny; he is suspicious of what he does not understand; and is skeptical of efforts for his well-being in which he has no directing part. He must be convinced that a real mutuality of interest exists between himself and his employers, and that he has some say in defining that interest. There will always be a problem, no final solution is possible; it is one of the necessities of life that this should be so, otherwise there would be stagnation and ultimate dissolution.

It is necessary that in a recognition of the mutuality of interest the employee be furnished with the facts of industry and kept informed of changes in them, and educated in the fundamentals of industrial issues, otherwise he will adopt fallacies apparently supporting the claims which he makes, or which are made for him.

"Open confession is good for the soul," and particularly good for the soul of the employer and employee. Suspicion of his foreman's and employer's policies is removed by the frankness of their attitude and treatment of the employee. Pay and any additional incentives appeal to him as fair and reasonable. Provision made for prompt and adequate communication of opinions and desires on matters pertaining to his status and conditions gives him a personal interest in the conduct of affairs.

The worker reserves the right to make his own mistakes, and no attempt should be made to dictate what he shall think or do in his own economic affairs. Paternalism, however well conceived or applied, is usually a cause for ultimate discontent. Safety, health, compensation, thrift inducements, educational opportunities are all beneficial, provided they are not regarded by the employer as things for which he may expect extra effort or consideration from the employee. These things will be approved by the employee only when his immediate personal interests are given proper consideration, and these latter are often surprisingly simple compared with the sociologist's anticipations. Industrial relations should be organized with the view primarily of giving serious study to all of the conditions and obtaining effective administration for any policies which may be adopted.

Industrial personnel may be defined then as the creation of the machinery necessary to give sufficient intensive attention to the human factors in industry, to make sure that the entire human element and man power in the industry is mobilized for attaining the proper objectives of that industry.

The engineer, as pointed out in the beginning, is vitally interested in this phase of the industrial relationship, and it should be one of the professional requisites that he familiarize himself with what results have been attained in the cultivation of more intelligent and less contentious relationships between the employees and employers in different large industrial concerns. The training which the engineer obtains should produce an analytical type of mind and peculiarly adapt him for the investigation and analysis of the elements entering into this problem, and by the application of the same methods which he uses in physical engineering works, add much toward a consistent and adaptable solution of these industrial relationships.

It may be interesting to the members of the Institute to know briefly what is being done on the Canadian National Railways looking towards a more sane and reasonable relationship with its employees.

Railway Employees' Relationship Organizations

The railroad labour organizations in Canada are largely international in scope, a vice-president generally being appointed to look after Canadian affairs. The agreements with our employees are made with a committee representing the employees, not directly with any labour organization, although we know that they are members of and operate under the constitution of the various labour organizations they represent. There are two exceptions to this practice,—one being with our shop crafts employees and the other with our maintenance-of-way and structures department employees,—these two agreements being made through the Railway Association of Canada at the request of the above-named organizations in 1918, in order to obtain uniform rates and working conditions throughout Canada in line with the national agreements made in the United States after the latter country took over the operations of the railways in that country on January 1st, 1918.

The employees have their respective periodical conventions, and each elects a General Grievance Committee as well as a general chairman for a defined territory (generally covering the same territory as the railway general manager), and local chairmen for local matters. All agreements are subject to revision or cancellation on thirty days' notice, except that for the maintenance-of-way and signal department employees which provides for a sixty days' notice. The elected general chairman acts as chairman of the General Grievance Committees as well as of committees handling negotiations with respect to wages and working conditions.

When an employee feels he has been unjustly treated or that he has a grievance in connection with wages or working conditions, he may take the matter up either directly or through his local chairman up to and including the superintendent of the division; if the matter cannot be adjusted with the superintendent, the local chairman may turn over the case to his general chairman, who, if he considers there is merit in the employee's contention, will appeal the case to the general superintendent, and, if necessary, to the general manager. When it is impossible for the general manager and the general chairman to agree, then, if it is a case of interpretation of the schedule, the general manager will refer the matter to the chief of wage bureau, Montreal, for an interpretation before definitely declining to adjust the dispute. If the general manager's contention is upheld, the general manager and the general chairman write up the case,—first agreeing and writing "a joint statement of facts",—after which the employees will set out their contentions, and the railway officer does the same. The dispute is then referred to the board or committee provided for in the agreement between the railway and the respective organization.

In the case of the following organizations, the case would be referred to the Canadian Railway Board of Adjustment No. 1,—created in August 1918 for the purpose of adjusting grievances:

Brotherhood of Locomotive Engineers
Brotherhood of Locomotive Firemen and Enginemen
Order of Railway Conductors
Brotherhood of Railroad Trainmen
Order of Railroad Telegraphers
United Brotherhood Maintenance-of-Way Employees and Railroad Shop Labourers.

This board is composed of twelve members, six being representatives of labour organizations,—generally vice-presidents,—and of six railway officers, a chairman and vice-chairman being elected from among the twelve members, such position alternating every six months between a railway officer and an officer of the labour organizations. The decisions of the board are final and binding upon both parties.

This board has done excellent work; there has never been occasion to call in an arbitrator since its existence. This board is considered one of the best mediums of disposing of grievances, and is very helpful in maintaining a harmonious relationship between employees and the railways.

In the case of shop crafts' employees, the joint write-up of the general manager and general chairman is sent to the Railway Association; the secretary of the association notifies the Sub-Committee on Wages and Working Conditions, and also advises the president and secretary of division No. 4, and a meeting is arranged, through a board consisting of ten members,—five being labour organization representatives and five being railway representatives.

In either case, whether the matter is referred to the Canadian Railway Board of Adjustment No. 1 or to the Railway Association of Canada's Sub-Committee, the parties to the dispute are advised of date the dispute will be heard. Both parties appear before the board of which they are a party, and, in addition to the written statements, submit oral arguments in support of their respective contentions. The board asks of each party such questions as, in its opinion, will help to clarify the points at issue, after which the parties to the dispute retire and the Board considers the case and arrives at a decision, which is made unanimous once adopted.

On the whole, the results obtained through this procedure have been very satisfactory indeed, as evidenced by our freedom from labour troubles.

The Canadian Brotherhood of Railroad Employees, which covers clerks, freight handlers, station, stores and shop laborers, has no international affiliations, and, while there is no obligation on their part to bring their grievances before the Board of Adjustment No. 1, their cases will be heard, provided they agree in writing beforehand that they will accept the decision of the board as final. It is expected, however, that within a short time, a separate board will be set up for these employees.

At the present time, the Canadian National Railways has in force in several of its shops what is known as the "Premium System," the essential features of which may be described as follows:

(1) A careful classification of the work to be done in the shop in question is made.

(2) Careful studies are made of the time required to perform the work under each classification.

(3) A complete system of cost accounting is installed.

(4) Employees are paid additional compensation in the form of a percentage allowance equivalent to the percentage improvement which they make over the standard time set in the time-studies for the class of work which is being done.

At these particular shops, meetings are held monthly at which shop superintendents, foremen, and charge hands exchange ideas, review the situation, offer suggestions and have a general discussion of the various problems from the standpoint of the company and the men. This system is working out very satisfactorily and results so far have been good.

Co-operation between standard organizations of railway shopmen and the railway management has long been the subject of discussion, and a tentative plan for co-operative management is being tried out on the Canadian National Railways.

Briefly, co-operation in management means the assumption of responsibility by the employees towards the major welfare of the railway enterprise as a whole. This finds expression in the work of joint shop committees, set up at each plant. The committees meet in co-operative conference for discussions and suggestions in such matters as:—

(1) Job analysis and standardization.
(2) Better tools and equipment.
(3) Care and distribution of tools.
(4) Proper storage, care and delivery of material.
(5) Economical use of supplies and materials.
(6) Re-arrangement of machine tools.
(7) Proper balancing of forces and work in shops.
(8) Co-ordinating and scheduling of work through shops.
(9) Improving quality of work.
(10) The introduction of output records.
(11) Condition of shops and shop grounds, especially in respect to heating, lighting, ventilation, safety, etc.
(12) Increasing effectiveness of shopmen's organizations.
(13) Securing new business for the railroad.
(14) Steps necessary to secure new work.
(15) Improvements in technical training of apprentices and others.
(16) Recruiting and building up of working force with competent responsible individuals.
(17) Local stabilization of employment.
(18) Improvement in physical working conditions.

Representatives of the employees and management are now engaged in setting up the necessary machinery. Obviously at this juncture, it is impossible to forecast the results.

The participation in, or "sharing fairly" the benefits of co-operation is one phase of the plan which probably presents a serious difficulty, for the reason that measurement of all of the work performed by the employees of the maintenance of equipment department in relation to man-hours is something which heretofore has not been accomplished. Time production in manufacturing is simple in comparison.

In several of the company's locomotive and car shops, a premium system is in effect, as previously stated, whereby work performed on time-schedules can be definitely measured. At some points, more than half of the shop activities are on a time-production basis, but these are confined to the Central Region, no extension of this method having so far been made to the plants located on the Atlantic and Western Regions.

A committee is now at work endeavouring to evolve a plan whereby a division may be made between employee and employer of such benefits as are expected to accrue from this new scheme of co-operation. It is realized that new and difficult ground must be broken, as the ascertainment of exact cost data in maintenance of railway equipment has never been vital to the existence of the mechanical department, with the result that reliable data is not obtainable through any existing accounting practices.

The indications are that in so far as the heavier work is concerned, a solution of the measurement difficulty lies in the complete application of the premium system already mentioned. Further study will develop to what extent this system can be applied to minor repairs in yards and at engine terminals, and also to the housing and caring for locomotives actually in transportation service.

Institute Committees for 1926

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F. P. Shearwood
K. B. Thornton
J. B. Challies

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Jas. Quail
R. W. E. Loucks
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Lesslie R. Thomson
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GZOWSKI MEDAL AND STUDENTS' PRIZES

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Frederick B. Brown
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LEONARD MEDAL

To be appointed

PLUMMER MEDAL

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C. J. Mackenzie (three years)
C. M. McKergow (two years)
Frederick B. Brown (one year)

HONOUR ROLL AND WAR TROPHIES

Brig.-Gen. C. J. Armstrong
A. E. Dubuc
Fraser S. Keith

CONCRETE DETERIORATION IN ALKALI SOILS

C. J. Mackenzie, Chairman
W. P. Brereton
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Willis Chipman
J. S. Dennis
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M. J. Butler
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Maritime General Professional Meeting

Preliminary arrangements have been completed and the final details are being planned for the Maritime General Professional Meeting which is to be held at Sydney, Nova Scotia, on Tuesday, Wednesday and Thursday, August 17th, 18th and 19th, 1926.

The provisional programme for this meeting provides for two technical papers with discussions. The first paper is on the "Development of the Humber Valley, Newfoundland," by H. C. Brown, A.M.E.I.C., electrical superintendent, Newfoundland Pulp and Paper Company, Limited. This paper should be of general interest. The plant of this company was opened less than a year ago, and is one of the largest and most modern equipped on the Continent. The second paper is on "Characteristics and Utilization of Nova Scotia Coals," by W. S. Wilson, A.M.E.I.C., assistant chief engineer, and M. W. Booth, A.M.E.I.C., steam engineer, Dominion Iron and Steel Company. While of vital interest to eastern members of The Institute, this paper is also of great interest to members throughout Canada.

The tentative programme, which is given below, provides for various other functions and entertainment. On Thursday, August 19th, following the meeting, arrangements have been made for a drive along Bras d'Or, through Baddeck and on to the Margaree Valley.

Tentative Programme

TUESDAY, AUGUST 17TH

9:30-10:30 a.m.—Registration.
10:30-11:00 a.m.—Address of Welcome — The Mayor of Sydney.
11:00-12:15 p.m.—Paper—"Development of the Humber Valley, Newfoundland," by H. C. Brown, A.M.E.I.C., electrical superintendent, Newfoundland Pulp and Paper Company.
12:15-12:45 p.m.—Photograph.
12:45- 2:00 p.m.—Lunch—Complimentary to visitors.
2:00- 5:00 p.m.—Visit to No. 1-B Colliery, Glace Bay; or Waterford Lake Power Plant; or sail on Harbour; or Golf.
5:30- 7:00 p.m.—Golf—Cards—Lingan Country Club.
8:00 p.m.—Informal dinner and dance, Lingan Country Club.

WEDNESDAY, AUGUST 18TH

9:30 a.m.—Business meeting.
10:00-12:00 noon—Paper—"Characteristics and Utilization of Nova Scotia Coals," by W. S. Wilson, A.M.E.I.C., assistant chief engineer, and M. W. Booth, A.M.E.I.C., steam engineer, Dominion Iron and Steel Company. Discussion.
12:00- 1:30 p.m.—Lunch—at individual choice.
2:00- 6:00 p.m.—Visit Steel Plant and Coke Ovens of Dominion Iron and Steel Company, Sydney, or drive to East Bay.
7:30 p.m.—Banquet — Prominent Speakers — Sing-song—Etc.

THURSDAY, AUGUST 19TH

9:00 a.m.—Leave Sydney for drive along Bras d'Or lakes, through Baddeck and on to the Margaree Valley—Fishing.

A special committee of the branch is arranging hotel accommodation for visiting members, and in order that all may be assured of such accommodation, it is important that all members planning to attend the meeting should notify the secretary of the Sydney Branch promptly.

Amendments to the By-Laws

Following the announcement which appeared on page 302 of the June issue of the Engineering Journal regarding the amendments to the By-laws, which became effective following the approval of the members by letter ballot returnable April 30th last, attention is directed to the changes given below:—

BY-LAWS SECTIONS NOS. 8, 9 AND 10

The changes under these sections refer particularly to the requirements for examination for admission to the grades of Student, Junior and Associate Member, and, with these changes in view, the Board of Examiners of The

Institute have prepared revised schedules of examinations, which together with sample examination papers are at present being printed and will shortly be available. These schedules are referred as follows:—

A—for admission as Student
B— " " " Junior
C— " " " Associate Member.

By-law Section 33

In accordance with the amendment to this By-law, which deals with the entrance fees, provision is made for the payment of the amount specified at the time of application for admission to The Institute. Accordingly, all applications for admission must be accompanied by a remittance covering the amount of entrance fee set forth in the By-laws for the grade of membership to which the applicant considers himself eligible.

By-law Section 35

This section deals with the schedule of annual fees payable by the various grades in The Institute and provides for an increase in these fees of one dollar in each case, which amount is deducted if the fees are paid on or before March 31st of the current year. In view of the fact that the ballot in connection with the amendments to the By-laws was not returnable until April 30th, the change in this By-law will not be made effective until January 1st, 1927.

Meetings of Council

Meeting of May 18th, 1926

A meeting of Council was held at eight p.m. on Tuesday, May 18th, Vice-President K. B. Thornton, M.E.I.C., in the chair and seven members of Council being present.

The report of the Finance Committee was approved, and its recommendations regarding twenty-seven cases of members in arrears of fees were approved.

F. P. Shearwood, M.E.I.C., was appointed treasurer of the Institute, succeeding the late Sir Alexander Bertram, and J. B. Challies, M.E.I.C., was appointed a member of the Finance Committee.

The report of the scrutineers, regarding the letter ballot on the Amendments to the By-laws proposed by Council at the Annual Meeting January 27th, 1926, was submitted, and the number of affirmative votes being in all cases greater than two-thirds the number of votes balloted, all the amendments were declared to be carried.

The question of the publication of Transactions was considered, and the secretary reported that over 290 members had signified their willingness to subscribe for the Transactions if published. It was considered that this response would justify the publication of a limited edition, say one thousand copies, and the Publications Committee was requested to submit a detailed plan for the proposed volume, for the approval of Council, at its next meeting if possible.

Discussion regarding the arrangements for the next Annual General Meeting took place, and the secretary was directed to confer with the Executive Committee of the Quebec Branch regarding this matter.

A letter was submitted from Mr. C. E. Skinner, chairman of the Tour Committee of the International Electrotechnical Commission, expressing appreciation of the arrangements made for the welcome and entertainment of that Commission during its Canadian tour.

The seventeen elections and fourteen transfers were effected as follows:—

Elections

Members	5
Associate Members	7
Juniors	3
Affiliates	2

Transfers

Associate Member to Member	4
Junior to Associate Member	1
Student to Associate Member	2
Student to Junior	7

Twenty applications for admission and transfer were scrutinized and classified for the ballot returnable June 15th.

The secretary reported that on May 18th, in accordance with Council's instructions, fifty-five names were removed from the list of members of the Institute for non-payment of fees, as follows:—

Members	4
Associate Members	41
Juniors	2
Students	8

The Council rose at 10.30 p.m.

Meeting of June 15th, 1926

A meeting of Council was held at eight p.m. on Tuesday, June 15th, Geo. R. MacLeod, M.E.I.C., in the chair, and six members of Council being present.

The monthly report and recommendations of the Finance Committee were approved and resignations of one Student and one Member were accepted. Five applications for re-instatement were considered.

The proposed programme for the Maritime Professional meeting to be held in Sydney, C.B., on August 17th and 18th was considered and discussed, and the preliminary programme for the Annual Meeting to be held in Quebec, Que., in February 1927, was also discussed.

A report was submitted from the chairman of the Publication Committee, stating that a preliminary list had been made of papers to be considered in connection with the proposed publication of volume of Transactions, these having been chosen from papers presented during the years 1923, 1924 and 1925. Arrangements were discussed for the further work in this connection.

The list of officers for the Quebec Branch for the year 1926-27 was submitted and approved.

The proposal from a member was considered outlining a scheme for group insurance for all members of The Institute, but, after discussion, it was not considered advisable to embark on such a scheme, such working falling more particularly within the activities of the various provincial associations of professional engineers.

The Board of Examiners presented a report containing the revised examination schedules and the sample examination papers, revised in accordance with sections 8, 9 and 10 of the by-laws as recently amended; these were approved for publication.

Prof. C. M. McKergow, M.E.I.C., was nominated to succeed the late Sir Alexander Bertram as one of the three nominees of The Institute of the Canadian Engineering Standards Association.

Further consideration was given to the request received from England to suggest a name for the next recipient for the Kelvin Medal.

The following elections and transfers were effected:—

Elections

Members	2
Associate Members	4
Juniors	3

Transfers

Associate Member to Member	4
Junior to Associate Member	1
Student to Associate Member	2
Student to Junior	4

Twenty applications for admission and transfer were scrutinized and classified for the ballot returnable September 21st.

Consideration was given to twelve special cases in connection with applications for admission.

The Council rose at 12:45 a.m.

OBITUARIES

Augustine V. Redmond, M.E.I.C.

It is with regret that we record the death of Augustine V. Redmond, M.E.I.C., which occurred on February 9th, 1926.

Mr. Redmond was born at Kingston, Ont., on May 16th, 1878, and graduated from Queen's University with the degree of B.Sc. in 1903. Since that date he had almost been continuously engaged on railway work, commencing as leveller and transitman on location with the Grand Trunk Railway and the National Transcontinental Railway in January 1904. For one year, from October 1908, he was resident engineer on construction of the National Transcontinental Railway. In October 1909 he was appointed division engineer on construction on the same railway, which position he occupied until May 1915. In June of the following year he was appointed resident engineer and acting division engineer with the Canadian Government Railways, and the following year was promoted to division engineer. In 1919 he became district engineer, Canadian National Railways, with headquarters at Winnipeg, Man. At the time of his death, the late Mr. Redmond was district engineer, Canadian National Railways, Winnipeg, Man.

The late Mr. Redmond was admitted to The Institute as Associate Member on January 8th, 1910, and transferred to Member on July 22nd, 1919.

David Frederic Maxwell, M.E.I.C.

It is with sincere regret that we record the death of David Frederic Maxwell, M.E.I.C., which occurred at his home in St. Stephen, N.B., on June 8th, 1926.

The late Mr. Maxwell was town engineer of St. Stephen, and had been active in his work until a few days prior to his death. He was a native of St. Stephen, having been born there on October 21st, 1848. Throughout his life he was greatly interested in railway matters, having devoted practically all his time to engineering work in connection with railways in the Maritime provinces.

As early as 1873 he was rodman and assistant engineer on the Chatham Branch of the Canada Eastern Railway. He was successively assistant engineer of the Kent Northern Railway in 1875; in New Brunswick Southern Railway in 1876; and in 1877 the New Brunswick Railway. In 1878 he became chief engineer of what was later part of the Washington County Railway in the state of Maine. From 1880-83 he was resident engineer of the St. Croix Cotton Mills and Gibson Cotton Mills, following which he was appointed chief engineer of the Canada Eastern Railway. From 1884-1888 he was engineer of railways for the government of New Brunswick, and for the next four years was engaged on railway surveys as division engineer. In 1894 he became chief engineer of the Calais, St. Stephen Electric Railway. In 1897 he entered private practice and during the next three years was engaged on reporting on water powers in connection with pulp mills.

In 1901 he became town engineer of North Sydney and from 1909-14 he was engaged as chief of location on the St. John and Quebec and on Fredericton and Grand Lake Railways in New Brunswick.

The late Mr. Maxwell was admitted to The Institute as Member on October 8th, 1903.

R. A. Hazlewood, M.E.I.C.

R. A. Hazlewood, M.E.I.C., formerly on maintenance and structures, Hudson's Bay Railway, with headquarters at The Pas, Man., died on February 23rd, 1926.

The late Mr. Hazlewood was born at Brockville, Ont., on June 26th, 1857. He commenced his engineering career with the Canadian Pacific Railway on surveys west of Port Arthur from 1875-78, and in 1878 was appointed, by that company, section engineer on the Thunder Bay division. In 1881 he was engaged on location work with the International Railway in Maine, U.S.A., and in 1882 he became engineer in charge of a section of the Ontario and Quebec Railway at Sharbot lake.

The following year he engaged in contracting for the Canadian Pacific Railway on the north shore of lake Superior. In 1884 he was with the same company in charge of a location party in the Eastern Townships, again returning to contracting in 1885 with the Minneapolis and Soo Railway. In 1886 he was divisional engineer, Canadian Pacific Railway, on the Windsor extension. Two years later he was engineer in charge and superintendent of construction of the Port Arthur, Duluth and Western Railway. For the following five years he was engaged in contracting work, returning to railway location in 1898 with the Rainy River Railway. For five years, commencing 1899, he was contract engineer on the Algoma and Hudson Bay Railway.

The late Mr. Hazlewood was elected Member of The Institute on April 23rd, 1903.

John Davis Barnett, M.E.I.C.

It is with regret that we record the death of one of the earliest members of The Institute, John Davis Barnett, LL.D., M.E.I.C., which occurred on March 21st, 1926.

The late Dr. Barnett's membership in The Institute dates back to January 20th, 1887, when he was admitted to The Canadian Society of Civil Engineers, some five months prior to its incorporation under Dominion charter.

Dr. Barnett was born in 1850, and at the age of fourteen he commenced his engineering studies as pupil in the shops and drawing office under the mechanical superintendent in the Great Western Railway at Wolverhampton, London and Swindon (England). In 1867 he continued his studies as pupil under the mechanical superintendent of the Grand Trunk Railway in Montreal. His subsequent rise was rapid and was successively junior draughtsman, chief draughtsman and assistant mechanical superintendent at Belleville, Ont., Montreal, Que., and Stratford, Ont. In 1883, he became mechanical superintendent of the Midland Railway of Canada, and in the following year was appointed divisional superintendent of Midland division, Grand Trunk Railway.

The late Dr. Barnett took a very active part in the affairs of The Canadian Society of Civil Engineers in its early days, and served on the Council of the Society for nine years, from 1889-1896 inclusive, and also in 1898. He was one of the Charter Members of the London Branch of The Institute.

Raoul Rinfret, M.E.I.C.

Sincere regret is expressed at the death of Raoul Rinfret, M.E.I.C., which occurred at Shawinigan Falls, Que., on May 8th, 1926.

The late Mr. Rinfret was born at St. Stanislas, Que., on July 16th, 1856. He received his degree of B.A.Sc. from McGill University in 1887, and was commissioned as a Dominion Land Surveyor and a Provincial Land Surveyor of Quebec. The year following his graduation, he was engaged on highway bridge construction and later, in 1893, he became engaged on railway location work. In 1907 he was appointed chief engineer for the town of Montcalm, a suburb of Quebec, and in 1909, chief engineer for Thetford Mines, Que., and at various times was engaged on:—the location of the transmission line for the Montreal Light, Heat and Power Consolidated, from Cedar Rapids to Lachine, Que.; estimates for the water-works for Ste. Therese, East Broughton, Matane and St. Jude, all in Quebec. He was later engaged in consulting practice, and at the time of his death was connected with the Shawinigan Engineering Company, Shawinigan Falls, Que.

The late Mr. Rinfret was admitted to The Institute as Associate Member on March 10th, 1908, and transferred to Member on October 13th, 1913.

PERSONALS

J. R. Bradfield, S.E.I.C., is with the Horne Copper Corporation at Rouyn, Que. Mr. Bradfield graduated from McGill University in 1922.

I. W. Boyd, S.E.I.C., who received the degree of M.Sc. (with honours) from Queen's University this spring, is at present on a tour in the Old Country.

Willard B. Fraser, S.E.I.C., who has just completed his third year in electrical engineering at McGill University, is with the Shawinigan Engineering Company, and is located at St. Narcisse, Que.

James Ferguson, A.M.E.I.C., formerly on the engineering staff of the Canadian National Railways, Montreal, Que., has been transferred by that company to Cochrane, Ont., where he is division engineer.

Ralph Allingham, A.M.E.I.C., has been appointed field engineer for the Semet-Solvay Company at Buffalo, N.Y., on the construction of a battery of sixty coke ovens and other additions to the company's plant.

J. J. Richardson, A.M.E.I.C., division engineer with the Canadian National Railways, Cochrane, Ont., has been transferred by that company to Montreal, where he is division engineer with headquarters at the Tunnel Station.

H. D. Cluff, S.E.I.C., who graduated from the University of Manitoba in 1924, is lieutenant with the Royal Canadian Corps of Signals, and is officer in charge of the North West Territories Radio-Telegraph station at Aklavik, North West Territories.

Darrel D. Steeves, Jr.E.I.C., who recently was with Messrs. C. O. Barton Company, of Detroit, Mich., has resigned and accepted the position of chief estimator of Messrs. Martin and Krausman, general contractors, Detroit, Mich.

Ernest Peden, A.M.E.I.C., who has for some time been with the Dominion Bridge Company at Lachine, Que., has joined the staff of Ross and Macdonald, architects, Montreal. Mr. Peden is a graduate of McGill University of the year 1912.

Frank L. Grindley, S.E.I.C., who received his degree of B.Sc. in civil engineering from the University of Alberta this spring, has been appointed instrumentman with the Canadian National Railways on the Cold lake survey in Alberta.

G. R. Adams, S.E.I.C., who this year completed his fourth year in civil engineering at Queen's University, is at present with Fraser Brace Engineering Company on work in connection with the development on the Gatineau river near Ottawa.

D. T. Welsh, S.E.I.C., who graduated from the University of Toronto in 1924, has resigned from the staff of the city engineer's department at Hamilton, Ont., and has joined the Fort William staff of the Department of Northern Development of the Ontario Government.

L. C. Prittie, A.M.E.I.C., who graduated from Queen's University with the degree of B.Sc. in 1912, and who for several years, subsequent to April 1920, was assistant patent examiner in the Patent and Copyright Office, Ottawa, Ont., is now patent attorney with the Canadian General Electric Company, Limited, Toronto, Ont.

A. G. Jeffreys, M.E.I.C., who through ill health was forced to discontinue active work for some time, has recently recovered sufficiently to return to his profession, and is at present with the Thunder Bay Paper Company, Limited, at Port Arthur, Ont., in charge of the engineering office in connection with the construction of the company's new paper mill.

Edward Hughes, A.M.E.I.C., who has been located at Camp Verde, Arizona, with the Western Chemicals, Incorporated, is going into the Dease lake country in northern British Columbia on Canadian Geological Survey work. Mr. Hughes has had considerable experience in railway, land and mine survey work, and was for a time with the Crow's Nest Pass Coal Company, Limited, as mine surveyor.

C. M. Walker, A.M.E.I.C., has been transferred from the Topographical Surveys Branch of the Department of the Interior to the engineering staff of the Canadian National Parks Branch. For the past thirteen years Mr. Walker has been engaged on Dominion land survey and subdivision work in the west and also did a large amount of townsite surveying in the western parks. His work with the Parks Branch will be in connection with highway location, and construction and municipal work.

R. M. Calvin, A.M.E.I.C., has rejoined the staff of H. S. Taylor, Limited, of Montreal. Mr. Calvin is a graduate of Queen's University, from which he received the degree of B.A. in 1911 and B.Sc. in 1914. Subsequent to graduation he served overseas with the Canadian Engineers. He was later for a short period with the Water Power Branch of the Department of the Interior, after which he joined the the staff of H. S. Taylor, Limited, where he remained until April 1923.

K. H. Smith, M.E.I.C., formerly chief engineer of the Nova Scotia Power Commission and district chief engineer of the Dominion Water Power and Reclamation Service of the Maritime Provinces, located at Halifax, N.S., is now employed by the Montreal Engineering Company, Limited, 164 St. James street, Montreal, Que., the engineering department of the Royal Securities Corporation. It is understood that Mr. Smith retains his connection with the Dominion Water Power and Reclamation Service in a consulting capacity.

S. Eastman Root, Jr.E.I.C., is construction engineer with the Wm. I. Bishop Limited on the extension to the Belgo plant of the St. Maurice Valley Corporation at Shawinigan Falls, Que. Mr. Root has had considerable construction experience, having been with the Thompson, Starrett Company on the construction of the mill for the St. Maurice Paper Mills, Limited, at Three Rivers, Que., and on construction at Donnacona, Que., with the Donnacona Paper Company. Previous to his present appointment he was on preliminary field work in connection with the new mill of the International Paper Company near Ottawa, Ont.

R. E. Butt, A.M.E.I.C., has accepted the position of mechanical engineer assisting the production manager with Messrs. General Motors New Zealand, Limited, at their new works at Petone, near Wellington, N.Z. Mr. Butt, in 1922, was chief engineer of Messrs. Kindred and Company of Wolverhampton, England, which company was a subsidiary of Messrs. Bostock and Hargrove Limited, and in 1924, due to trade depression, Mr. Butt was transferred to the parent company, which was engaged on the installation of power plants, pumping and filter plants. Early in 1925 Mr. Butt went to New Zealand, where he was engaged on various temporary work until his recent appointment.

J. G. MacLachlan, A.M.E.I.C., who has been division engineer, Kamloops-Kelowna-Lumby Line of the Canadian National Railways, has been transferred to The Pas, Man., and has been appointed division engineer, construction, operation and maintenance, Hudson Bay Railways, succeeding the late R. A. Hazlewood, M.E.I.C. Mr. MacLachlan has had extensive railway construction experience which dates back to the year 1906. For five years he was with the Canadian Northern Ontario Railway as resident engineer on various sections. He served overseas as company commander in the Canadian Railway Troops, and subsequent to the War he was division engineer on construction, Canadian National Railways, Okanagan Branch, at Kamloops, B.C., later being appointed to the position from which he has just been promoted.

J. B. Hamilton, A.M.E.I.C., receives Appointment

J. B. Hamilton, A.M.E.I.C., who for the past five years has been town engineer and superintendent of utilities of the town of Estevan, Sask., has recently resigned to undertake the management of a manufacturing organization in England, which controls certain patents on mechanical tools. Mr. Hamilton was born at Bellshill, Scotland, on March 31st, 1892. His technical education was received in the Old Country.

Prior to coming to Canada he was assistant plant manager with Messrs. Harland and Wolff, ship builders, Belfast, Ireland, and carried out the erection of that company's new shipyard on the Musgrave Channel, Belfast. Previous to that Mr. Hamilton was assistant inspector in the Aeronautical Inspection Directorate of Great Britain.

During his tenure of office in Estevan, he was particularly active in advancing the interests of the municipality, particularly in connection with its electrical and sewage works and in encouraging industries to locate in that town. During the past year, Mr. Hamilton was the unanimous choice of the Conservatives of Estevan to represent them as federal candidate for the constituency of Assiniboia in the recent election.

Major R. B. Jennings, A.M.E.I.C., appointed General Manager of Inspection Company

Major Robert Bernard Jennings, A.M.E.I.C., who has been appointed general manager of Robert W. Hunt and Company Limited, with headquarters at Montreal, was born at Paris, Ontario, June 29th, 1888. After receiving his education in Humberside Collegiate Institute, Toronto, and Faculty of Applied Science, University of Toronto, he engaged in railway location and construction, and was appointed resident engineer, Canadian Northern Ontario Railway, in 1909.

He served in this capacity on the various lines under construction until January 31st, 1916, when he enlisted in the Canadian Overseas Expeditionary Force. He was appointed Lieutenant, and promoted to Major in the 10th Battalion, Canadian Railway Troops, with active service in France and Belgium.

On his return to Canada, he was placed on the Reserve of Officers, and was on June 1st, 1919, appointed division engineer, Toronto Division, Canadian National Railways, Toronto, Ontario.

On February 22nd, 1921, he was appointed division engineer, Ottawa Division, Canadian National Railways, Ottawa, Ontario, and on May 1st, 1922, he was appointed division engineer, Montreal Division, Canadian National Railways, Montreal, which position he recently resigned to accept his present appointment.

Recent Graduates in Engineering

In addition to the list of Students of The Institute who have recently completed their courses at the various universities, as published in the June issue of the Journal, congratulations are also in order to the following, results of whose examinations were received too late for publishing with the main list last month:—

Nova Scotia Technical College

Special Prize

MacIntosh, Charles Alexander Daniel, North Earltown, N.S., The Alumni Medal.

Degree of B.Sc.

MacIntosh, Charles Alexander Daniel, B.Sc., (Mi.), North Earltown, N.S.

Pippy, George Alexander, B.Sc., (E .), Springhill, N.S.

McGill University

Honours in the Graduating Class, Medals, Certificates and Prizes

Arthur Caldwell Abbott, Montreal, Que., Honours in Electrical Engineering.

Douglas Orrin Bremner, Montreal, Que., Montreal, Light, Heat and Power Consolidated, Second Prize.

Herve Alfred Gauvin, Ottawa, Ont., Prize for Summer Essay.

Erceldoune Gray-Donald, Montreal, Que., Undergraduates' Society's Third Prize for Summer Essay.

Morris Katz, Montreal, Que., British Association Medal in Chemical Engineering, Honours in Chemical Engineering.

John Whiting Noyes, Montreal, Que., British Association

Medal in Metallurgical Engineering; Research Fellowship in Metallurgical Engineering.

George Hugh Pringle, Three Rivers, Que., British Association Medal in Mechanical Engineering; Honours in Mechanical Engineering.

Guy Raoul Rinfret, Montreal, Que., British Association Medal in Civil Engineering; Jenkins Bros., Limited, Scholarship; Honours in Civil Engineering.

Francis Edward Winter, Montreal, Que., British Association Medal in Electrical Engineering; Montreal, Light, Heat and Power Consolidated, First Prize; Honours in Electrical Engineering.

Degree of B.Sc.

Abbott, Arthur Caldwell, B.Sc., (El.), Montreal, Que.
Archambault, Jules, B.Sc., (El.), Montreal, Que.
Baxter, Gordon Bruce, B.Sc., (El.), Three Rivers, Que.
Bremner, Douglas Orrin, B.Sc., (El.), Montreal, Que.
Cooper, Donald Frederick, B.Sc., (Mi.), Montreal, Que.
Costigan, James Percival McDougall, B.Sc., (El.), Montreal, Que.
Crepeau, Louis, B.Sc., (Ci.), Montreal, Que.
Dion, J. Edgar, B.Sc., (Me.), Ottawa, Ont.
Gauvin, Herve Alfred, B.Sc., (Ci.), Ottawa, Ont.
Gilmour, William Alexander Turner, B.Sc., (El.), Hamilton, Ont.
Gray-Donald, Erceldoune, B.Sc., (El.), Montreal, Que.
Halpenny, Merle Benjamin, B.Sc., (Me.), Montreal, Que.
Henderson, Ian Gordon, B.Sc., (Ci.), Williamstown, Ont.
Herscovitch, Charles H., B.Sc., (Me.), Montreal, Que.
Hinchliffe, Joseph Edward, B.Sc., (Ci.), Victoria, B.C.
Hodina, Frank Albert, B.Sc., (Chem.), Montreal, Que.
Jubien, Ernest Burchell, B.Sc., (El.), North Sydney, N.S.
Katz, Morris, B.Sc., (Chem.), Montreal, Que.
Leitch, Hugh James, B.Sc., (Ci.), Montreal, Que.
Lister, Arthur, B.Sc., (El.), Montreal, Que.
McClung, Joseph Eldon, B.Sc., (El.), Montreal, Que.
Mills, Cecil Gordon, B.Sc., (El.), Montreal, Que.
Mulligan, Henry Iveson, B.Sc., (Ci.), Fort Coulonge, Que.
Nathanson, Max, B.Sc. (El.), Montreal, Que.
Norris, Herbert Bethel, B.Sc., (El.), Montreal, Que.
Noyes, John Whiting, B.Sc., (Met.), Montreal, Que.
Paterson, Alexander Pierce, B.Sc., (El.), St. John, N.B.
Pigot, Charles Hugh, B.Sc., (Ci.), Quebec, Que.
Pringle, George Hugh, B.Sc., (Me.), Three Rivers, Que.
Reid, Kenneth, B.Sc., (El.), Metchosin, B.C.
Rinfret, Guy Raoul, B.Sc., (Ci.), Montreal, Que.
Ross, William Thomas Dygnum, B.Sc., (Chem.), Pictou, N.S.
Rutherford, James Forest, B.Sc., (El.), Montreal, Que.
Salter, Frederick Cumberland, B.Sc., (Ci.), Montreal, Que.
Simon, Robert Carleton, B.Sc., (Me.), Montreal, Que.
Stewart, Donald, B.Sc., (El.), Lakeside, Que.
Stewart, William Franklin, B.Sc., (El.), Antigonish, N.S.
Vernot, George Edward, B.Sc., (El.), Montreal, Que.
Wallace, Reginald Henderson, B.Sc., (Me.), Halifax, N.S.
Webster, James Stewart, B.Sc., (El.), Ottawa, Ont.
Wilson, Valentine William Gibson, B.Sc.,(Mech.), Montreal, Que.
Winter, Francis Edward, B.Sc., (El.), Montreal, Que.

University of Manitoba

Special Prizes

Gauer, Edward—Joseph Doupe Gold Medal for highest aggregate in third and fourth year Civil Engineering.

Rodgers, Lawrence Aylmer—Gold Medal in Electrical Engineering.

Degree of B.Sc.

Antenbring, Clarence, B.Sc., (Ci.), Winnipeg, Man.
Carry, Charles William, B.Sc., (Ci.), Winnipeg, Man.
Gauer, Edward, B.Sc., (Ci.), Winnipeg, Man.
Hadden, Lyall Conley, B.Sc., (El.), Winnipeg, Man.
Hardy, A. Elvin, B.Sc., (Ci.), Winnipeg, Man.
Kellett, James Edward, B.Sc., (Ci.), Winnipeg, Man.
Kernaghan, Edward Benson, B.Sc., (El.), Winnipeg, Man.
Kennedy, James Mitchell, B.Sc., (Ci.), Winnipeg, Man.
O'Day, Martin, B.Sc., (Ci.), Winnipeg, Man.
Reekie, William George, B.Sc., (El.), Winnipeg, Man.
Rodger, Lawrence Aylmer, B.Sc., (El.), Winnipeg, Man.
Sumner, Joshua, B.Sc., (Ci.), Winnipeg, Man.
Treble, Harold Edison, B.Sc., (Ci.), Crystal City, Man.
Warkentin, Cornelius Paul, B.Sc., (Ci.), Winnipeg, Man.
Wilson, James Harvey, B.Sc., (El.), Qu'Appelle, Sask.

ELECTIONS AND TRANSFERS

At the meeting of Council held on June 15th, 1926, the following elections and transfers were effected:—

Members

BRYANT, Orville Frank, B.S., (New Hampshire Univ.), chemical engineer, Laurentide Co., Ltd., Grand'Mere, Que.

NICHOLS, David Andrew, B.Sc., (Queen's) M.A., (Columbia), engaged on research work for Ph.D. degree at Columbia Univ., Ottawa, Ont.

Associate Members

BROUGHTON, William Hamilton, Instructor in industrial mechanical engineering, the Provincial Inst. of Tech. and Art, Calgary, Alta.

HUTCHINSON, Eric Charles, C.E., (Ecole Polytechnique Fédérale Suisse), ch. of engrg. party at Farmers dev. on Gatineau river for Fraser Brace Engineering Co., Chelsea Falls, Que.

McLEOD, Neil, ch. elect. all coal mining operations, Brit. Empire Steel Corp., Glace Bay, N.S.

WHITE, Hans Grove, mining engineer, Glacier Creek Mining Co., Stewart, B.C.

Juniors

ADDIE, Donald Kyle, B.Sc., (McGill), mechanical engineer and at times night superintendent with Dominion Glass Co., Ltd., Montreal, Que.

McDONALD, James Alexander, B.Sc., (Univ. of Alta.), coke ovens dept. of Steel Co. of Canada, Hamilton, Ont.

PATTERSON, Thomas MacMillan, B.A.Sc., (Univ. of Toronto) with Dom. Water Power and Reclamation Service, Ottawa, Ont.

Transferred from class of Associate Member to that of Member

KELLY, Edward Arthur, asst. engineer on construction, C.P.R., Lethbridge, Alta.

MOODIE, Kenneth, B.A.Sc., (McGill), ch. engineer, P. Burns Co., Ltd., Calgary, Alta.

MORSE, John, E.E., (Chalmers Tech. Inst., Gottenburg, Sweden), gen. supt., Shawinigan Water & Power Co., Montreal, Que.

POLYBLANK, Kenneth Grahame, asst. ch. engineer, Rouyn Mines Rly., O'Brien, Que.

Transferred from class of Junior to that of Associate Member

BUCKMAN, Addison W., asst. to engineer in charge, Ottawa-Prescott Highway, Kemptville, Ont.

Transferred from class of Student to that of Associate Member

DAWSON, Heber William, B.Sc., (McGill), electrical and hydro-electric design, Shawinigan Engineering Co., Montreal, Que.

McLAGAN, Thomas Rodgie, B.Sc., (McGill), asst. supt., mechanical pulp mill, Laurentide Co., Grand'Mere, Que.

Transferred from class of Student to that of Junior

CAMPBELL, Amos John Gladson, B.Sc., (Queen's), sales engr., Riley Engineering & Supply Co., Ltd., Toronto, Ont.

DUNBAR, Prosper Gerald, B.A.Sc., (Univ. of Toronto), layout dftsman, mech'l dept., Smith Hinchman & Grylls, Detroit, Mich.

ELLIS, Franklin Alexander, B.A.Sc., (Univ. of Toronto), session demonstrator, i/c third year electrical lab., Univ. of Toronto, Toronto, Ont.

SMITH, George Westwood, B.A.Sc., (Univ. of Toronto), engr. with Lago Petroleum Corp., Maracaibo, Venezuela, S.A.

B.C. Professional Engineers Issue Year Book

The Association of Professional Engineers of British Columbia have issued a pamphlet containing the Engineering Act of the province of British Columbia and the by-laws, code of ethics, schedule of fees and membership list of the Association.

The Relation of the University to the Engineering Profession

R. W. Brock, M.A., LL.D., F.G.S., M.E.I.C.,
Dean of the Faculty of Applied Science, University of British Columbia, Vancouver, B.C.

Paper presented before a joint meeting of the members of the Vancouver Branch of the Engineering Institute of Canada, Vancouver members of the American Society of Electrical Engineers, and the Vancouver Engineers Registered under the Engineering Act of the province of British Columbia, on May 26th, 1926.

The address took the form of answers to questions which had been submitted to the Dean. The questions were, in part:—

1.* Should not all students of engineering be encouraged by the faculty, (or by the Dean), to register, on commencing their studies, with the Association of Professional Engineers ?

2. Should not the aims of the profession, as expressed in the "Engineering Act," the by-laws and regulations of the association, together with the terms of registration of pupils and engineers-in-training, be printed in the university calendar ?

3.† Should not professors of engineering seek registration under the "Engineering Act" ? Would the Dean use his influence thereto ?

As the notice of this meeting has advised you, I am going to answer a number of questions relating to the relationship of the university to the engineering profession, or to the Engineering Act. Before answering the questions, I desire to give as best I may some idea of my conception of what education is and to combat an erroneous conception held by many people.

Many people think that the schools—public, high, college or university—exist to supply students with information which will be useful to them in their business life, and that anything, or indeed everything useful should be included in the curriculum. Such a conception of the task of the university is manifestly erroneous. It is an impossible task.

It is true that the work of the public schools is to teach the three R's, but beyond this, I maintain the chief work of the schools is not to impart mere information, but to educate. If, of course, at the same time, students incidentally get information so much the better. I am developing grave doubts about some of our new education movements. All movements are not necessarily advancement. It may be retrograde, and I am beginning seriously to wonder if the system of the old Scottish dominie has not much in it to be recommended.

On one point at least I am clear,—the main task of school, college and university is to *educate and to turn out students*—students—those who know how and what to study. What is education ? It is from educare—to lead forth, and it embraces the development of the body, the spirit and the mind. I cannot do better than to quote to you Huxley's conception of a liberal education.

"That man I think has a liberal education who has been so trained in youth, that his body is the ready servant of his will and does with ease and pleasure all the work that as a mechanism it is capable of; whose intellect is a clear, cold, logic engine with *all* its parts of equal strength, and in smooth working order; ready like a steam engine to be turned to any kind of work and spin the gossamers as well as forge the anchors of the mind; whose mind is stored with a knowledge of the great and fundamental truths of nature and of the laws of her operations; one who, no stunted ascetic, is full of life and fire, but whose passions are trained to come to heel by a vigorous will, the servant of a tender conscience; who has learned to love all beauty, whether of nature or art, to hate all vileness and to respect others as himself. Such an one, and no other, I conceive has a liberal education, for he is, as completely as a man can be, in harmony with nature."

This conception of a liberal education is, in my opinion correct. The man so educated is the man of energy, background, broad vision and trained imagination, the man required for the big job, for leadership in all walks of life.

Unfortunately the time spent at university is all too short for such an education. Therefore much has to be deferred, to be acquired by the student after he leaves college. In deciding what shall be included in a college course, the determining factor should be not merely what is most useful or necessary, but rather what can one acquire at college that one cannot acquire so well, if at all, outside.

The student should develop his physical body. Without this he cannot have the healthy brain and energy necessary for the full accomplishment of which he would be capable in life. Too little attention is devoted to this phase of his education by most university authorities. He should have enough of the humanities to give him a liking for and an insight into them and to develop his taste and feeling. These are the subjects that develop the spiritual side of his nature.

He should have the basal sciences, not merely to know nature and her laws, not merely because man's life is a struggle to bring himself into harmony with them and secure the most from nature that is possible only by a knowledge of these laws and by conformity with them, but also because science is the great tool for educating the mind, and because the scientific method is the only technique by which material truth can be apprehended and established. It trains the observation, it trains in ordering and marshalling of facts so that they will tell their story. It trains in inductive reasoning, deductive reasoning and enables one to test these results. It subjects the mind to rigid discipline. That is, it trains the observation, the reasoning faculties, imagination and judgment. It trains one to recognize problems and to solve them. Science is peculiarly adapted to educating the mind. Since life consists of facing and solving problems, what other form of training can be more beneficial ?

Many facilities exist outside the university for education along humanitarian and spiritual lines. Provided one has developed a taste for them, has some knowledge of them, is a trained student and recognizes a lack of sufficient training in them, one can and will make good this deficiency after leaving the university.

The sciences require special facilities that are rarely to be found outside the halls of learning. In large part therefore they must be acquired at college if at all. For this reason they may be included in a sound educational course, even at the expense of further desirable training in the humanities. Incidentally I may observe that the reason classics rightly formed such an important place in the arts curriculum, was that the precision and rigidity of these languages afforded an excellent mental discipline such as none of the other humanities did, and at the same time they give one the historical background necessary for an appreciation of our civilization. No other of the older university studies served at one and the same time so many useful purposes.

In laying out the courses in the Faculty of Applied Science, of our provincial university, we have had the above principles in mind.

We require one year in Arts, to give the student his start in the humanities and to enable him to form the lasting college friendships with arts students from which he will, unconsciously perhaps, continue his education along humanitarian lines. In his first two years in applied science, his course is a general one covering mathematics and the basal sciences. When possible these classes are taken with students of other faculties for the broadening educational effects. At the end of his second year, applied science, or third year at college, he selects his more special course. In this time he has had a chance to learn something about the courses and their content, he has had the science or sciences on which each is largely based, and has learned his own tastes and aptitudes in the subjects. He is therefore in a position to make an intelligent choice. But even in the last two years these specialized courses are kept as general as possible, to give the broad training, so that the student, if he has made a mistake in his choice can still switch into another specialty.

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*It was mentioned in support of this theory that some form of annual registration was, it was reported, practised at McGill.

†Any liability or legal need to registration by the professors had not been advanced, only the desirability thereof, and the help to the profession was advanced and emphasized.

Such an applied science course furnishes sound education for almost any industry or life of affairs.

We think it forms the best possible training for one who intends to become a professional engineer. No attempt is made to turn out the finished product. It would not be desirable even if it were possible. Some information necessary to the engineer has been omitted from the course, but that he can acquire outside. Indeed if it is necessary, he must, so we may safely trust to his doing so.

The success or otherwise of such a course will be shown by the success of our graduates. We are too young for decisive results to have appeared, but the indications so far may he said to be very favourable. For example, universities of world-wide renown are giving special recognition to our graduates.*

There is a conception abroad, and it seems to be held by some professional engineers, that the Faculty of Applied Science is an engineering school. From my introduction it should be evident that it is not. I do not want this body, the public, or the students, to think it merely and solely a professional school. It is the aim of the Faculty to give a broad education, useful in almost any life of affairs. So it is not a professional school, such as a law school, or what a medical school has now become. Not one-half of the present students will ever enter the engineering profession. I say to the students,—look into those industries, those walks of life where up to the present technically trained men have not been employed. There, your opportunity lies. These are openings in British Columbia for all we turn out. The best industry to get into is one that does not know it needs technically trained men. There is even room in the engineering profession. It will take the present graduates ten years to qualify as professional engineers, and what a tremendous expansion will have taken place by then! British Columbia will need them.

In the United States, such is the demand for technically educated men, that although the schools are turning out 485,000 men per annum, industry is exercised about its future supply.†

Two ways are open to ambitious youth, dissatisfied with his present prospects:—Leave the country or go to the university. The university is the one great stopper to emigration.

I repeat, gentlemen, not half of the science students will enter the field of engineering, so the university does not wish to give the Faculty of Applied Science a professional school label. It wishes to encourage all who can be induced to take this training, but it does not wish to push anyone into an engineering career, but to have this confined to those who cannot resist the call. I want you to remember your own attitude when you first became a free agent and authority tried to shove you where they had not the power to force you. The students today are just the same as when you arrived at college. It is thus, the work of the profession to interest those students who are thinking of becoming engineers. The initiative rests with the profession. The university wants the profession to take an interest in the students who are thinking of going into engineering, and in their welfare and training, and the university will co-operate heartily to this end.

Another question put to me was "Should engineering professors of the faculty be registered?" In other words. "A movement, such as the professional engineer movement, is judged by the world by the number of influential men supporting it." A number of the university faculty are not members, and it is suggested that I, as Dean, should urge them to register with the association.

Such influence or authority as I may have is academic and this is not an academic matter. It is bad policy to give an impression that one is using his academic influence in a matter entirely outside his academic jurisdiction. So I am the last man to be selected for such a task.

On account of the almost total absorption of the university staff in their work, there is a corresponding lack of initiative in outside interests. Members of the faculty who do outside work are naturally subject to the "Engineering Act" and thus are registered and are members of the Association of Professional Engineers. It is not surprising that those who do not do outside work are not registered and are not members of the association, nor is this uncomplimentary to the association. They are merely assuming that the professional engineers are competent to look after their own affairs without academic assistance. Speaking as a registered engineer, that is, as a member of the association, I say, if these professors would be of help to us, if their names and presence would be of value, how about making them honourary members,—honourary registration,—thereby, putting them under some obligation to the association? Then we would be free to call on them. Such an arrangement would be,—members of the university staff who practise, obtain registration in the ordinary way,—those who do not, receive honourary registration, but all are at your call for assistance and advice.

Now a word as to the relationship of the university to the engineering societies, and to the Association of Professional Engineers. The relationship is very close. To a limited extent the university can help the profession,—to an unlimited extent the engineers can help the university. University help is limited by the fact that no university savant has yet discovered how to get more than twenty-four hours into a day. No one outside of the university knows how completely the time of a conscientious professor is absorbed by his official duties. How little time there is for research, and without "research" teaching is work without inspiration.*

Further, every society with which our civilization abounds feels it has the right to call on the time and the interest of the professor. I suppose that upon no other class are so many demands made. There is a limit to the kind of appeal made to the church or to a service club, but there is not a mortal thing that any sport, or artist, or prophet, or fool ever conceived to be of any value, that the university man is not expected to support with his time and meagre allowance. For instance, I am severly criticized for lack of proper interest in societies for the advancement of science or engineering and complaint has been made to the president. As acting president, I have to jump on myself for this lack of interest. I am a convicted shirker, yet, Gentlemen, I do belong to some twenty of these Societies, and pay dues and am expected to take an interest in them and devote my time to them. Then there are the religious, military, cultural, social service, uplift societies ad infinitum et ad nauseandum.

The relationship between the engineering societies and the university I have said is very close; it can be made yet closer by the help of the profession. I have already referred to interesting the faculty and the students. Other avenues of help are:

1. Get the facts about the university and combat the stupid, ignorant criticism based on mere opinion and founded on imaginary facts,—the opposite of the truth. For example:

a. Students are spoiled as real workers.

b. Students are educated for the United States.

c. The province cannot afford higher education.

The province cannot afford not to have higher education. Our competitors are using technically trained men in every department. We cannot compete unless we also make use of knowledge and employ those who know.

d. Higher education costs too much.

e. Faculty of Agriculture useless and a loss.†

2. To create a demand for students by making industry and business see the possibilities in student labour.

3. To encourage donations for scholarships for research.

When graduates of applied science permeate industry then there will be a greater demand for professional engineers for they will realize how professional engineers may be employed and the value of their services. For instance, all mining is based on some geological theory. We give students a considerable amount of training in geology. Not that they may do their own geological work, for they cannot, but that they will know enough to employ geologists. And this is much needed, for notwithstanding that all mining is based on some sort of a geological conception, good or bad, of mining conditions, until two years ago there was not a trained geologist in the employment of a single mining company in Canada, while some United States companies were employing geological staffs stronger than most national geological surveys. Again, I know a man who has managed a specialty for thirty years. In this line, he will not risk one cent without technical advice, but in any other line, about which he knows nothing, he will risk any amount on his own uninformed "guess."

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*At this point the Dean gave as illustrations the recognition afforded by the universities of Oxford, Princeton and Illinois, and then resumed.

†The Dean, here, showed that only eight per cent of university men in recent years left for the United States, and most of these for post graduate work.

*The Dean then outlined the value of research to the teacher, to the student and to the public, and added:

†The Dean here remarked that, "as he was not a member of the Faculty of Agriculture he was in the happy position of being able to refute such a stupid assertion." The Dean then gave many instances where the faculty saved to the province annually many times, over and over again, the cost of the faculty.

No, when technical men get into industry, it will be a brave day for engineers.

If we attract into professional engineering, only the students who are born with an engineering call, furnishing the students by a liberal education with abundant means to discover what is involved and with sufficient breadth to enable them to switch into some other pursuit if they find they are in the wrong field, we shall have done the most effective work possible for raising the status of the engineer. For it is the *men* who make the status of their calling. Laws do not accomplish, they merely register accomplishments. Those laws are laws that do enforce themselves.

Let us, as engineers, avoid that simple, pathetic faith in the efficacy of law that is making this continent ridiculous, and remember that no real results are yielded by legerdemain, but only by honest, patient, intelligent effort.

The "Engineering Act" will assist your work and your efforts; it cannot replace them.

CORRESPONDENCE

Why is the Educational Basis of the Engineering Profession Different to that of Law and Medicine?

The Editor, (*The Engineering Journal*)

Dear Sir:—

In connection with Dean R. W. Brock's address appearing in this issue, it is submitted that, although it is not within the province of the writer to question the views given from an educational aspect, yet, it is felt that interest in the profession warrants at least the following criticism, particularly in view of the importance of the questions arising therefrom.

The Dean is reported to have said:

> "The Faculty of the University object to the Department of Applied Science being labelled as an 'Engineering School,' as the law and medical schools are known."

Is it not then strange, this being the ruling principle, that degrees, or diplomas are given, not as Bachelors of Applied Science alone, but as Bachelors of Applied Science in civil or mining or electrical or mechanical engineering? Is not the addition of the words (Branch) engineering clearly a Professional label?

Does not the course as given in the calendar bear every indication of a professional label, when the courses are headed—"Courses in Civil Engineering—leading to a B.A.Sc. degree?"

Are not the courses popularly and rightly recognized as courses or instruction, not in applied science, but in engineering in all branches, and are not the graduates popularly and rightly recognized as chemical, civil, electrical, forestry, geological, mechanical, mining or structural engineers?

Why should not the engineering profession have its "Engineering Schools" in exactly the same way as theology, law and medicine?

CONDITIONS ARISING FROM THE OPERATION OF THIS PRINCIPLE

How would a lawyer or doctor regard the presence in the community of thousands of commercial men, salesmen, drug mixers, who were known and recognized as lawyers and doctors, who had received degrees—Bachelors of Science or Art—in law or in medicine, and popularly known as lawyers and doctors—where would be the professions (as known to-day)? Indeed the answer to this question seems to be that the professions of law and medicine would not exist as professions at all, but would be merely occupations.

Much more could be said on this subject. It is sufficient for the time and for the purpose, if this letter encourages the whole profession throughout the Dominion to study deeply the problem.

The writer begs to appeal to engineers more qualified than himself to speak on this subject, to give their views in future numbers of the Journal, and this appeal is made particularly to educationists who at heart and in heart feel the call for aid from every member of the profession.

E. A. WHEATLEY, A.M.E.I.C.,
Vancouver, B.C.

BOOK REVIEWS

Fuels and Their Combustion

By R. T. Haslam and R. P. Russel. McGraw-Hill, New York, 1926. Cloth, 6 x 9 in., 809 pp., illus., $7.50.

This book, just off the press, affords a most comprehensive review of present knowledge regarding the chemistry and engineering of the combustion of the standard commercial fuels. A certain portion of the given material is available elsewhere, but the present work presents within the covers of one book, a thorough treatment of the essentials of what is termed combustion engineering.

It is interesting to note, that in the chapter on combustion calculations, the authors present to their readers the concept of the pound-mol. This is the number of pounds of a substance numerically equal to the molecular weight. Therefore for all gases a pound-mol at 0° C. and pressure of 760 mm, will occupy 359 cu. ft. The use of the pound-mol is not as familiar to American engineers as its convenience warrants.

The authors present in logical order a description and a discussion on the origin and types of fuels, the extent of these resources, the fundamental chemistry of combustion, and the principles of combustion calculations. From this point they proceed to a discussion of the combustion of coal on grates and stokers, powdered fuel, the combustion of fuel oil, efficiencies, and gaseous fuels. A chapter on the carbonization of coal—obviously of profound importance for the future—closes the main portion of the work. It perhaps may be pointed out that this last chapter does not give sufficient prominence to the possibilities of low temperature carbonization, nor does it emphasize sufficiently the commercial results achieved at Fairmont by C. V. McIntire. Three valuable appendices are also included. These discuss flow of liquids, flow of heat, and the rate of heating. Much of the material in these three appendices has in the past been extremely difficult to obtain.

On the whole the present work is a valuable and very comprehensive addition to the library of fuel technologists.

LESSLIE R. THOMSON, M.E.I.C.

Combustibles Inferieurs et de Remplacement

By Pierre Appell. Gauthier-Villars, Paris, 1926. Paper, 5 x 8 in., 197 pp., illus., 20 fr.

A very complete review of the various fuels, such as wood, charcoal, coke, lignite, peat, coal, etc., commonly in use for domestic and power purposes in France. It contains tables and graphs of the quantities produced in France and in other countries, as also the characteristics of the fuels referred to. The production and uses of the various by-products are outlined and a number of interesting designs of furnaces, boilers, etc., are given as being adaptable for the different classes. It is a booklet well worthy of perusal by any one interested in the production and use of heat, not only in Europe but in America as well, for it refers to the fuels found in this country, as well as in Europe, and comparisons are drawn between the methods in vogue here and those in Europe. A useful bibliography is appended.

E. A. RYAN, A.M.E.I.C.

Recent Additions to the Library

Transactions, Proceedings, Etc.

PRESENTED BY THE SOCIETIES:

- List of Members of the American Institute of Mining and Metallurgical Engineers, 1926.
- Annuaire de la Société des Ingénieurs Civils de France, 1926.
- Proceedings of the Institution of Mechanical Engineers, May-Dec., 1925.
- Transactions of the American Society of Mechanical Engineers, vol. 46, 1924.
- Year Book of the American Society of Civil Engineers, 1926.
- Transactions of the Institution of Water Engineers, vol. 30, 1925.

Technical Books

PRESENTED BY JOHN WILEY & SONS, INC.:

- An Elementary Treatise on Statically Indeterminate Stresses, by J. I. Parcel and G. A. Maney.

PRESENTED BY E. AND F. N. SPON, LIMITED:

- Workshop Operations and Layouts for Economic Engineering Production, by Philip Gates.

The Alouette Power and Storage Development in British Columbia

In the Vancouver Branch news appearing in this issue, there is a report of the visit of members of the Branch to the Alouette development of the British Columbia Electric Railway Limited. In view of the many interesting features of this development a brief outline of the entertainment is given below:—

Synopsis of Construction Features

The essential features in connection with the Alouette development are:

1. The Alouette dam, creating a storage reservoir, diverting the waters of the river into Stave lake.
2. The Alouette-Stave tunnel, leading from Alouette lake into Stave lake.
3. TheAlouette generating station, utilizing the fall between Alouette and Stave lakes.
4. A transmission line, connecting the generating station with the transmission system of the B.C. Electric Railway Company Limited, at Stave Falls.

All of these items have been completed with the exception of the generating station, which will be ready for operation in the fall of 1927.

The dam is an earth-fill structure built by the semi-hydraulic method. Clay excavated by steam shovel from the spillway channel was hauled on to the dam with standard-gauge railway equipment and dumped near the outer slopes of the dam. The dump piles were then attacked by the streams from hydraulic monitors which spread the clay in toward the centre of the dam, at the same time segregating out the finer material and washing this into the sluicing pond which was carried in the central portion of the dam. The fine suspended clay settling out of this pond forms the impervious core of the dam.

The tunnel is 3,485 feet long, with a section 12 feet wide by 16 feet high, excavated entirely in solid rock. It is unlined except near the entrance and exit, and for a short section where faulty rock was encountered.

The power house for the Alouette generating station will be a substantial building of reinforced concrete construction located on the shore of Stave lake. Extensive rock excavation will be required, extending 40 feet below high water level in Stave lake. There will be a single unit consisting of a 12,500 h.p. vertical reaction turbine, direct-connected to a 10,000 k.w. generator. The plant will be arranged for automatic operation with the starting and stopping controlled from the Stave Falls station.

The transmission line is 10½ miles in length and is of single pole construction with pin-type insulators carrying one circuit of No. O stranded copper designed for operation at 66,000 volts. The country traversed by the transmission line is very rough and most of the materials for construction had to be packed in on the backs of men.

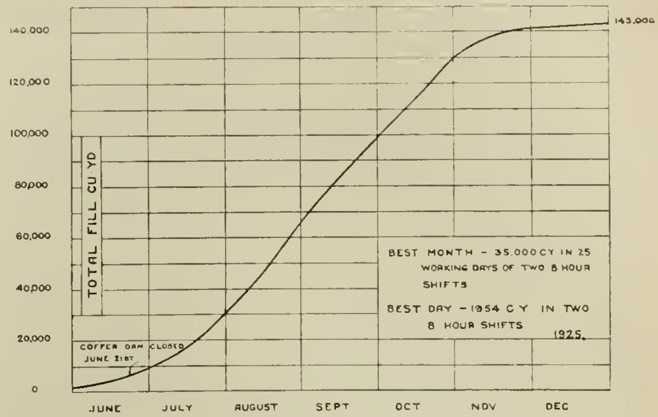

Figure No. 2—Chart of Progress in Placing Fill.

The record day in placing material in Alouette dam was when 1,954 cubic yards of material were washed into place in two 8-hour shifts, and the best month recorded a total of 35,000 cubic yards placed in 25 working days of two 8-hour shifts. In order to expedite the work, flood-lighting was used, which permitted uninterrupted progress.

Alouette Dam and Reservoir Statistics

Average annual precipitation at dam site	100 in.
Estimated drainage area	79 sq. mi.
Average runoff (133% based on precipitation at dam site)	779 c.f. s.
Design based on regulated draft of	700 c.f.s.
Elevation of natural lake level above sea-level	370 ft.
Difference between high and low reservoir levels	45 ft.
Storage capacity	170,000 ac. ft.
Average difference in elevation between Alouette and Stave lakes	138 ft.
Height of dam above stream bed	63 ft.
Length along crest	1,000 ft.
Width of crest	20 ft.
Upstream slope	3½:1 and 4:1
Downstream slope	2½:1 and 3:1

Yardage of fill:

Clay	108,000 cu. yd.	
Gravel facing	29,770 cu. yd.	
Rock paving	3,380 cu. yd.	
Cofferdam—enclosed	1,850 cu. yd.	
Total		143,000 cu. yd.
Total concrete		8,000 cu. yd.

Spillway:

Three stoney roller gates	18′ x 22′
Open weir—length on crest	348 ft.
Thirteen undersluice gates, 6′ x 7′, to augment low water discharge for log splashing.	
One logway bay, 10′ x 18′, for passing timber products	
Combined spilling capacity	30,000 c. f. s.

Figure No. 1—Compounding Water Fifty Feet above Former Lake Level.

Alouette dam is 1,000 feet long and 63 feet high, with a curved crest. The spillway is shown to the right. The width of the crest is 20 feet. The dam is of hydraulic fill construction, containing 143,000 cubic yards of material and 8,000 cubic yards of concrete.

Proposed Constitution for an International Standards Association

Following the announcement of the proposal to form an international body to develop and perfect industrial standards, which appears on page 307 of the June 1926 issue of the Engineering Journal, the following suggested constitution for this association will be of interest to the members of The Institute.

Section 1—*Title*. The name of the organization shall be the International Standards Association (I.S.A.).

Section 2—*Aims and Objects*. The aims and objects of the International Standards Association are:

(*a*) To lay the groundwork for international agreement upon standards by providing simple systematic means of interchanging information on the standardization work and activities in the different countries.

(*b*) To develop general guiding principles for the assistance of the national standardizing bodies.

(*c*) To promote uniformity among the standards of the various national bodies.

(*d*) It is the intention of the International Standards Association that its work shall include the approval of international standards, and the administrative machinery herein set up is so designed that it may be readily extended or modified to include the approval of such international standards when sufficient experience has been acquired.

Section 3—*Membership*. The International Standards Association shall be composed of the central National Standardizing Bodies existing in the different countries, one for each country, which have accepted this constitution.

Section 4—*Plenary Assembly*. (*a*) The chief executive body of the International Standards Association shall be the Plenary Assembly, composed of delegates nominated by the national bodies. The final authority rests with the national bodies.

(*b*) A Plenary Assembly can be called by the President, or in case of his inability to act, by two members of the Administrative Council. The Administrative Council shall call a meeting of the Plenary Assembly upon the request of—national bodies. The date and place of meeting shall be fixed by the Administrative Council. Six months' notice of a Plenary Assembly shall be given, except in the case of the first Assembly.

(*c*) The Plenary Assembly shall be presided over by the President of the National Standardizing Body in the country in which the Assembly is held.

(*d*) As a general rule, Plenary Assemblies will be convened once in three years.

Section 5—*Voting Power*. At a Plenary Assembly each National Standardizing Body shall be entitled to one vote only, either by person, by proxy, or by correspondence, whatever the number of delegates it may send to the meeting. All questions except those for which provision is made in this constitution shall be decided by a majority of the members voting.

Section 6—*Officers*. (*a*) The Plenary Assembly may confer the title of Honorary President on persons of distinction whose co-operation it is desired to enlist.

(*b*) The President shall be elected by the National Standardizing Bodies either in Plenary Assembly or by correspondence; he shall hold office for a period of three years and shall be ineligible for re-election until a further period of six years has elapsed.

(*c*) Each national body shall designate a Vice-President of the I.S.A.

(*d*) A General Secretary shall be appointed by the Plenary Assembly. He shall attend the meetings but without power to vote.

(*e*) The Officers of the International Standards Association shall retain office until their successors have been appointed.

Section 7—*Administrative Council*. (*a*) An Administrative Council shall be appointed by the Plenary Assembly and shall be composed of the President of the I.S.A. and four other members on nomination by selected National Standardizing Bodies, with a power for the President to call other persons to attend, but without vote. In the case of death or inability of the member to serve on the Administrative Council, the National Standardizing Body concerned may nominate one of its members to act in his place.

(*b*) Provision shall be made in by-laws for rotation in office.

(*c*) The Administrative Council shall call such meetings and take such steps as it may think desirable to facilitate the progress of the work. It can agree by correspondence.

(*d*) The Administrative Council shall be responsible for all financial matters.

(*e*) The Administrative Council shall take no technical decisions.

(*f*) The reports of the meetings of the Administrative Council shall be circulated to all member National Standardizing Bodies without delay.

(*g*) The travelling expenses of the members of the Administrative Council shall be paid by the respective National Standardizing Bodies.

(*h*) The Administrative Council shall meet at least once each year.

Section 8—*Central Office*. (*a*) The Plenary Assembly shall decide on the locality of the seat of the International Standards Association and the Central Office of the Association shall be established in accordance with this decision.

(*b*) The Central Office shall be under the supervision of the General Secretary acting in accordance with the instructions of the Plenary Assembly and of the Administrative Council.

(*c*) It shall be the business of the Central Office to circulate among the members all information available as to standardization matters of importance to the work of the Association and in every way to further international agreement on such matters.

(*d*) Formal business of the International Standards Association shall be conducted by correspondence between the Central Office and the National Standardizing Bodies.

Section 9—*Technical Committees*. (*a*) Technical Committees are committees appointed for the purpose of studying technical subjects having an official status in the Association, as provided in Section 10 (*a*) and (*b*).

(*b*) Each technical committee shall consist of one official delegate from each of those National Standardizing Bodies desiring to take part in the work of the Committee. Additional unofficial delegates may be appointed.

Section 10—*General Procedure*. (*a*) On receipt of a request from one or more Member Bodies to study a technical subject, the Central Office shall at once inform all Member Bodies, asking whether they are in favour of a Technical Committee being formed to study the subject, and, if so, whether they wish to nominate a delegate, should a Technical Committee be formed. The Central Office shall then place the matter before the Administrative Council, together with the replies received.

(*b*) If the majority (not being less than three) of the members voting are in favor of a Technical Committee being appointed, then such committee shall be appointed by the Administrative Council. [See Section 10 (*j*)].

(*c*) Before a Technical Committee is organized, the scope of the work, or terms of reference, shall be clearly outlined, and no Technical Committee shall go beyond the work outlined for it.

(*d*) The Administrative Council, in consultation with the Technical Committee concerned, shall appoint either the Central Office or one of the National Standardizing Bodies to act as Secretariat for that Technical Committee. The Secretary so appointed shall be responsible to the Administrative Council for the work, including all correspondence.

(*e*) Meetings of Technical Committees shall be arranged in consultation with the delegates, either by the Central Office or by the National Standardizing Body appointed to act as Secretariat for the subject in hand.

(*f*) The General Secretary ex-officio shall have the right to attend all meetings of the Technical Committees and take part in the discussions, but without the power to vote.

(*g*) A report of each Technical Committee meeting shall be sent to the members of that Committee and to the General Office.

(*h*) The Administrative Council shall be authorized on behalf of the Association to instruct the Central Office to keep all national bodies in touch with all subjects having official status, by reports and memoranda. This is a general rule, action not being required in individual cases.

(*i*) The Secretary of any Technical Committee shall submit the proposals of that Technical Committee to the National Standardizing Bodies appointing delegates. When the Technical Committee has reached agreement, its proposals shall be sent to the Central Office to be dealt with in accordance with Section 10 (*h*).

(*j*) If a request has been received from one or more bodies for a Technical Committee, but it has been decided not to appoint such a Committee, then the group of national bodies interested in the

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Unanimously agreed upon by the Third International Conference on Standardization, New York, April, 1926.

subject shall be encouraged to come to agreement with regard to them. Such an agreement shall not be considered as a decision of the Association.

SECTION 11—*Units Employed.* English and metric measures shall be used in the published recommendations of the International Standards Association. Conversions shall always be given unless otherwise decided by the Administrative Council.

SECTION 12—*Funds.* (*a*) The financial support of the central office shall be divided into three parts:

1. A sum amounting to 25 per cent of the total budget divided equally among the national bodies.
2. A sum amounting to 50 per cent of the total annual budget divided in proportion to the average total foreign trade of each country during the preceding three years.
3. A sum amounting to 25 per cent of the total annual budget divided in proportion to the population of each country.

NOTE: Assuming a first budget of £2000 per year, these amounts would be:

1. Fixed sum for each national body....................£25
2. For every hundred million pounds total foreign trade..£12 10s.
3. For each million inhabitants...........................£1

Increases in these amounts in subsequent budgets shall be subject to the approval of the national bodies.

(*b*) Each National Standardizing Body joining in the work of the Commission shall agree to contribute to the expenses of the Commission for three years and shall give not less than one year's notice if they desire to retire

(*c*) In the event of the expenses in any one year being less than the amount contributed, the Administrative Council shall establish a Reserve Fund, and fix the maximum, after which any sum unexpended shall be deducted from the contributions due from the National Committees for the subsequent year pro rata.

SECTION 13—*Accounts.* The accounts of the Central Office, which shall be made up annually to the 31st December, shall be submitted to the Administrative Council before the 31st March in each year and shall be signed by the President and by the General Secretary. In the case of the inability of the President to do so, they shall be signed by one of the other members of the Administrative Council on his behalf. The report of a professional auditor shall be accepted as proof of the correctness of the accounts.

SECTION 14—*Alteration of Statutes.* Any future alteration to these Statutes can only be effected by a vote of four-fifths of the participating National Standardizing Bodies and after ratification by a Plenary Assembly.

SECTION 15—*Liquidation.* In case of the International Standards Association being dissolved, the Administrative Council shall decide upon the disposal of the remaining funds.

Agreement Reached Looking to Preservation of Niagara Falls

In a statement issued to the Press, the Honourable Charles Stewart, minister of the Interior, announces that an agreement has been reached with the United States looking to a study of the problem of preserving the scenic beauty of the Niagara falls.

Mr. Stewart stated that it has been a matter of common knowledge that the Horseshoe falls are progressively receding upstream in a manner which materially alters the general appearance of the falls from year to year. Periodic surveys of this crest line have been made from the year 1764 to date. These surveys show that the average recession of the escarpment in that period has been some 650 feet, or an average of 4 feet per year. While the recession has been widespread along the crest, the maximum rate has taken place in the bend of the Horseshoe and has totalled in the same period to 820 feet. During the period 1917 to 1925 this maximum rate of recession has proceeded at the rate of seven and a half feet per annum.

It is the judgment of close observers of the falls that the rate of recession in the notch of the Horseshoe will progressively increase since more and more of the total flow is being continuously concentrated at this point, and this in turn is resulting in a faster and faster rate of recession. This has frequently been referred to as the "suicide of Niagara Falls."

The recession of the notch of the Horseshoe has had the effect of withdrawing water at an ever-increasing rate from the escarpment forming the ends of the Horseshoe on either side of the river, leaving these sections at times and in places totally without flowing water. The withdrawal of water under treaty provisions for power purposes has in some quarters been credited with laying bare of the borders of the Horseshoe falls. Some observers, however, consider that a greater effect arises from the natural process referred to in the foregoing and that the withdrawal of water for power purposes, by reducing the total volume, has to some extent at least, been instrumental in retarding the rate of recession in the notch of the Horseshoe and to this extent has been beneficial.

While the investigation which has been agreed upon by the two governments has primarily in view the study of the conditions which have been and are adversely affecting the scenic beauty of the falls, with a view to designing such remedial works as are feasible for the protection of the falls from further erosion and for the preservation of their scenic beauty, the study will also include an investigation into the total amount of water which, in conjunction with the installation of remedial works and consistent with the restoration and maintenance of the scenic beauty of the falls, could be released for the development of power. The board will not consider the question of allocation as between Canada and the United States, of any additional water which it may find could be made available. This is a matter reserved for subsequent negotiation.

The investigation will be carried out by an International Niagara Board of which J. T. Johnston, M.E.I.C., director of water power and reclamation, and Dr. Charles Camsell, deputy minister of mines, are the Canadian members, and Major D. C. Jones, of the United States Corps of Engineers at Buffalo, and J. Horace McFarland, former president of the American Civic Association, are the United States representatives. The board's report will be submitted to the two governments for their respective consideration.

Survey Parties engaged in Mapping Canada

The following members of the Engineering Institute are engaged on topographical, control, and aerial surveys this season:—

TOPOGRAPHICAL SURVEYS

Topographical survey parties are engaged in various districts across Canada mapping on different scales and by different methods.

C. H. Taggart, A.M.E.I.C., is using photo-topographic methods in completing the mapping of an area surrounding Kamloops, B.C.

W. Christie, M.E.I.C., and F. H. Wrong, A.M.E.I.C., are revising the Victoria Sheet of the Sectional Map, on a scale of one inch to three miles, and G. C. Cowper, A.M.E.I.C., the Battleford sheet.

P. E. Palmer, A.M.E.I.C., is finishing the field work for Sheet M 13 N of the one millionth international map of the world.

In Quebec, C. Rinfret, A.M.E.I.C., is making plane table surveys of the Shawinigan area.

In Nova Scotia, A. L. Cumming and G. A. Bennett, A.M.E.I.C., are similarly mapping the Windsor area.

CONTROL AND AERIAL SURVEYS

G. H. Blanchet, A.M.E.I.C., is continuing explorations and lines of control surveys in the Northwest Territories. During the season he is to explore the Wood Buffalo reserve and report on its possibilities for supporting the present number of buffalo and any future increase in the herds.

C. S. Macdonald, A.M.E.I.C., in Northern Saskatchewan, S. D. Fawcett, A.M.E.I.C., in New Ontario, and L. Brenot, A.M.E.I.C., in northern Quebec are obtaining sufficient ground control to enable plotting aerial photographs of these areas.

J. Carroll, A.M.E.I.C., and C. B. C. Donnelly are acting as navigational officers with the sea planes of the Royal Canadian Air Force.

B. W. Waugh, M.E.I.C., is obtaining horizontal and vertical control for the Fredericton sheet, New Brunswick, and P. M. H. LeBlanc, A.M.E.I.C., is doing the same for the Shawinigan area in Quebec.

Map of Kootenay Park, B.C.

Another new map just off the presses of the Topographical Survey, Department of the Interior, is of Kootenay park in British Columbia and shows a portion of the route of the Banff-Windermere highway, nearly sixty miles of which lies through the centre of this park. The map was printed for the Canadian National Parks Branch, Department of the Interior, Ottawa, and will be distributed by that organization.

The Application of Engineering Methods of Analysis to Financial Investigations

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It is not so long ago as to be almost within the memory of men now living that most of our industries were owned either by individuals or by a small group, and financial transactions involved little more than taking money into the till and paying it out again. The amount taken in, in a year, less the amount paid out, measured the year's profit. Accounting was just about as simple as that.

But as our industries grew, and more particularly in the building of our railroads, large amounts of capital were required, and to secure this capital it was necessary to devise different types of securities to suit the widely different views of investors. Before an investor of one class would venture his savings in the enterprise he wanted to know for a certainty that his interest would be paid to him regularly and his principal returned when due. He was not gambling or speculating, he was investing. The mortgage bond suited him.

Another wanted security, but like most of us he liked the idea of participating in the profits as well. For him preferred stock was invented.

Another wanted to rise or fall with the enterprise and the common stock was the class of security that appealed to him.

If you think back you will realize that comparatively few of the business enterprises of the country have been complete failures but a very large number have been failures in one degree or another. That is to say there are all sorts and degrees of failure and the measure of failure may be said to be the extent of the company's inability to meet the bed rock expectations of its promoters as expressed by the fixed interest requirements of its debts.

A fixed interest requirement, when it represents a considerable part of a company's net earnings, has done more, in my opinion, to cause the failure of sound business enterprises than any other agency for which man is responsible and I would like to take the time to tell you why I think so.

Let us take an extreme case for purposes of illustration. Assume that two companies doing the same class of business and of about the same volume are started off at the same time. One secured its funds to a large extent by the sale of bonds and to a small extent by the sale of stock; the other wholly by the sale of stock.

We will say that for several years each pays about the same return to its security holders.

As is inevitably the case in every business, these two companies run into a period of hard times. The first is obliged to pay its interest to keep solvent, but its officers firmly believe better times are just around the corner. Usually, however, their optimistic hopes are not realized and business gets worse instead of better and to meet the interest payments they reduce the inventory, suspend payment of bills, sell any marketable securities the company may own, perhaps make short time loans from banks or individuals and thus pile up a large floating debt in addition to the mortgage debt. During such a period the company almost invariably fails to maintain its property adequately. It is no time to put in new machinery that would tend to improve the product or reduce its operating cost, and finally, if this condition continues long enough, the company is unable to pay the next installment of interest and a receiver is appointed. It has failed.

Now what of the other company ? Its owners, in my opinion, were better gamblers to begin with, and I use the word gambler in the best business sense as men with nerve and foresight, men who are willing to take their chance with the business and to forego profits when times were such that the company could not earn them.

In the period of hard times that we have just brought into the lives of these two companies, the second immediately reduced its dividend. When times became harder still, the company suspended dividends altogether. But each year there was a surplus which was devoted to the improvement of the plant and product. When times got better this company was able to expand, in all likelihood absorb a considerable part of the business of the first company, and resume dividends at perhaps a higher rate than formerly.

Now in point of fact, did the man who invested in the first company actually make his investment more secure by buying bonds instead of stock? What he really did, and what in fact very many men have actually done, was to buy the right to strangle the company when it most needed relief, and for this right he paid a higher price than did the man in the second company who bought stock. Of course, as I said in the beginning, this is an extreme case, but it has been made so purposely to illustrate the point.

Now let us look at this matter from the standpoint of the ability of large industrial concerns, over a long period of years, to earn a fair return on their investment, which fair return we ordinarily regard as 6 per cent. Of course, we all know of instances where much larger returns than 6 per cent are made on invested capital. Many sound industries make very much more for short periods and sometimes even for long periods, but as a percentage of the capital invested in all of the industries of the country, they are relatively few and do not appreciably affect the long time average.

I believe very few people realize how low the average earnings of money invested in business enterprises really are. It is said that the island of Manhattan was bought from the Indians for $24.00 a few hundred years ago, which seems cheap enough, but the astonishing fact about this purchase is that this $24.00 if invested at 7 per cent compound interest for the period since the purchase was made would amount to several times the total assessed value of Manhattan island realty to-day; and yet in all probability the increment of increase in value of Manhattan island has been greater than that of any other real estate in the world.

This is only another way of saying that average earnings over a long period are not nearly as large as we are accustomed to think they are, and when we erect a financial structure that makes it obligatory upon a company to pay out in interest charges year by year an amount that represents what we normally regard as a reasonable return on the actual investment, we are likely to lay up trouble for the future.

This, in fact, is the very difficulty that is facing many financiers to-day. The ease with which money can be gotten by the sale of bonds rather than stock is a temptation to mortgage a property for its full value. Cases have been cited where the interest charges on the bonds amount to more than any reasonable expectation of earnings of the property, and yet you and I buy bonds of this character thinking we have security merely because we have a mortgage.

In the early days of railroad construction in the United States most of the different classes of railroad securities were invented that are in use today. But in many cases the bonds alone represented real money. The stock was largely given to the bondholders as a bonus and to the promoters for their services. Even in such cases the bonds were often sold at a discount. As a result, the face value of the bonds was often greater than the actual amount of cash invested in the enterprise. Many of these companies flourished for a time until from without, the inexorable laws of competition and the hand of regulation, and from within the even more inexorable law of depreciation, began to make themselves felt. These companies could not in a few years, notwithstanding their great size and strength, raise the level of the average return on invested capital and as a result a very large part of the railroad mileage in the United States has at one time or another been in the hands of receivers. Many companies have suffered this experience a number of times and in some cases the old bonds are now, through one reorganization after another, wholly represented by stock.

There are over twenty billions of dollars invested in the railroads of the United States and railroad investment is normally regarded as profitable, yet the Transportation Act of 1920 provides that rates shall be fixed, as nearly as may be, so that the annual net earnings in the aggregate shall equal 5.75 per cent of the value of the railroad property. As a matter of fact in not a single year since the act was passed, except 1925, have the earnings nearly equalled that rate. The 1925 earnings were nearly that amount based upon the Interstate Commerce Commission's valuation, but this valuation is regarded by railroad officers as entirely too low.

If then, the average earnings of money over a long period of time are less than 6 per cent it is apparent that when a large percentage of these earnings is committed to fixed interest requirements, often at a rate considerably higher than 6 per cent, the margin of safety for lean years may be nothing, or less than nothing.

To my notion therefore, the adjustment of a company's capital, particularly its fixed interest bearing capital, to its earning power is one of the most important matters to which financiers should give consideration. Most of the failures to which my attention has been drawn have been due to inability to pay interest during periods of depression, and as our companies are managed by boards of directors, elected by the stockholders, it is only human that a board will view the company's prospects from the standpoint of the stockholders, and in the effort to avoid a receivership and the consequent depression in the value of the stock, and a lowering of the company's credit will allow the property to run down and otherwise curtail expenditures, and the inevitable result of such a procedure is to depreciate also the security behind the bonds.

Now, I want to say that I am not in the least opposed to corporations borrowing money whether on bonds or notes. What I want to emphasize is that, from the point of view of investors, many corporations borrow too much money. Over-borrowing usually takes place in good times, when there are no clouds on the business horizon, when everybody is feeling optimistic, even the banker who arranges the loan, and bankers are supposed to be proverbially pessimistic.

It is not the low average return on investment that bothers business concerns, or the rates that bankers must charge for the use of money, but rather the failure to realize and provide against the wide fluctuations in earnings in connection with the amount of the loans, and the fact that interest must be paid each year whether earned or not. When the capital raised by borrowing is a large percentage of the total capital of the company and bad times come, as come they always have and probably always will, whether due to a general business depression, inherent peculiarities of the business, competition, new inventions which render processes obsolete, or what not, and the leeway between interest and earnings disappears altogether or even becomes a minus quantity, then there is real trouble ahead for everybody, whether stockholders or bondholders.

The railroads of the United States are perhaps as stable business enterprises as we have, yet the fluctuations in the railroad business are sometimes very wide both in individual cases and as a whole. The average percentage of bonds to total capitalization is somewhat over 60, and this being an average, there are, of course, many roads whose bonds bear a much higher proportion than this to the total securities outstanding.

My own feeling is that the man whose inclination would be to invest only in high grade securities, (and that usually means bonds), would often be better secured, if the capital of the company in which he was an investor were represented only by stock and he a stockholder, instead of a bondholder; and recently in the reorganization of a railroad company in which we had a voice, our views in this respect prevailed to the extent that no bonds whatever were issued, and I might add that the company has since prospered beyond our expectations; but I might also say that when it again needed money it issued bonds.

As a matter of fact the reorganization which follows the bankruptcy of a company is usually in its rough essentials merely the process of converting the senior bonds into junior bonds and the junior bonds into preferred or common stock. In other words, if the financial structure had been designed in the first place with a larger percentage of stock to bonds or entirely without bonds, the stockholders would have had to forego dividends during the period of the company's rehabilitation but the company would not have become bankrupt and in due course would have recovered.

The most a bondholder can hope for is that his interest will be paid promptly and his principal returned when due. But the dollar returned is not usually worth nearly as much in buying power as the dollar he loaned, or at least such has been the tendency for many years. For my part I would rather be a stockholder in a going concern with an interest in a property that is steadily appreciating in value than a bondholder whose best prospect is to be paid in a depreciated dollar.

I said a moment ago there were perhaps two reasons which might be stretched to the point of justifying my appearance before a scientific society, the first was some slight connection with the great invention—interest; the second is in the field of discovery.

It seems to me that throughout my career as a consultant on corporation business, I am constantly rediscovering an old truth, and that is that things are not always as they seem.

I think this is best exemplified in the case of the most recent railroad financial disaster, that of the Chicago, Milwaukee and St. Paul. So prone are people to take appearances at face value that there are a great many very influential people in the United States to-day who do not believe that the receivership of the St. Paul was necessary.

The circumstances that led to the St. Paul receivership are now under investigation by the Interstate Commerce Commission and I do not wish to appear to prejudge the question at issue; but it is a subject that I want to talk to you about for a moment because in several of its aspects it illustrates the points I have just made, and the lessons to be drawn from the experience of the St. Paul are of the greatest importance.

The St. Paul was before the receivership and is to-day a magnificent railroad of 11,000 miles, one of the largest in the world.

Just now it is commonly referred to as the biggest financial failure in history. But it did not completely fail by any means, it merely found itself in a position where it was unable to meet all of its obligations.

As a matter of fact, while the difficulties of the St. Paul culminated in 1925, they really began with the construction of the Puget Sound Extension which was commenced in 1906, and opened in 1909. Prior to that time the company was in a strong position with a financial structure that was amply able to supply the needs of its growing business. Its preferred stock was selling at 170 and its common at 110. It was therefore able to meet all of its requirements for additional funds by the sale of preferred and common stock. In connection with what I have just said in relation to fixed interest obligations an important fact to bear in mind, as measuring its ability to weather the storms of business depression, was that at that time only one-third of its outstanding capital was represented by fixed interest bearing securities and two-thirds by capital stock, whereas these ratios at the date of receivership, March 17th, 1925, were exactly reversed, that is two-thirds of its capital was represented by bonds and one-third by stock. At the earlier date the percentage of bonds to total capital was much lower than that of the average of all of the roads in the United States, at the later date it was much higher. Had it been possible to have maintained the ratio of bonds to stock of the earlier date throughout the subsequent period the railroad would not be in the hands of receivers to-day and I think it is safe to say that a large part, at least, of the depreciation in the market value of the company's securities as a result of the receivership would not have occurred.

But to state the facts in this way is merely to state effects rather than causes, or in engineering terms to compare the cross-section of the company's affairs as of 1909 with that of 1925. The causes which led to the change in its situation and the cure were not so easy to ascertain or to state. Were they easy, my firm would not have been engaged to make an investigation of the company's affairs and I personally, upon whom the work devolved, would have been spared a lot of trouble and worry and misrepresentation.

The purpose of the investigation for which we were engaged was to determine the best course to pursue in the interest of all security holders in view of the pending maturity of about $75,000,000 of bonds of which $48,000,000 were due in 1925, $3,000,000 in 1926 and $25,000,000 in 1927.

I might say that when I began to look into the affairs of the company I had no thought that the ultimate outcome would be a receivership. The resources of the company were generally thought to be so large, its pre-war record so good, its gross earnings so enormous that I shared the optimistic views of the officers and directors that some course could be devised to tide the company over its difficulties.

It occurs to me that perhaps the methods used in examining the company may be of interest to you.

As a preliminary to the real work of the investigation I made a trip of inspection over the company's main line from Chicago to Seattle. An inspection of the physical property is an important part of an examination of a railroad company's financial status. It is necessary to know the condition of the property, (including roadway, track, buildings, machinery, equipment and all other physical elements), both for the purpose of ascertaining the amount of money that must be expended upon it for maintenance and rehabilitation, to determine its adequacy for the work demanded of it, and to be in a position to estimate the requirements of the future. But this inspection trip was not wholly as its name implies for the purpose of observing the physical condition of the property, but was also planned as a means of bringing all of the officers together under one roof, as it were, for discussion of the company's problems, free from interruption so that each officer, irrespective of rank, could be interrogated and given an opportunity to express his independent views concerning those matters with which he was personally familiar.

The story of what happened to the St. Paul is rather a long one, because so many things happened to it, but I will try and condense it into a few words.

As I stated a few moments ago its troubles began with the construction of the Coast Extension which was completed in 1909. If any of you Canadians should be tempted to build another line to the Pacific coast and feel that your own experiences do not furnish sufficient warning not to do so, I suggest that you meditate on St. Paul.

To those who are inclined to criticize the St. Paul management for building the Coast Extension, let it be said in the first place that our hind sight is better than our foresight. At that time trade was booming with the Orient; the lumber industry was growing rapidly; important mining developments were under way; gold had been discovered in Alaska; federal, state and private irrigation projects were being built and as a result the Northern Pacific and Great Northern railroads were doing a heavy business. To participate in this rapidly growing traffic the St. Paul directors decided to build to the coast. Unfortunately, no sooner had the line been completed than the building boom in the Northwest subsided. The lumber industry has remained practically stationary ever since. To make matters worse, the development of the Northwest has been retarded by restrictive immigration laws and immigrants who had been brought over at the expense of the Canadian Government could no longer, in such numbers, at least, be induced to move across the line.

As a result, the St. Paul's Pacific Coast Extension, which includes 3,000 miles of line and cost $252,000,000, in the best year of its history, 1924, earned but 6/10 of one per cent on this investment, notwithstanding the fact that it was supported at its eastern end by 8,000 miles of railroad comprising the balance of the St. Paul system and situated in the heart of the agricultural section of the country.

But this was only one of the St. Paul's difficulties. In recent years not only has the competition of the older established lines been keener but new transportation agencies have come into the field which have affected all railroads alike. Your newer Canadian transcontinental lines, the Canadian Northern and Grand Trunk Pacific, have not been an inconsiderable factor in contributing to the troubles of the St. Paul. Knowing something of the history of the Canadian National lines, I have no doubt you feel you have railroad troubles enough of your own without shouldering any part of the responsibility for the troubles of lines on the other side of the border; and I think, as a Canadian born, I should be inclined to share that view with you and will not pursue the subject further.

As a matter of fact, though, in respect of competition, the new agencies that have most adversely affected the company have not been other railroads at all but the Panama canal in freight transportation, and the motor vehicle in passenger transportation.

I feel certain that if the effect of Panama canal competition could have been foreseen the St. Paul's Coast Extension would never have been built. The extent to which the canal route has grown in popularity with shippers may be judged from the fact that freight transported through the canal increased from 5,000,000 tons in 1915 to 27,000,000 tons in 1924. Of the traffic of the later year, eliminating 16,000,000 tons of California oil and other tonnage that would not in any case have moved across the continent by rail, there remain 11,000,000 tons in which the transcontinental lines would have participated had the canal not been built. And it seems to me that with improved refrigeration on ships, larger and better vessels and a reduction in operating costs, that the canal route will continue to grow in favour and that this prospect must be frankly faced by the transcontinental lines.

Now let us see what this 11,000,000 tons would have meant to the railroads had the canal not been built. There are ten transcontinental lines by which this traffic might have been moved, and if we assume that the St. Paul would have moved one-tenth of the tonnage this would be equivalent in transportation units to 2,200,000,000 ton-miles, or just one-fifth of the total ton-mileage of the St. Paul for the year 1924. This traffic could have been moved at much below the company's average operating ratio since a great many items of expense would not have been affected by it. It is probable that this traffic would have added about $8,000,000 a year to the net revenue of the company, which would have been much more than sufficient to have offset the deficit; and that portion of this revenue accruing to the Pacific Coast Extension would have raised the return on the investment of $252,000,000 in that property from 6/10 of one per cent to 2.5 per cent, which, though still a low rate of return, would easily have saved the company from default. One of the major considerations in building the Pacific Coast Extension was to participate in the movement of this traffic, and it will be seen from what I have said that the heavy loss of revenue entailed in the diversion of this traffic to the canal has been a great disappointment to those who promoted the building of the extension.

I do not know a better ocular demonstration of unrealized hopes than is to be found in the docks and warehouses at Tacoma and Seattle built by the company to accommodate transcontinental and trans-Pacific traffic that unfortunately never materialized. At the time of my inspection not a vessel was at the docks and the freight in the warehouses would scarcely have filled an ordinary room. The sense of desolation about these enormous works was oppressive, yet there are those who contend that the Panama canal has not adversely affected the traffic of the transcontinental lines.

I mentioned a moment ago the disastrous effect of motor vehicle competition in passenger transportation. This is an item which cannot be accurately measured. We know this, however, that notwithstanding improved service the St. Paul's passenger revenues declined from $31,000,000 in 1920 to $21,700,000 in 1924, a loss of $9,300,000, or 30 per cent in only four years. We know also that the registrations of motor vehicles in this territory doubled during this period and that the business of the Northwest expanded, and but for motor vehicles the passenger business of the line would undoubtedly have increased. It is apparent, therefore, that the loss from this source is even greater than that indicated by the figure I have just mentioned. The saddest phase of this story is that this loss is wholly a net loss because the company performed more passenger service in 1924 than in 1920.

I firmly believe that but for these two sources of loss the St. Paul would be a prosperous road to-day and that rate reductions of considerable proportions would have been possible in the western territory where the farmers are in greatest need of such relief. I think it could be said also that the inability of the railroads to reduce rates in the Northwest because of canal competition, has placed a burden upon the people of that territory that they should not be required to bear. The lower rates of the canal route benefit the country as a whole but the effect of canal competition upon the railroads is borne in large measure by the people of the Northwest, and these people, because of the unfavourable agricultural situation of the past few years, have been less able to sustain that burden than the people of any other section of the country.

So far I have spoken only of some of the occurrences which contributed to the inability of the St. Paul to meet its obligations. Now these troubles did not all fall upon the company at once. Instead they came in series—one following another. And throughout the long period since its difficulties began the officers and directors believed, (until shortly before the receivership), that better times for the company were not far off. So prone are business men, and I think more particularly American business men, to view the concerns in which they are interested through rosy spectacles that when drastic action is required to restore sound condition in a company's affairs it is almost inevitably too long delayed. And such was the case with the St. Paul.

We found for example that through pressure to meet its various obligations its position with respect to current assets and current liabilities had reached a condition that was embarrassing to the management. At the time of our examination there was a net deficit in current position of over $13,000,000.

A brief résumé of the company's financial transactions for the four years ended December 31st, 1924, is illuminating in this connection, one result of which was the deficit in current position.

The deficit in earnings after payment of interest was	$20,700,000
Additions to road and equipment amounted to	26,700,000
The increase in advances to subsidiaries was	3,100,000
And various small investments amounted to	1,500,000
A total of	$52,000,000

Now, what was the source of this money, a large part of which it will be noted, was required to meet interest obligations?

Bonds were issued which netted	$29,500,000
Materials and supplies were liquidated to the extent of	6,900,000
Net current assets were reduced	5,800,000
A bank credit was supplied of	2,300,000
Investments were sold amounting to	1,500,000
Various other items netted	6,000,000
An equal total of	$52,000,000

In other words, the company during this period had to a large extent been living on its assets.

Let us now consider the matter for a moment from the standpoint of what was to be done in those circumstances.

A careful estimate of probable future earnings was made in which all factors having a bearing on the subject were taken into consideration and numerous sources of information were consulted. This estimate showed that it would be several years before the company could earn the fixed charges on its present capital, not to mention interest on the new money which must be invested in the property from year to year to enable it to meet its obligations as a common carrier in adequately serving the public. Without these annual expenditures for new equipment, for roadway improvements and the numerous purposes for which funds must be provided, no railroad can hope to maintain a position against the competition of other lines. I might add that the actual results of operation show that our estimate for the first year was a fairly accurate forecast.

The conclusion reached in this connection was, of course, only one measure of the credit position of the company. Its inability to earn its interest charges over a period extending even to several years would not of itself have brought about a receivership, providing the company possessed other resources from which the deficiency might be made good until such time as its net earnings equalled or exceeded its interest charges, but as might naturally be expected under these circumstances we found in making a survey of what may be termed its treasury resources, that the company was in an unusually weak position because of the fact that it had from time to time, in past years, used up practically all of its resources of this nature that might now be available as new financing media. The only assets possessed by the company that could be considered as in any sense available for raising money were $9,000,000 General Mortgage Bonds, selling at a considerable discount, $44,000,000 General and Refunding Bonds, saleable only at a very heavy discount, and a small amount of capital stock, also selling at a very great discount, and the stock of the Milwaukee Land Company owned by the railroad company.

The Milwaukee Land Company owns large tracts of timber lands in the west and was organized to furnish traffic to the railroad. While its holdings will ultimately be of considerable value, they are not such as to be quickly realizable except at a great sacrifice, and after a careful examination it was found that their value for borrowing purposes was surprisingly small.

Briefly then, to sum up, we found the company in this position:

1. Its earnings for years past had been quite insufficient to meet its interest charges.
2. Its position with respect to current assets as against current liabilities was decidedly weak.
3. For several years the company had been obliged to resort to the measure of depleting its treasury assets in order to meet its current obligations.
4. The estimates of earnings offered no prospect of relief in the immediate future.
5. The company possessed no current or convertible assets that could be considered as at all adequate in the circumstances to employ in the formulation of new financial plans, except such as would only postpone the evil day, and its financial structure was so designed that it was not possible to issue and sell additional securities in sufficient amounts to provide the new money to meet its large maturities and for new capital requirements.

Notwithstanding our regret that such should be the outcome of our investigation we could see no other course in the interest of all concerned than a readjustment of the capital structure, and that was our recommendation.

This recommendation necessarily involved a receivership and the process of readjusting the securities is now being carried out through a plan of reorganization formulated by Kuhn, Loeb and Company and the National City Bank of New York.

If as a student in engineering at McGill I had listened to a talk such as I have just made I would have said, "This may be interesting to others but what has it to do with me—an engineering student ?" I would like to take a moment to answer that question, because it seems to me that the answer possesses points of great interest to students of engineering.

I believe the scope of the engineer is broadening far beyond our realization, not only in technical work but along the lines of practical everyday business. It is not so long ago that engineers were regarded as being wholly without business sense—and that feeling was expressed in the facetious definition of an engineer, that he was a man who could do anything except earn a living for his family.

I do not know whether engineers have taken that characterization to heart, or whether it never was true, but the fact remains that engineering advice is coming to be more and more sought upon subjects that wholly concern the business phases of industry. After all it is as much the job of the engineer as the business man to make a dollar earn the largest return. There is perhaps not the romance in the business phases of an enterprise that there is in technical engineering work but it is quite astonishing to those of us who have been on both sides to find how much adventure lurks in the problem of setting a new dollar to work or of stirring up an old one. I believe that engineering is the greatest of all professions, and I also think that its pleasantest phases are to be found in construction work. But the fact is that there is no more delightful indoor sport than spending other people's money, and particularly when in doing so one can build a monument to himself. This sort of sport, however, is not always healthful from the standpoint of the stockholders of the company. And it is the desire to build too well for the purpose, to build ahead of the times and having to wait too long for a return, that has been the cause of many business failures. We have had an example of it before us for many years in the case of the old Grand Trunk Railway. We have had it in many other railways—some of which should never have been built at all. We have had it in the case of irrigation projects where it should have been foreseen in the beginning that the outgo would exceed the income for many years to come.

In fact we have these examples of unwarranted expenditures before us all the time but we go right ahead creating new ones. Now why is this ? I think there are several reasons for it. It is easier to explain the mistakes of the past than to foretell the mistakes of the future. It is due to over enthusiasm for the project both on the part of the promoter and the engineer and the failure to gather the evidence against the project as well as for it, and to give each its proper weight. I think we all naturally revert from discussions of the possibility of a mistake and dwell more often on the pleasanter subject of rosy prospects.

The reason I speak of these things is because I believe the man with an engineering training is splendidly equipped to solve business problems, particularly if he has the knack of the diagnostician. While engineering is not an exact science it is more nearly so perhaps than any other. In technical practice the engineer deals with the forces of nature which operate with exactness and his mistakes come home to him at once. He cannot be half right and get results. He must be all right. Therefore in his college training and later in his practice he learns to weigh all sides of a question. He must be careful, methodical, accurate and above all things he must be without bias. Now when he applies this training and habit of thought to a business proposition it is to be expected that he will reach sound conclusions.

And so we find that the engineering profession is not only broadening its scope in the technical branches but an entirely new field is opening up—that of business engineering. I am not sure which is the more important, the technical or the business branch, and it is not necessary to know. This much is to be said, however, that the technical engineer does not need to know a great deal about the business side of his problems, but the business engineer must know a great deal about the technical phases, and for that reason I suppose the business engineer is almost invariably a graduate from the technical branch.

The difficulty we now face, as I see it, is due to the fact that the business engineer does not begin early enough in acquiring a knowledge of the fundamentals of business. Whether the student intends to confine himself strictly to technical work or whether, as is usually the case, he has no well defined ideas on the subject, it seems to me he should have a grounding in practical business procedure such as would enable him to understand financial operations, the meaning of the items on a balance sheet and income statement and generally the manner in which corporation business is transacted. The graduates of a technical school have no feeling about the fact that not since graduation have they directly applied many of the subjects taught them as students. They were broadened by these studies and they were an indispensable prelude to other work. But as I see the profession advancing into the field of business I often ask myself the question—are the students recognizing this movement and are the colleges preparing men for a business engineering career after they have served an apprenticeship in technical work ? Even should the graduate never apply the knowledge thus gained in professional practice I am sure he would benefit greatly in the management of his personal investments.

But the thought behind this suggestion and which impels me to speak of it now is that business men, and particularly bankers, are beginning to look with increasing confidence to the engineering profession for advice in the management of industrial concerns in which they are interested, and the men who are pioneers in this field, among whom may be included the members of my own firm, have long felt that the preliminary training for such work should be organized and directed by the colleges just as in the technical branches of the profession.

And so if I may, I would like to convey to students of engineering my own impression that there is an immense new field opening up for the engineer of the future that will not only tax his ability and knowledge of matters pertaining to technical practice but will require of him training and experience in the solution of business problems of the greatest importance; and to those who are engaged in moulding the minds of the students I should like to express the hope that recognition be given of this new development.

BRANCH NEWS

Halifax Branch

K. L. Dawson, A.M.E.I.C., Secretary-Treasurer.

At the regular monthly meeting of the Halifax Branch on March 3rd, 1926, J. W. MacDonald, JR.E.I.C., mechanical superintendent of the Oil Refinery at Imperoyal, gave an account of the investigation to date into the bursting of a steel tank 115 feet in diameter and 35 feet high which was used for the storage of water and which failed suddenly a few days before. This tank was not insulated and there was ice at the sides and bottom as well as on the top. A vent was always maintained through the ice on the top. The overflow pipe was located inside the tank and near the north side. The tank split from the top to the bottom on the north side opposite the overflow pipe and the cause of the failure is not known. Mr. MacDonald described the construction of the tank, referred to thickness of plates, size of rivets, location of I-beams, roof and overflow pipe.

The Toronto-Hamilton Highway

H. S. VanScoyoc, M.E.I.C., consulting engineer, service and promotion department, Canada Cement Company, who was visiting the branches of the Institute in the Maritime provinces at the request of the branches, was then introduced by the chairman. Mr. VanScoyoc described the construction of the concrete highway between Toronto and Hamilton and also the manufacture of cement. Each of these descriptions was illustrated by means of motion picture films. At the close of his address a discussion was opened by R. W. McCulloch, A.M.E.I.C., chief engineer of the Nova Scotia Highway Board, and participated in by a number of the members present.

Some of the points which were brought out in the discussion were very interesting. It appears that the concrete road between Hamilton and Toronto was laid on the natural soil without any special preparation of the subgrade and the cost of maintenance has been low, about $70.00 per mile per year. The cases of subsidence were very few and of minor importance. Perhaps the most interesting things which were mentioned were the rise of property value along the road and the very great increase of the vehicular traffic which followed the completion of the road.

Mr. VanScoyoc said that the values of property along the highway had increased by six millions dollars. The significance of this increase is seen in the following. The road passes through fourteen townships or municipalities exclusive of the cities of Toronto and Hamilton, each of which was required to share in the expense of building the road, the cities of Hamilton and Toronto and the provincial government absorbing the balance of the cost. It was thought that this would mean an increase in the rate of taxation in these townships and the people at a distance from the road did not see why they should be taxed for the benefit of the people near it. However, with the increase in property values along the road it was found that the rates actually went lower and that the people living at a distance from the road, the value of whose properties did not increase as much, were paying less taxes than before the construction of the road.

In 1914 the highest traffic-count was 526 vehicles per day. Since the completion of the highway the highest traffic-count has risen to 20,000 vehicles per day.

Truck traffic at the present time is greater than the total original traffic. The average number of vehicles per day-period for the maximum week is 7,000.

In connection with the manufacture of cement, Mr. VanScoyoc referred to a piece of road which had been constructed by the Canada Cement Company for test purposes which did not fail under a 2,000-pound per square inch test at the end of twenty-four hours. The quick setting of the cement in this road was obtained by mixing calcium chloride with the cement in the proportion of one part in fifty. At the close of his address the vote of thanks was tendered Mr. VanScoyoc, which was moved by C. A. Fowler, M.E.I.C., and seconded by C. B. Blanchard, M.E.I.C.

George D. MacDougall, M.E.I.C., vice-president of the Institute for the Maritime provinces, was present and spoke briefly. He expressed his thanks to the Institute in the Maritime province for the honour which they had conferred upon him and asserted his desire to be of the greatest help to the Institute during his period of office.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

The final supper-meeting of the year was held at the Barker House on the evening of June 6th. C. S. G. Rogers, A.M.E.I.C., chairman of the branch, presided. During the course of the supper hour several banjo duets were rendered by Messrs. Leverett Hutchinson and Bob Selig. Vocal solos were also given by Mr. Fred Wilkins.

At the conclusion of the repast the annual financial statement was read and the names of officers elected for the ensuing year announced. Only the required number were nominated at the meeting held for the purpose on April 30th, consequently an election was unnecessary.

The following are the officers for 1926-27:

Chairman	A. S. Gunn, A.M.E.I.C.
Vice-Chairman	G. C. Torrens, A.M.E.I.C.
Secretary-Treasurer	V. C. Blackett, A.M.E.I.C.
Executive Committee	Prof. F. L. West, A.M.E.I.C.
	Jas. Pullar, A.M.E.I.C.
	G. E. Smith, A.M.E.I.C.

In addition to the above, the members of the Executive Committee are:—A. F. Stewart, M.E.I.C., J. D. McBeath, M.E.I.C., J. R. Freeman, A.M.E.I.C., F. O. Condon, M.E.I.C., (ex-officio), C. S. G. Rogers, A.M.E.I.C., (ex-officio), M. J. Murphy, A.M.E.I.C., (ex-officio).

A. S. Gunn, A.M.E.I.C., the incoming chairman, in moving a vote of thanks to the retiring secretary-treasurer, M. J. Murphy, A.M.E.I.C., referred in high terms to the untiring efforts of Mr. Murphy in furthering the work of the local branch during the six years he had been in office.

After the business of the meeting had been disposed of, a very interesting display of coloured slides and motion pictures was shown, depicting Canada from coast to coast, along the Canadian National Railways. The views were greatly enjoyed by the gathering and thanks are due the advertising department of the Atlantic Region, Canadian National Railways, for the courtesy shown the Moncton Branch on this occasion.

Saulte Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

A regular meeting of the branch was held at the Y.W.C.A. rooms on June 1st. Twenty-seven members and guests attended the dinner held previous to the meeting.

C. H. Speer, M.E.I.C., chairman, called the meeting to order and the business was quickly attended to. The secretary read an article by B. E. Barnhill, M.E.I.C., one of our members who is at present on railroad location work in Florida. Mr. Barnhill's description of the troubles of a locating engineer in that district was good. They have their amusing as well as their serious problems to contend with. If it is not rain, flies, etc., it is the realtors that help worry them. The land values in that section of the country could increase more in twenty-four hours along the right-of-way than the tide of the Atlantic.

Mr. Speer then introduced Mr. G. C. Bateman, secretary of the Ontario Mining Association and Mr. T. F. Sutherland, chief inspector of mines for the province of Ontario.

The Mining Situation in South Africa

Mr. Sutherland, who visited South Africa in 1924 to study safety work in deep shaft sinking and deep mining, gave a most vivid description of the mining situation in South Africa. Mr. Bateman handled the slides which Mr. Sutherland had taken while in the African mining districts.

Mr. Sutherland pictured the country in all its rugged splendours. As he took you from Cape Town up through the country you could almost see the existing conditions as he found them. He pictured in vivid fashion, the mineral wealth of the Union dealing with the Rand section and the newer discoveries in Rhodesia and also telling of a visit to the Belgian Congo.

The following minerals are being mined in South Africa: diamonds, gold, cobalt, asbestos, copper, mica, zinc, lead and platinum at the present time.

In comparing the accident death rate with that of Ontario, he showed that in 1924 the Ontario rate had been 3.24 fatalities to one thousand employed while the South African rate had been 2.45 per thousand. The three main reasons he claimed for this, were,—

1. More government inspectors than in Ontario and the strict enforcement of the laws against foreign labour.
2. The educational work done by the Chamber of Mines who spend $25,000 per year in accident prevention work.

3. The license system in force, that is, all responsible men, such as mine managers, surveyors, electricians, foremen, stationary engineers, etc., must have certificates issued by a board of examiners.

The Ontario output in comparison to total accidents, however, had been 170, as against 70 tons in South Africa.

On the Rand in 1924 there were over 180,000 men employed, of whom 15,000 were white bosses, he said, and the remainder blacks. That year the Rand had mined 28,500,000 tons of gold ore, as compared to 4,500,000 tons in Ontario. The Rand ore had yielded 9,500,000 ounces of gold. These mines have not reached their maximum output, Mr. Sutherland said. There are 700,000,000 tons of ore running from $3.00 to $4.00 per ton blocked out and it is only a question of further reducing the cost of operation before that will be available. At present there is an agreement that not more than nine blacks will be employed for each white man, but he did not think that this agreement would last as black labour was much cheaper than white. The farther he went into the interior, the poorer the class of labour becomes. In the Belgian Congo, they pay $2.50 to $3.00 per month and feed the men and their families. Here the natives are housed in villages and not in corralls as in the Rand section. The Belgian Congo district is only 13 degrees south of the equator, hence it is not a white man's country.

In the Rand section, he pointed out that most of the mining was now below the 3,000 feet level, some of the mines reaching an actual depth of 7,000 feet, although the shaft to reach this level is 9,500 feet long. At this depth the rock temperature is 95 degrees and the air temperature is 88 degrees, although artificial ventilation is maintained. One of the greatest troubles met with is from silicosis, a disease which results from the clogging up of the lungs by fine dust particles from the crushing of the quartz. Medical inspection to insure the soundness of the lungs, proper ventilation and the plentiful use of moisture are employed to lessen the danger, although it is estimated that 20,000 had died from silicosis in the mines. As this district has been in operation since 1886, there are vast areas opened up underground which causes earth tremours and rock bursts, which are other difficulties to contend with.

Mr. Sutherland gave an interesting description of the Morensky Reef in Rhodesia where platinum has been recently discovered. This is the largest known deposit in the world and controls the world's market. He touched also on the copper deposits farther north in Katonga district, which is also a very large area.

The description of the diamond mining was most interesting. The Premium diamond mine has an area of 80 acres and a depth of 400 feet. This mine is operating at one-third capacity due to the demand and to keep the prices up. The diamonds are found in rock-like formation and this is crushed and the diamonds are taken out by a process of screening.

Many interesting points were brought out by the speaker. In nearly all the mines the machinery was the latest that could be bought. Wood is the main fuel for the boilers, while steam shovels were few as labour is so cheap. In the Belgian Congo reforestation is being extensively carried out to keep the fuel supply up. His address was touched with a quiet humour that made it doubly entertaining and the numerous slides shown brought out forcibly the fine points of his address, especially the last slide.

R. S. McCormick, M.E.I.C., moved a hearty vote of thanks to Mr. Sutherland for his splendid and instructive address; Wm. Seymour, M.E.I.C., on behalf of the members and Mr. J. E. Irving on behalf of the guests seconded the motion.

Vancouver Branch

E. A. Wheatley, A.M.E.I.C., Secretary-Treasurer.

Meetings of the Branch Executive

Meetings were held on May 5th, 14th, and 28th.

The resignation of P. H. Buchan, A.M.E.I.C., as secretary of the branch, was accepted with great regret. He was offered a seat as a member of the executive of the branch, as a small token of appreciation for his services, and a letter to this effect was requested to be sent by the secretary, E. A. Wheatley, A.M.E.I.C. Mr. Wheatley was appointed to succeed Mr. Buchan as secretary of the branch.

Other routine business was discussed and methods of improving the attendance and membership of the branch agreed upon.

The invitation of E. E. Carpenter, M.E.I.C., on behalf of the B.C. Electric Railway Company to visit the Alouette lake development was accepted.

Joint Meetings

A luncheon-meeting under the auspices of the branch, the Vancouver Section of the American Institute of Electrical Engineers and the Vancouver members of the Association of Professional Engineers, was held on May 26th.

The Relation of the University to the Engineering Profession

An address under this heading was given by Dean R. W. Brock, M.A., LL.D., F.C.S, M.E.I.C., Dean of the Faculty of Applied Science, University of British Columbia, on May 26th, 1926, to members of the Vancouver Branch of the Institute,—Vancouver members of the American Association of Electrical Engineers and the Vancouver engineers registered under the "Engineering Act" of the province. The meeting was arranged by and held under the auspices of the Association of Professional Engineers of B.C. J. P. Hodgson, M.E.I.C., was in the chair, and Major Geo. A. Walkem, M.E.I.C., President of the Institute, was present. A report of Dean Brock's address appears on another page of this issue.

The Dean was awarded an ovation and the chairman, J. P. Hodgson, M.E.I.C., conveyed the enthusiastic thanks of the meeting to him.

It is the hope of the engineering societies in Vancouver that many addresses on this, and allied subjects, will be given during the fortcoming months in the hope that the profession will educate itself to a realization of the problems facing them.

Inspection Trip to Alouette Dam of the B.C. Electric Railway, Limited

On a day of glorious sunshine, this beautiful trip was enjoyed by one hundred and fifty visitors composed of the engineers, their wives and friends, who were received by E. E. Carpenter, M.E.I.C., and Mrs. Carpenter.

The members motored from Vancouver some thirty-five miles to Port Haney, where a special train, consisting of two flat cars suitably equipped with special benches and hauled by a logging locomotive, was provided through the courtesy of the Abernethy-Lougheed Logging Company. Nine miles of the trip were thus taken through a beautiful, original forest to the dam.

The technical features of this gravel dam have been explained elsewhere, but even the ladies were interested to learn that both the dam and the concrete work surrounding the sluice-gates were set on a bed of clay and that borings had proved that there was no rock for over one hundred feet.

A luncheon was tendered the party by the B.C. Electric Railway Company in the now deserted construction camp adjoining the Lodge.

W. H. Powell, M.E.I.C., as chairman of the Vancouver Branch, was in the chair. After the toast of the King was given by the chairman, the president of the Institute, Major Geo. A. Walkem, M.E.I.C., referred to the early history of the B.C. Electric Railway Company; the success of the company under the management of Mr. Geo. Kidd, and the great development occurring at the moment under the control of E. E. Carpenter, M.E.I.C. He referred to the well-known hospitality of the company and three rousing cheers were given showing the appreciation of the members.

Mr. Carpenter responded on behalf of the B.C. Electric Railway Company.

A. E. Foreman, M.E.I.C., proposed the toast to the Ladies. Mr. Foreman's very witty remarks on behalf of the ladies met with enthusiastic applause and Mrs. E. E. Carpenter responded in a most charming and piquant manner on their behalf.

A scow, properly fitted with tarpaulins and benches, was supplied as the means of travelling up ten miles of Alouette lake, surrounded by the most beautiful scenery, to the mouth of the intake to the tunnels which carry the water from Alouette lake to Stave lake.

Specially printed programmes giving bird's-eye or aeroplane photographs were provided by the railway company and enabled every one of the party to realize the tremendous work done.

The party returned at seven o'clock and all agreed that the most enjoyable trip within the knowledge of the branch had taken place.

The Generation of Steam at Critical Temperatures

On Tuesday, June 8th, one hundred and twenty-five members of the Engineering Institute of Canada and the American Institute of Electrical Engineers and other engineering societies, gathered to hear an address by Dr. Mark Benson, F.R.G.S., on "The Generation of Steam at Critical Temperatures." An abstract of Dr. Benson's address will appear in the August issue of the Journal.

The lecture, which was followed with close attention by the large attendance, created great interest, and was followed by a number of questions from the members present which were dealt with somewhat at length by Dr. Benson. Following a hearty vote of thanks the meeting then adjourned.

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

Visit to B.C. Cement Company's Plant

On Friday, April 16th, the Victoria Branch visited the Bamberton plant of the British Columbia Cement Company, Limited, leaving Victoria at about one o'clock and going by motors to Butchart's Gardens and thence by the company's boat to Bamberton, arriving at Bamberton about 3 p.m.

Mr. Edwin Tomlin, manager of the Cement Company, acted as host to the men of the party and Mrs. Tomlin as hostess to the ladies, who only went as far as Butchart's Gardens and remained for tea in Mr. Butchart's house, joining the party on their return from the plant.

About thirty men and an equal number of ladies comprised the party.

Upon arriving at Bamberton each member of the party was given a very attractive programme, each programme being marked with the member's name for whom it was intended. This programme, in addition to giving the times of arrival, etc., at the different points, showed a complete "flow sheet" and gave various other information about the plant.

Description of Plant

The site of this plant is on a steep side hill, and all shipments from and to the plant are made by water and the company has a private dock at this point. Complete repair shops are located at the lower level and power is obtained from the British Columbia Electric Railway Company and transmitted at 60,000 volts and stepped down to 550 volts in the sub-station.

The wet system entirely is used and the wet mill consists of 5 ball mills and 5 tube mills in series. Closed circuit grinding is practised, 2 trix separators being placed in the circuit between the ball and tube mills. Two sets of slurry pumps elevate the product 98 feet to the slurry mixers. The final product from the wet mills contains about 32 per cent moisture, and about 7 per cent (dry) is retained on a 180 by 180 screen.

Slack coal is delivered on scows and unloaded by a bucket elevator and conveyed to the coal store. The coal is then dried until the product contains only about 1 per cent moisture and then ground to a fineness of about 95 per cent through a 100 by 100 mesh screen, and is then blown up 80 feet to two cyclones and elevated again and conveyed to the kiln storage bins.

The quarry is worked in two benches by means of two electric and one steam shovels and about 800 tons of rock are quarried per day. The product from the quarry is used exactly as it comes out and, with the exception of gypsum, forms the entire raw product for the cement.

The amount of lime content is controlled by maintaining a higher content in some of the mixers than the others, and when drawing off the material just before going to the kilns the product is taken from the high and low content lime mixers as required, so that the final slurry will have exactly the amount of lime desired. The slurry is pumped from the mixers and fed in at the back end of the kilns and powdered coal blown in at the front end. There are three kilns 185 feet long each having a capacity of 1,000 barrels per day. The temperature in the burning zone is about 2,800° F.

There is a cooler in conjunction with each kiln and the air used for cooling being thus heated is later used for combustion in the kilns.

The dry mill consists of 4 ball and 4 tube mills and the amount of gypsum necessary to retard the time of setting is fed to the ball mills along with the clinker and steam is added in the tube mills to hydrate any free lime and to insure a sound product.

About 100,000 barrels of storage room is available and the cement is drawn from the storage bins as required and sacked in bags of 87½ lbs. nett, the bag loading machines automatically filling the bags and weighing in the proper amount of cement.

There is a complete physical and chemical testing laboratory.

On arriving at the cement plant the party was divided into small groups, each taken charge of by one of the officials of the company acting under instructions from Mr. Anderson, the manager of the plant, so that each individual member of the party was able to get personal attention from an official who knew all the details.

The Cement Company has a raw material at this point which gives them a very quick hardening cement. It is pointed out, of course, that quick hardening and quick setting must not be confused as having the same meaning, as a quick setting cement is not desirable under any practical conditions as it causes trouble in the mixers, chutes, wheelbarrows or other means of conveying the concrete from the mixers to the work, but a quick hardening cement will make concrete that does not lose its fluidity until deposited in its final position and then hardens very quickly.

This raw material, without the addition of gypsum, would form a very quick setting cement and one that could not be used under practical conditions, but the addition of the gypsum changes the product from a quick setting cement to a quick hardening cement with the result that very rarely indeed is any trouble occasioned by the quick setting properties of the raw material, this trouble only occurring when there is a stoppage in the gypsum feed and this danger has now been entirely overcome, but occasionally when the plant first started up there was some such trouble experienced with the result that it was almost impossible to get concrete out of the mixers before it set.

After going over the whole plant the party assembled in the store room for tea and were there also addressed by Mr. Tomlin and Mr. Anderson, returning later by the company's boat to Mr. Butchart's Gardens, rejoining the ladies and returning to Victoria by motor.

One of the ladies of the party has kindly supplied the following item in regard to the trip,—

After the men left for the cement works, the ladies, led by Mrs. Tomlin, proceeded to the sunken gardens, which were as beautiful as ever; though it was too late for the daffodils, there were many glorious colours, which were gorgeous in the bright sunshine.

After viewing the gardens, it was delightful to walk through the charming house, hear the wonderful organ and enjoy a rest on the cool verandah in comfortable lounges and chairs.

A very tempting tea was served which was thoroughly enjoyed and appreciated by all. After tea, while waiting for the men to return, the time was pleasantly spent reading some of the numerous magazines, or strolling in the garden, and resting on one of the many garden seats which are so tastefully placed in the arbours covered with climbing roses.

Many thanks are due to Mrs. Butchart for her kind hospitality, and also to Mrs. Tomlin, who made a most charming hostess.

Quebec Branch

Louis Beaudry, S.E.I.C., Secretary-Treasurer.

The eighteenth annual meeting of the Quebec Branch was held at the City Hall, Quebec, on Tuesday evening, May 25th, 1926.

At this meeting, A. B. Normandin, A.M.E.I.C., presided, and following the reading of the minutes of the previous annual meeting, Z. Langlais, A.M.E.I.C., and Robert Sauvage, JR.E.I.C., were appointed Scrutineers for the election of officers for the ensuing year.

The secretary-treasurer then presented the financial statement for the year 1925-26.

Receipts	
Balance in bank, 6/29/25	$119.71
Rebates from headquarters	219.21
Bank interest	.65
	$339.57
Expenditures	
Luncheons and meetings	$ 55.00
Printing	41.02
Postal box	6.00
Secretary's expenses, 1925/26	100.00
Postage, etc	5.00
	$207.02
Surplus on May 25th, 1926	132.55
	$339.57

Following this, Hector Cimon, A.M.E.I.C., Alex. Lariviere, A.M.E.I.C., and T. J. F. King, A.M.E.I.C., were appointed members of the Nomination Committee for the ensuing year, and Hector Cimon, Alex. Lariviere and F. X. Ahern, A.M.E.I.C., were appointed members of the Legislation Committee.

A vote of thanks was tendered to his Worship, the Mayor of Quebec for making available quarters for the meetings of the branch.

The report of the Secretary showed the election of the following officers for the year 1926-27:—

Chairman	A. B. Normandin, A.M.E.I.C.
Vice-Chairman	S. L. deCarteret, A.M.E.I.C.
Secretary-Treasurer	Louis Beaudry, S.E.I.C.
Committeemen	T. E. Rousseau, M.E.I.C.
	Hector Cimon, A.M.E.I.C.
	L. C. Dupuis*, A.M.E.I.C.
*In Office for another year.	Alex. Lariviere*, A.M.E.I.C.

It was motioned by A. R. Decary, M.E.I.C., and seconded by F. X. Ahern, A.M.E.I.C., that a vote of thanks be tendered to the retiring officers, following which Mr. Normandin thanked the members for the honour in re-electing him chairman of the Branch.

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Members of Council for 1926

PRESIDENT
*GEO. A. WALKEM, Vancouver, B.C.

VICE PRESIDENTS
*A. S. DAWSON, Calgary, Alta.
†PETER GILLESPIE, Toronto, Ont.
*K. B. THORNTON, Montreal, Que.
†W. G. MITCHELL, Quebec, Que.
†GEO. D. MacDOUGALL, New Glasgow, N.S.

PAST PRESIDENTS
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J. G. SULLIVAN, Winnipeg, Man.
ARTHUR SURVEYER, Montreal, Que.

COUNCILLORS
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*E. V. BUCHANAN, London, Ont.
*G. H. BURBIDGE, Port Arthur, Ont.
‡J. L. BUSFIELD, Montreal, Que.
*E. V. CATON, Winnipeg, Man.
*F. O. CONDON, Moncton, N.B.
*R. L. DOBBIN, Peterborough, Ont.
*JOHN DOW, Lethbridge, Alta.
†J. T. FARMER, Montreal, Que.
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*J. H. HUNTER, Montreal, Que.
*E. LAVOIE, Chicoutimi, Que.
*O. O. LEFEBVRE, Montreal, Que.
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*J. E. PORTER, Ford, Ont.
†J. L. RANNIE, Ottawa, Ont.
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*C. H. E. ROUNTHWAITE, Sault Ste. Marie, Ont.
*T. S. SCOTT, Niagara Falls, Ont.
*R. S. TROWSDALE, Calgary, Alta.
*A. G. TAPLEY, St. John, N.B.
†H. K. WICKSTEED, Toronto, Ont.
*C. H. WRIGHT, Halifax, N.S.

*For 1926 †For 1926-27 ‡For 1926-27-28

TREASURER
F. P. SHEARWOOD, Montreal.

SECRETARY
R. J. DURLEY, Montreal.

OFFICERS OF BRANCHES

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(Ex-Officio) C. H. WRIGHT

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Executive, J. J. McDOUGALL, W. E. CLARKE, J. R. MORRISON
(Ex-Officio) S. C. MIFFLEN, GEO. D. MACDOUGALL

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Vice-Chair., S. R. WESTON
Sec.-Treas., W. J. JOHNSTON, Box 1417, St. John, N.B.
Executive, A. G. TAPLEY, J. D. GAREY, W. R. PEARCE, H. F. MORRISEY, E. A. THOMAS

MONCTON
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Vice-Chair., G. C. TORRENS
Sec.-Treas., V. C. BLACKETT, Eng. Dept., C.N.R., Moncton, N.B.
Executive, F. L. WEST, J. FULLAR, G. E. SMITH, A. F. STEWART, J. D. McBEATH, J. R. FREEMAN
(Ex-Officio) F. O. CONDON, C. S. G. ROGERS, M. J. MURPHY

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The Humber Development of Newfoundland Power and Paper Company, Limited

A Description of the Power Development and the Power Equipment and its Installation in the Paper Mill

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Paper to be presented before the Maritime General Professional Meeting of The Engineering Institute of Canada, at Sydney, N.S., August 17th, 1926.

It appears that hydro-electric power development on the Humber has been considered at different periods for the past twenty-five years. The British government, under the Trade Facilities Act, and the Newfoundland government assumed certain guarantees to assist in the building of a 100,000-h.p. power development and a 400-ton newsprint paper mill. Actual construction on the present development commenced in June, 1923, by the general contractors, the Sir W. G. Armstrong, Whitworth and Company, Limited, London, England, and paper was actually produced in July, 1925. This covers very little over two years from the inception of construction to production of the manufactured product.

Several schemes were considered, and it was finally decided to locate the power house at Deer Lake and the mill at Corner Brook. The locating of the mill at Corner Brook, rather than at Deer Lake, close to the power house, was deemed advisable owing to excellent water shipping facilities at Corner Brook which allows the paper to be conveyed from the mill direct to the steamers, saving the loading and unloading of railway cars with consequent freight and handling charges. This change necessitated the use of high-voltage transmission lines between Deer Lake and Corner Brook, a distance of 32 miles.

Water Storage

Water storage is necessary owing to the great seasonal variations and the run-off from the watershed falling short of the rate of consumption at certain periods of the year.

Grand lake, with an area of 215 square miles, makes an ideal regulating storage reservoir. The Grand lake catch-

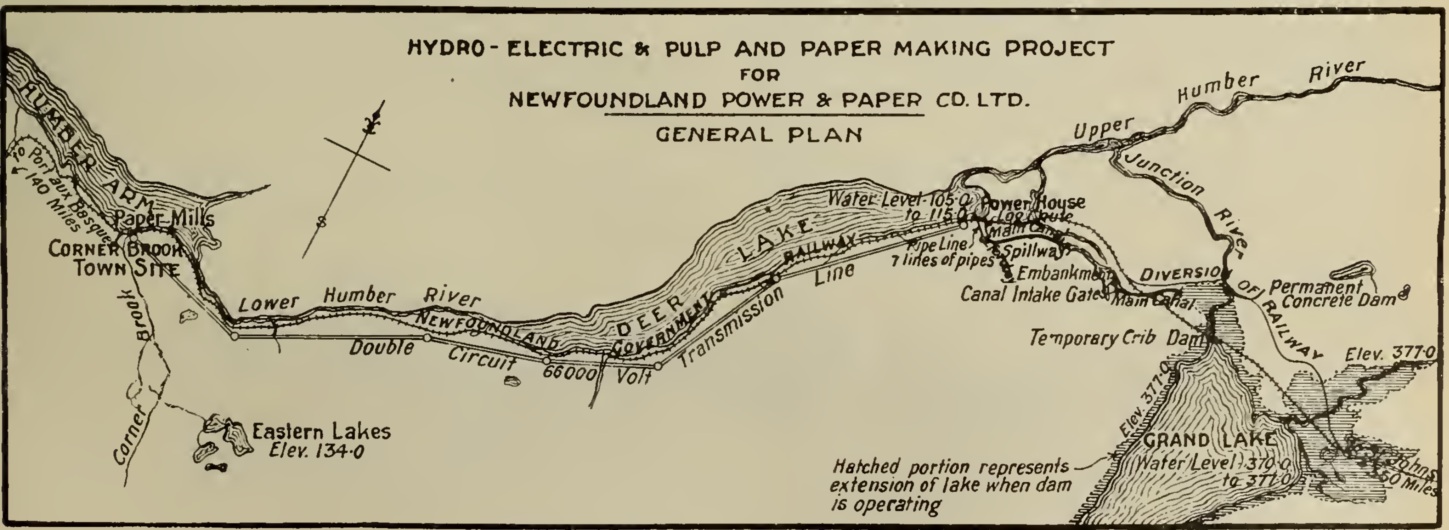

Figure No. 1.—General Plan.

ment area is about 1,650 square miles, having an average yearly run-off of about three cubic feet per second per square mile, giving an approximate average flow of about 5,000 cubic feet per second.

The storage capacity of reservoir is about 30,000 mill. cu. ft.; this, properly regulated, will, even during periods of greatest recorded drought, guarantee continuous full load output throughout the year.

Grand lake level has been raised about 30 feet by a dam placed across Junction river, which was the original outlet of Grand lake to Deer lake via the Upper Humber river. The operating difference in elevation between Grand lake (elev. 377) and Deer lake (elev. 107) is 270 feet.

Investigation of Precipitation and Flood Conditions

To carefully check the rain and snow precipitation four gauge stations have been installed. However, it was found extremely difficult to obtain accurate snow depth measurements during the past winter owing to wind conditions causing a very unequal depth of snow.

For the purpose of measuring the depth of snow, a light copper tube was made up in three sections having bayonet joints and with special shaped auger to cut through the layers of hard crust. A small spring balance scale was used to weigh the snow and tube, and the weights were converted to inches of rain precipitation by using a paper scale pasted to the spring balance. This method allowed a large number of samples to be taken in a short period of time. Prior to commencing this work the method was carefully checked. The survey party consisted of two men with dog teams, and samples were taken on selected clearings free from snow drifts and protected from the wind. The average of a number of samples was taken and it was found that snow depths were very consistent, varying over the territory covered from 48 to 52 inches.

The spring run-off from the uncontrolled watershed covering the Upper Humber river, Junction river and Deer lake must be taken care of at a different period than Grand lake excess storage discharge. This prevents excessive high tail-race water levels at Deer lake which would cut down the output of the power house and also affect logging operations in the Lower Humber river, as large quantities of logs are stored in the Lower Humber during the winter months.

High water levels in Deer lake would greatly increase the flow in the Lower Humber and there would be great danger of ice and log jams breaking the log booms, causing heavy monetary loss. Once the ice is clear in Deer lake and the Lower Humber river, this danger disappears.

Main Dam Across Junction River

A hollow reinforced concrete Ambursen type dam about 800 feet long, with a maximum height of 75 feet, was constructed across Junction river at a point now known as "Main Dam." This dam has a spillway with a capacity of 26,000 cubic feet per second for the purpose of discharging the occasional heavy floods that occur or when the lake level rises above the normal operating level.

The spillway consists of eighteen gate-controlled openings each 15 feet wide. Two special portable motor-driven lifting cranes, running on wide gauge rails, are used for lifting the gates. Three-phase, 550-volt power is available from weather-proof plug receptacles spaced across the dam for operating the lifting mechanism.

Power is supplied to the transformers for light and power to the dam and woods department depot buildings located at Main Dam, at 6,000 volts, 3-phase.

Provision has been made for the installation of heating elements in the gate guides for thawing ice between guides and gates if necessary. A small motor-driven low-pressure air compressor supplies air to the front of the gates to agitate the water and prevent freezing in of the gates. For purposes of economy the operation of gates is handled by the staff of the woods department, located at Main Dam, on instructions from the hydro-electric department.

Figure No. 2.—Panoramic View of Corner Brook showing New Mill.

Main dam contains 29,000 cubic yards of concrete, and to accomplish its construction 19,000 cubic yards of excavation was necessary, form work aggregating 600,000 square feet was constructed, 400 tons of reinforcing steel were placed, and it was necessary to build a rather large crib dam.

Due to the increased level of Grand lake, which is raised some 30 feet by this dam, a diversion of the railway was necessary and it is carried over Junction river on the dam.

Canal

To convey the water from Grand lake to the forebay near the power house, a canal approximately seven miles long was constructed. This canal is divided into two sections by Glide Brook lake, which is artificially formed by two earth embankments, one 4,400 feet long with a maximum height of 35 feet, and the other 950 feet long with a maximum height of 75 feet. By the formation of this lake the total length of canal excavation was shortened by 2½ miles.

Glide brook, with an average flow of about 200 cubic feet per second, discharges into the canal via the lake.

Figure No. 3.—Crib Dam—some Stop-Logs Removed.

During construction its normal course was maintained by means of sluices at the bottom of the longer of the two embankments. These sluices are built of concrete and form part of the permanent canal works. The peak spring run-off from Glide brook is taken care of by cutting down the normal water supply to the canal from Grand lake.

The excavation and construction of the canal involved the moving of approximately five million yards of earth.

Canal Intake Works

To regulate the water flow in the canal, an intake works, consisting of five gate openings each 20 feet wide by 15 feet high, is placed at the downstream end of the eastern section of the canal, so that the water level of Grand lake is maintained in this section.

These gates have individual electrically-operated lifting gear, with necessary electrical limit switches to prevent over-travel. Remote control push button contactor type of motor starters are used.

Power for motors, heating and lighting is taken through necessary switchgear and transformers from a 6,000-volt power line. A small motor-driven blower and electric heater supply heat in winter to the intake building, which consists of a small wood frame building covered by galvanized corrugated iron.

Two travelling gantry cranes used on the construction of the steel penstocks at the power house and operating on wide gauge rails outside the building are available for placing the heavy stop-logs on both sides of the gates.

The roof of the intake house is designed for removal in sections for lifting of heavy equipment. Slots for stop-logs are located outside the building and the stop-logs can be lifted without affecting the building roof.

All gate openings have curtain walls to prevent trouble from ice and logs affecting operation of gates. A sluice for logs is provided to allow logs to be sluiced from Grand lake to the western section of the canal.

One man is stationed at the canal intake to take care of its operation and look after the logging operations during the summer months.

Forebay

The arrangement of the forebay at the downstream end of the canal is such that the gate house is parallel to the canal banks on the Deer lake side of the canal with the seven penstocks to the power house running at right angles to the canal.

Figure No. 4.—Main Dam during Construction.

Across the end of the canal is a spillway 160 feet wide, the top of which is at elevation 369, and two automatic Stauwerke gates and an ice chute, all of which empty into the spillway channel running into Deer lake.

A log flume is located between the gate house and the ice chute. It has an electrically-operated gate with provi-

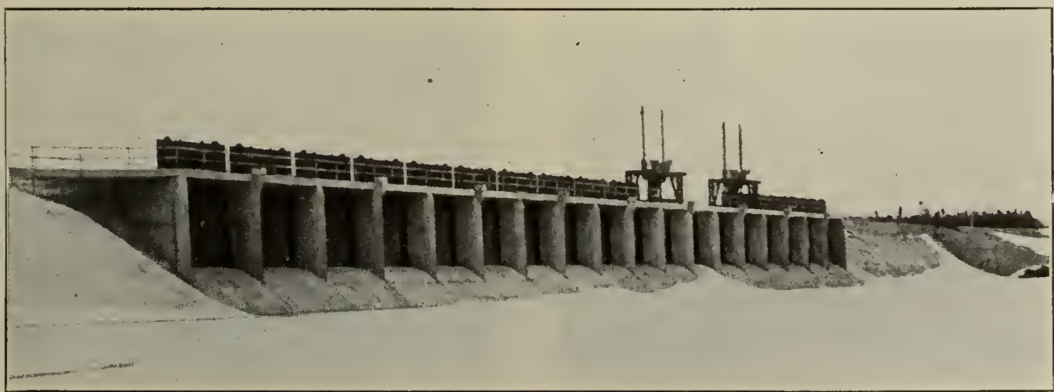

Figure No. 5.—Main Dam.

Figure No. 6.—The Canal.

Figure No. 7.—The Intake.

sion for stop-logs and guide booms attached to it for guiding the logs into the chute. The log flume is made of rivetted steel plate in the form of the letter " U " and runs parallel to the penstocks. It is supported on wooden framework and is provided with necessary expansion joints. Only a small quantity of water is used in sluicing the logs from the canal into Deer lake, where they are boomed and towed to the Lower Humber river, from which point they float down to the booms at Humbermouth and are towed to the slasher mill.

The gate house is a reinforced concrete building 138 by 34 feet, covering the requirements of the present development. A light end wall allows provision for future extensions. Seven gate openings, 11 feet 10 inches by 11 feet 10½ inches, are utilized at present and two spare openings blocked with stop-logs provide for future additions to the power house. Trash racks are built on heavy removable steel framework having 2 inch by ¼ inch flat iron on edge on 1¼ inch centres bolted together with spacers. The spacing used with these trash racks has proven very satisfactory with operations experienced to date from woods department logging operations and material brought down from flooded areas. Comparatively little trouble has been experienced from foreign material clogging racks, compared with experiences of power houses which operate on log driving streams.

The seven gates have individual electric hoisting mechanism somewhat similar to mechanism used at Main dam and canal intake house. Push button contactor type starters are used and electrical starting arrangement is such that an inching button allows the gates to be opened one inch when the current is tripped off. This allows penstocks to fill gradually. When penstocks are full the regular " running " button can be operated to open gates.

A multiple conductor aerial cable is run from the power house switchboard which allows the power house operator to close the gate and shut off water from the penstocks, in case of emergency, on all seven gates. Velocity trips are also provided on all penstocks so that in case of an accident occurring allowing velocity of water to reach an abnormal speed, the velocity trip, through an electrical contact, will close the particular penstock gate. Air vents for penstocks are provided in rear of all gates.

The design of the gate entrances and trash racks is such that there is no noticeable loss of head under normal operation with an approximate water velocity of 1.7 foot per second at the gate entrance.

The gate house is supplied with a heating system to prevent formation of ice at the trash racks. Heating ducts are run under the floor and allow hot air to be blown down on the water and trash racks. An electric heating unit with a maximum capacity of 200 k.w. is supplied with a motor-driven blower. Knife switches allow a wide range of this heating capacity to be used. It is interesting to note that no ice troubles of any kind occurred during the first winter's operation, and it is not anticipated there will be any trouble from frazil ice as there are no rapids or points where water is agitated or affected by wind to cause formation of frazil.

A 10-ton electric crane, hand-operated from the floor, is supplied for operating work and repairs.

Necessary transformers and switchgear for forebay power, lighting and heating are arranged for connection to two sources of 6,000-volt power. One line is direct from the power house to the forebay and is the one normally used. The auxiliary line is a short branch line from the 6,000-volt line going to the canal intake and Main dam.

Two automatic Stauwerke gates are used in addition to the spillway for taking care of abnormal rises in canal

Figure No. 8.—Forebay, Deer Lake.

Figure No. 9.—Pipe Line, Deer Lake.

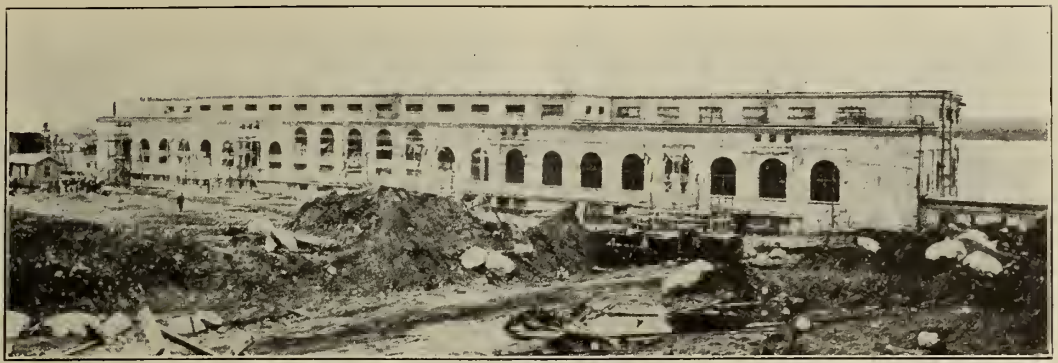

Figure No. 10.—Power House, Deer Lake.

water level, such as would occur with the sudden shutting down of the power house or sudden excess discharges from Glide brook which empties into the canal. This type of automatic gate is used considerably in European practice, but not to any great extent in America.

Electric heating units are supplied in the concrete walls adjacent to the gates to prevent the gates freezing to the walls during the winter. Hot air is also blown into the gate chamber and siphon chamber to prevent formation of ice. A total heating capacity of 75 k.w. is supplied for this purpose.

The elevation of the top of the Stauwerke gate in its normal closed position is elevation 369, and the elevation when fully opened approximately 359.0. Each gate is 25 feet wide and has two openings each 11 feet wide giving an approximate discharge when fully opened and water elevation slightly above 369.0 of 2,400 cubic feet per second.

Pipe Line

From the forebay the water is carried to the power house by seven penstocks, each approximately 4,000 feet long.

For the upper 2,500 feet these consist of wood stave pipes with an internal diameter of 9 feet 6 inches, while rivetted steel pipes 9 feet 6 inches in diameter at the top and 8 feet 6 inches at the bottom are employed for the lower 1,500 feet.

The wood stave pipes which are carried down to a head of 170 feet required about 150,000 cubic feet of timber. British Columbia fir was mostly used, together with a small quantity of pine, spruce and fir supplied from Newfoundland. About 2,000 tons of steel bands were supplied for the wood stave pipe, while the rivetted steel pipes weigh nearly 4,000 tons.

Two expansion joints are provided in each steel penstock to take up any expansion or contraction which might occur. The steel pipes were laid on the ground and covered with earth to about three feet over the top. The wood stave pipe is supported on concrete saddles clear of the ground. The pipe lines fan out at each end when entering the power house and forebay. Individual inspection chambers with penstock manholes allow entrance to each penstock near the power house, forebay and at a third point in the steel penstocks.

A special wood planer, manufactured in Norway, cut the special tongue and groove and gave the timber the proper curvature, all in one operation. Slots for 1/16-inch steel plates between ends of timbers required a second operation. Compressed air wrenches were used to tighten up the nuts on the steel bands, and this greatly assisted in the speedy erection of the wood pipe line.

An outside erecting yard was used for erection of the steel penstocks. Two electric gantry cranes and heavy automatic compressed air rivetters, as used in large boiler and railway shops, greatly assisted in speeding up the fabrication of the steel plates. These gantry cranes, as mentioned previously, were transferred after erection of the penstocks to the canal intake for permanent use in lifting the heavy stop-logs.

Power House

The power house is located at Deer Lake Town and is a reinforced concrete structure on a structural steel framework. The building is 193 by 62 feet and is divided into a generator section having a width of 34 feet and a transformer and switchgear section of 24 feet in width.

The generator units consist of seven 14,000-h.p., 375 r.p.m., horizontal type Francis turbines, and each direct-connected to a 10,250-kv.a., 95 per cent power factor, 50-cycle, 6,000-volt alternator with direct-connected 110-volt exciter.

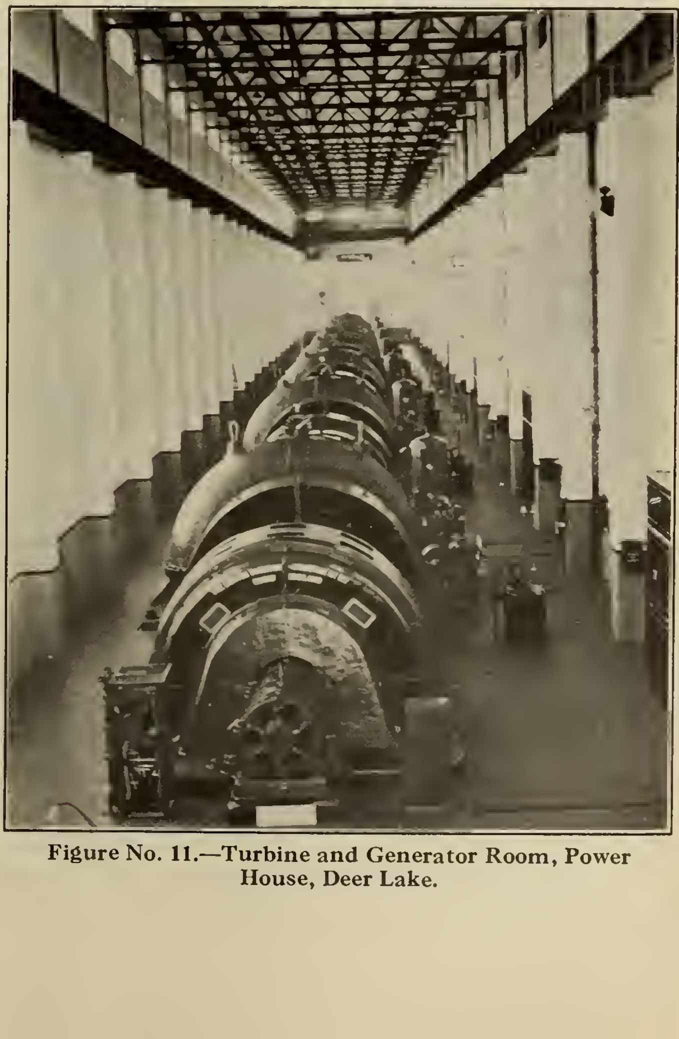

Figure No. 11.—Turbine and Generator Room, Power House, Deer Lake.

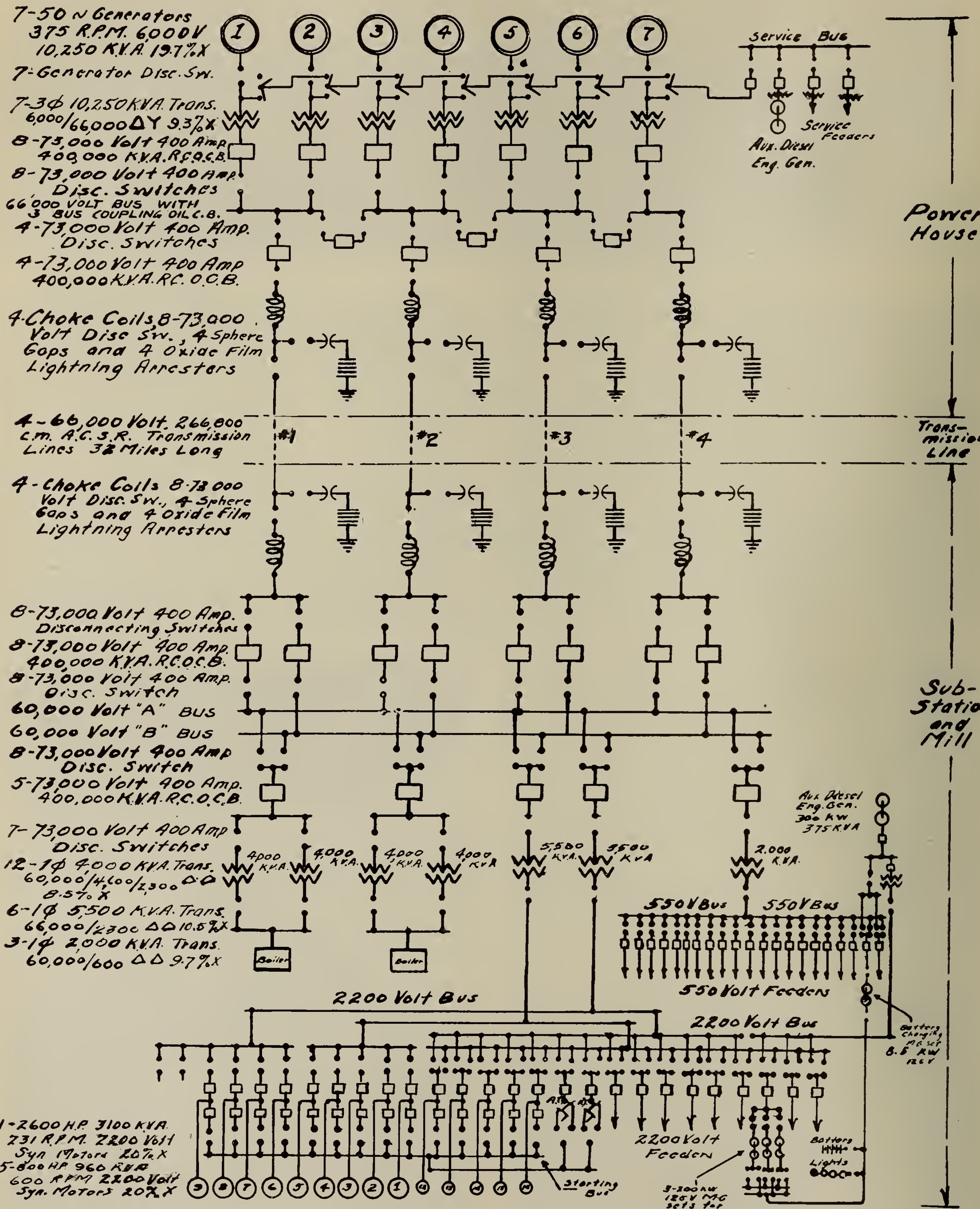

Figure No. 12.—Single Line Diagram of Newfoundland Power and Paper Company's Power System.

A 20-ton flywheel, 12 feet in diameter, is inserted between the turbine and the alternator. This flywheel is required for proper speed regulation owing to the lack of required flywheel effect in the generator rotor. Each generator is directly connected with heavy lead-covered cables to a 10,250-kv.a., 3-phase, 6000/66,000-volt, oil insulated, water-cooled transformer. These transformers as well as the oil breakers are installed in fireproof cubicles. A generator and transformer combine to make an individual unit supplying current direct to the 66,000-volt high-tension bus through an oil circuit breaker.

The high-tension 66,000-volt bus consists of stranded copper cable mounted on post type insulators consisting of two 44,000-volt insulators forming one insulator unit. The high-tension bus is divided into four sections by three circuit breakers which allows the isolation of bus sections. Four transmission line oil breakers supply the four outgoing lines. Where the conductors go through the power house wall, 110,000-volt compound filled wall bushings are used. Four outdoor type 72,000-volt oxide film lightning arresters connect directly to transmission lines just outside the power house. All lightning arresters are provided with the necessary isolating disconnecting switches. No spare or auxiliary excitation system is used for the generators as the exciter on the end of a generator is so designed that an armature or whole exciter can be very quickly changed, the extension of the generator shaft supporting the exciter armature which has no end bearings.

Electrical controls connected to the switchboard are provided in order that the operator can properly control the loads and also shut down a unit from the control room by tripping the butterfly valve mechanism. Each turbine is equipped with butterfly valve and necessary relief valves to take care of the excess pressure in the penstocks under sudden load changes, as no surge tank is used in connection with the penstocks.

The switchboard consists of twenty-five panels controlling the generators and oil circuit breakers for the operation of the plant. These switchboard panels are equipped with an extra panel mounted above the ordinary panel, electrically indicating when an oil breaker or a disconnecting switch is closed or open.

The relay system at the power house consists of differential and overload relay protection on the generators and transformers as a unit, as well as earth leakage relays on generators and transmission lines. The transmission lines

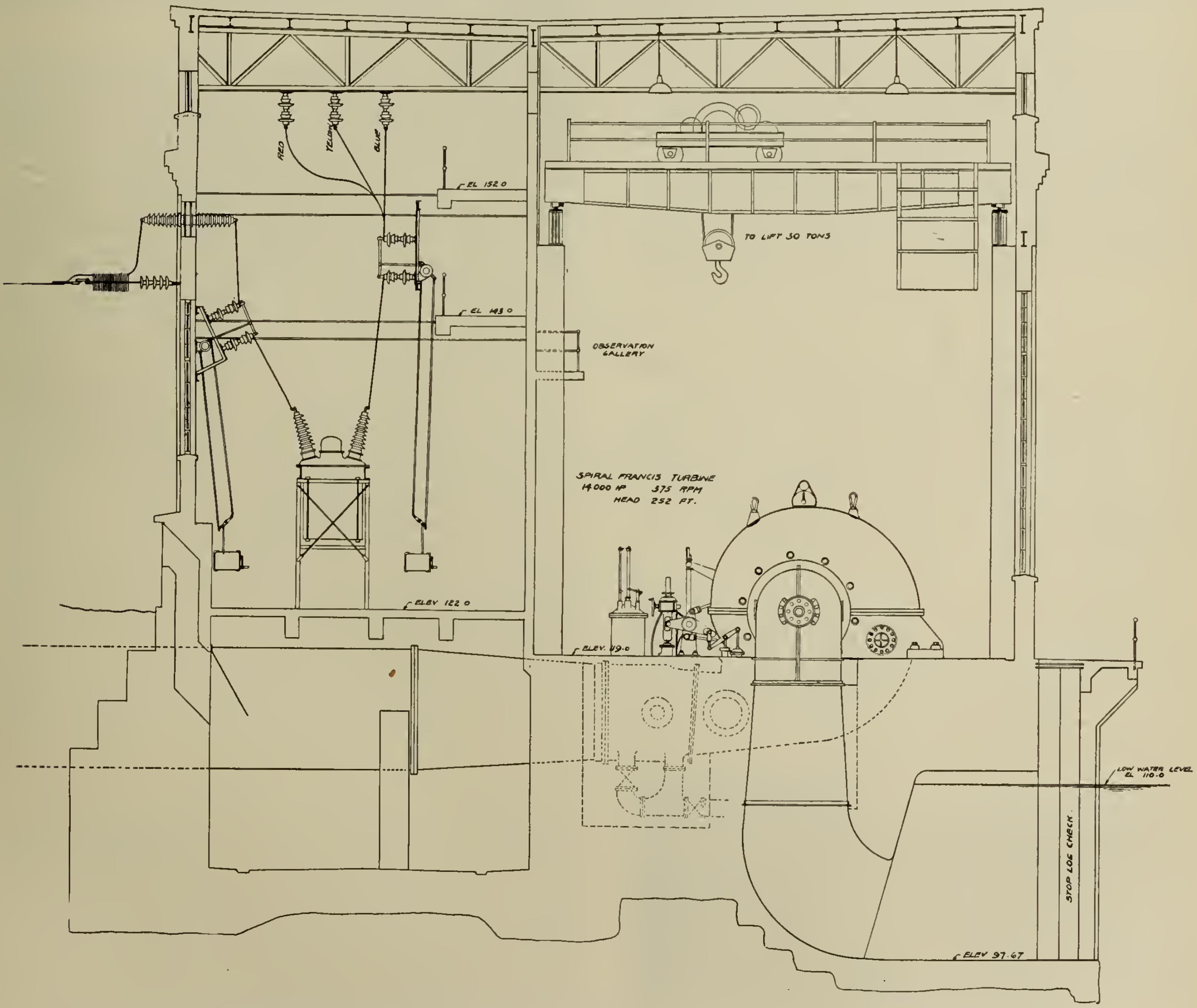

Figure No. 13.—Cross Section through Power House showing No. 4 Turbine and No. 2 Outgoing Transmission Line.

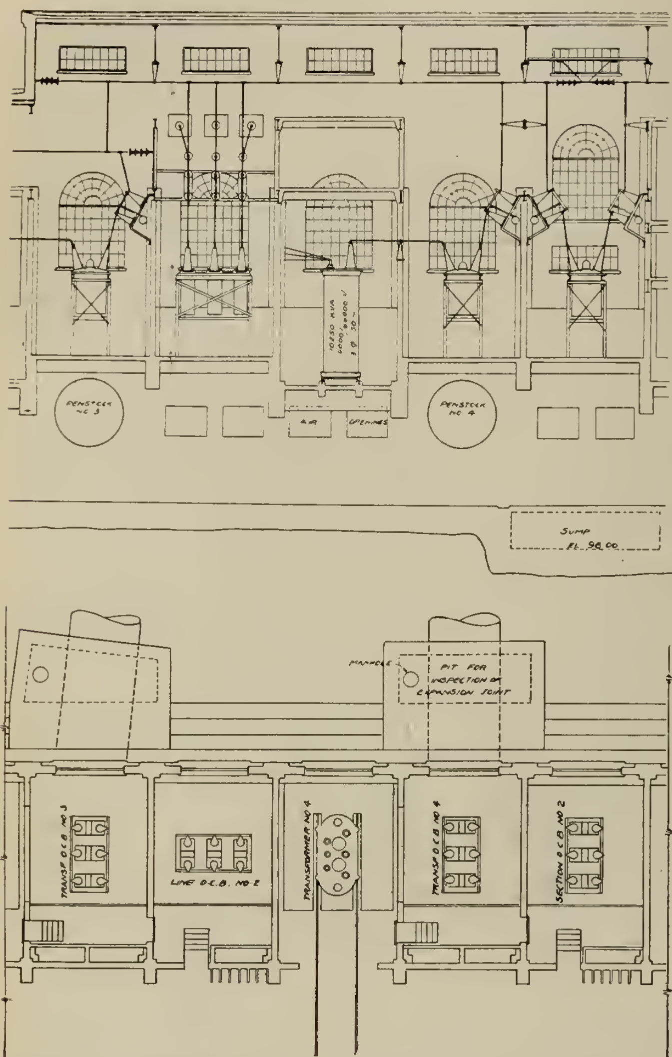

Figure No. 14.—Typical Plan View and Elevation showing part of Switchhouse.

are also provided with overload relays. The 6,000-volt bus coupler oil breakers are arranged with overload relays to take care of bus shorts only. All auxiliary power feeders are supplied with overload and earth leakage relays. Transformers are connected delta star with the star connection on the high-tension side. Generators are connected star and have their " Y " points earthed through a resistance.

The 6,000-volt auxiliary power supply is arranged to be taken from each of the seven generators, which are grouped into two sections, four being in one section and three in the other section. One generator on each section normally feeds approximately 50 per cent of the auxiliary power load. The bus coupler circuit breaker is installed between the two low-tension sections so that in case the generator, feeding one section, should be tripped off, this bus coupler is automatically thrown over too quickly for the motors to be tripped by the " no-volt " releases on their starters. Each generator in each section has a set of disconnecting switches which are so interlocked that it is impossible to open them under load and also impossible to parallel any two generators on one section through these disconnecting switches or to parallel generators in two sections. This system of low-tension auxiliary power supply has proved very satisfactory to date, considering that it is somewhat different from American design of stations where a small-sized high-tension transformer or small generator units supply auxiliary power. Power at 6,000 volts is supplied to an outgoing line to the Main dam and intake and a second line to the forebay. It also supplies low-tension transformers 6000/550 volts for station, auxiliary power and townsite distribution which is at 550 volts, 3-phase.

A separate 280-k.w., 550-volt, 3-phase Diesel engine generator set is arranged to supply through the transformers 6,000-volt power, and directly to the 550-volt bus. This Diesel engine generator set was purchased to be utilized during construction and later serve as an auxiliary to the power house.

The pressure oil system for the turbines and generators, which have water-cooled oil bearings, has the oil tanks located on the high-tension floor gallery so as to obtain the necessary head for proper circulation. The oil filter and oil storage tanks are located in the basement and the oil pumps are driven by two small motors and a small spare turbine-driven oil pump. Each of the three units is capable of supplying oil required for the whole system, and in case of failure of one pump, sufficient storage is provided in the tank on the high-tension gallery to run several hours, while the necessary repairs are being made to the oil system equipment, without interfering with the operation of the turbines or generators.

Necessary water sump pumps and an ejector are supplied to take care of any accumulation of water which might occur in the basement. A small motor-driven air compressor supplies the necessary air for blowing out generators, operation of air drills required for repair work, etc.

The air supply for the generators is taken direct into the basement through adjustable air openings. This allows a direct supply of air from the outside, across the short passage, direct to the generators, and assures a good continuous supply of clean dry air. The ground outside of the power house is grassed for a considerable distance in order to eliminate the dust.

The heating of the power house in winter is accomplished by using the heat from the generators. A circulating air system, through openings at the top of the building in the walls between the transformer section and the generator section, keeps the building comfortably warm. These large openings allow the air to pass down through the transformer and circuit breaker rooms, and through properly-guarded openings in the floor of the latter room the air passes into the basement where it is drawn into the machines, thus making a circulating system between the generator room and the transformer rooms. This system of heating of the power house has proved satisfactory during the past winter.

The power house is supplied with two 30-ton electric cranes, and provision is made for the insertion of a special wood mat between the rotor and the stator of the generator, in case it is necessary to lift the stator of the generator, so that the complete unit can be lifted by the two cranes. This arrangement is necessary owing to the fact that the stator was supplied in one piece.

The station lighting consists of overhead lights so adjusted as to be clear of the cranes when they are travelling, and are such as to give a six foot candle intensity on the power house floor. The lighting units are arranged in such a manner that there are no shadows. Flood lights are installed on the roof of the power house to illuminate the lightning arresters and transmission towers in the vicinity of the power house. They are also arranged on the tailrace side of the building to assist in night operation of the tugs which tow wood to the Humber river.

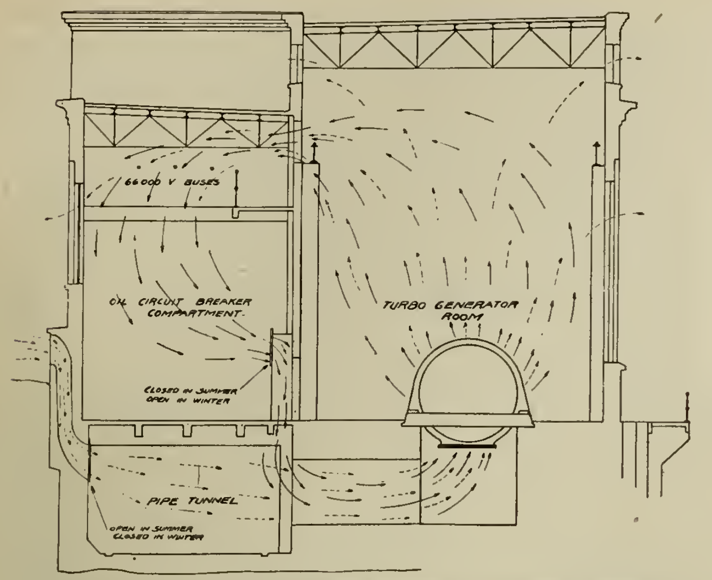

Figure No. 15.—Cross Section of Power House showing Air Circulation.
——+ Winter Circulation - - - - - -+ Summer Circulation

Transmission Lines

The transmission line consists of four separate 3-phase, 66,000-volt lines, covering a distance of 32 miles between Deer Lake and Corner Brook, composed of standard-size 266,800 CM. aluminum steel reinforced cable. The towers are of steel and the standard towers and strain towers are a duplicate of those used by the Shawinigan Water and Power Company on their Quebec lines. This also is true in regard to the concrete foundations which are used for supporting the towers. Insulators are of the pin type, except on the strain towers. There are 966 towers spaced approximately 350 to 400 feet apart. This transmission line has withstood the wind storms of two winters, and to date no failures have occurred on the steel towers. Wooden oak pins are used to support the insulators. Part of the transmission line is over a very rugged mountainous section and considerable difficulty was experienced in the erection of this portion of the line. Two special strain towers, having a height of 92 feet, provide proper clearance for the long span required to cross the railway tracks and give clearance to the buildings between the towers and the substation.

Telephone lines between Corner Brook and Deer Lake are run on wooden poles adjacent to the railway and were installed during the early construction period. Practically no induction trouble of the transmission line has been experienced on telephone lines, as they are a considerable distance from the power lines. Provision is made for instrument connection along the telephone line for the convenience of the patrol men. Telephone lines extend from Deer Lake to Howley for woods department operations.

Substation

Four transmission lines from Deer Lake enter the substation through 110,000-volt wall bushings, connect directly through disconnecting switches to four oxide film lightning arresters, duplicate to those outside the power house at Deer Lake, and connect through choke coils, and four 3-pole electrically-operated disconnecting switches, which are also designed for hand operation, to the high-tension volt busses. A double bus system is used for the 60,000-volt busses, two oil breakers being used on each incoming line. This arrangement permits the splitting of the load so as to take advantage of the best governing units at the power house in case trouble is caused by speed variation on the synchronous motors operating the paper machine electric drives, which are very sensitive to frequency changes. Single-circuit breakers are supplied with each transformer bank and provision is made with disconnecting switches to allow any circuit breaker to be connected to either of the two busses. Pin type insulators, the same as used on the transmission line, are used with a steel pin and an adjustable base to facilitate the alignment of the busses on the insulators. Standard metal caps are used on the top of the insulators for holding the copper tubes. The insulators are mounted on the latticed steel girders provided for the high-tension busses and the top metal cap allows for special clamps on the roof steel to take care of the connections between busses. This arrangement of the insulator and fittings provides a very simple and cheap scheme for high-tension busses for ceiling or ordinary mounting as parts are interchangeable, as against the more expensive post type insulators.

The high-tension room contains the 60,000-volt oil breakers and lightning arresters and has the steel work arranged specially for the busbar equipment. Circuit breakers and lightning arresters are supplied with light fireproof partitions in the form of cubicles up to a height just above the top of the oil breakers and metal-covered doors with wired glass openings are provided. Red and green indicating lamps, similar to those used on the switchboard, are supplied directly under the disconnecting switches located over the oil breakers to assist the operator in switching operations, so that a disconnecting switch will not be pulled under load as the lights indicate when an oil breaker is closed or open. This prevents the necessity of the operator going into the cubicle to see if the breaker is open, as the design of the top mechanism of the breakers is such that it is necessary to look at a small indicator on the breaker to know whether it is open or closed.

About one mile of ¾-inch iron pipe size copper tubing was used on the 60,000-volt bus work in the high-tension room and in that over the transformers.

Three different radii bends were adopted and a home-made bender was constructed which permitted accurate and quick bending of copper tubing and made the bending of the copper bus symmetrical. This scheme saved a large amount of labour and made possible the very quick erection of the copper tubing. All short ends of this copper tubing were saved and used on the low-tension circuit breakers, so that practically 100 per cent of the copper ordered was used.

Figure No. 16.—Transmission Line.

All tap connectors were drilled and pinned after the plant had been in operation approximately three months. This was done after all connectors were tightened up and had become set to their normal position. A small drill was used and the whole high-tension bus structure was completed during a single Sunday.

From the high-tension room to the short 60,000-volt busses directly over the transformers 110,000-volt floor bushings were used. A small concrete curb is provided around these bushings to prevent any possibility of burning oil running into the transformer rooms. Oil drains are also provided in all oil breaker cubicles, as well as under all transformers, to provide quick disposal of burning oil in case of trouble. Oil piping is provided in each oil circuit breaker cubicle so that the oil can be changed from the oil breakers directly from the oil tanks located in the oil storage room in the basement.

The substation is so designed that one side of the building accommodates the low-tension oil breakers on one floor and the switchboard room on the floor above, which has for its ceiling the floor of the higher-tension room. The other side of the building is so arranged that there is only one dividing floor between the transformer room and the high-tension room.

There are seven banks of transformers located in the transformer room, consisting of twelve 4,000-kv.a., single-phase, 60,000/4,600-2,300-volt, step-down transformers used for the two electric boilers, each taking two banks of three transformers or 24,000 kv.a.; six 5,500-kv.a., single-phase, 60,000/2,300-volt transformers for 2,200-volt motors and Corner Brook townsite power, and three 2,000-kv.a., single-phase 60,000/600-volt step-down transformers for 550-volt motors. The 4,000-kv.a. transformers have their secondaries designed for quick connection to 2,300 volts in case it is desired to use these transformers for power purposes, other than electric steam generators, at a future date. One transformer of 5,500-kv.a. capacity is utilized as a spare for both the 4,000-kv.a. 4,600-volt and the 5,500 kv.a. 2,300-volt transformers. The impedence of this transformer is so designed by the manufacturer that the transformer will operate correctly with either the 4,600-volt or 2,300-volt transformer banks. One spare 2,000-kv.a. transformer is available for 600-volt service.

The electric boiler transformers are grouped along the outside wall of the building and are connected through disconnecting switches to short 60,000-volt busses directly overhead. The low-tension terminals lead through disconnecting switches to 4,600-volt busbars located on the walls behind the transformers. These busbars run direct to the electric boilers located in a room separated from the trans-

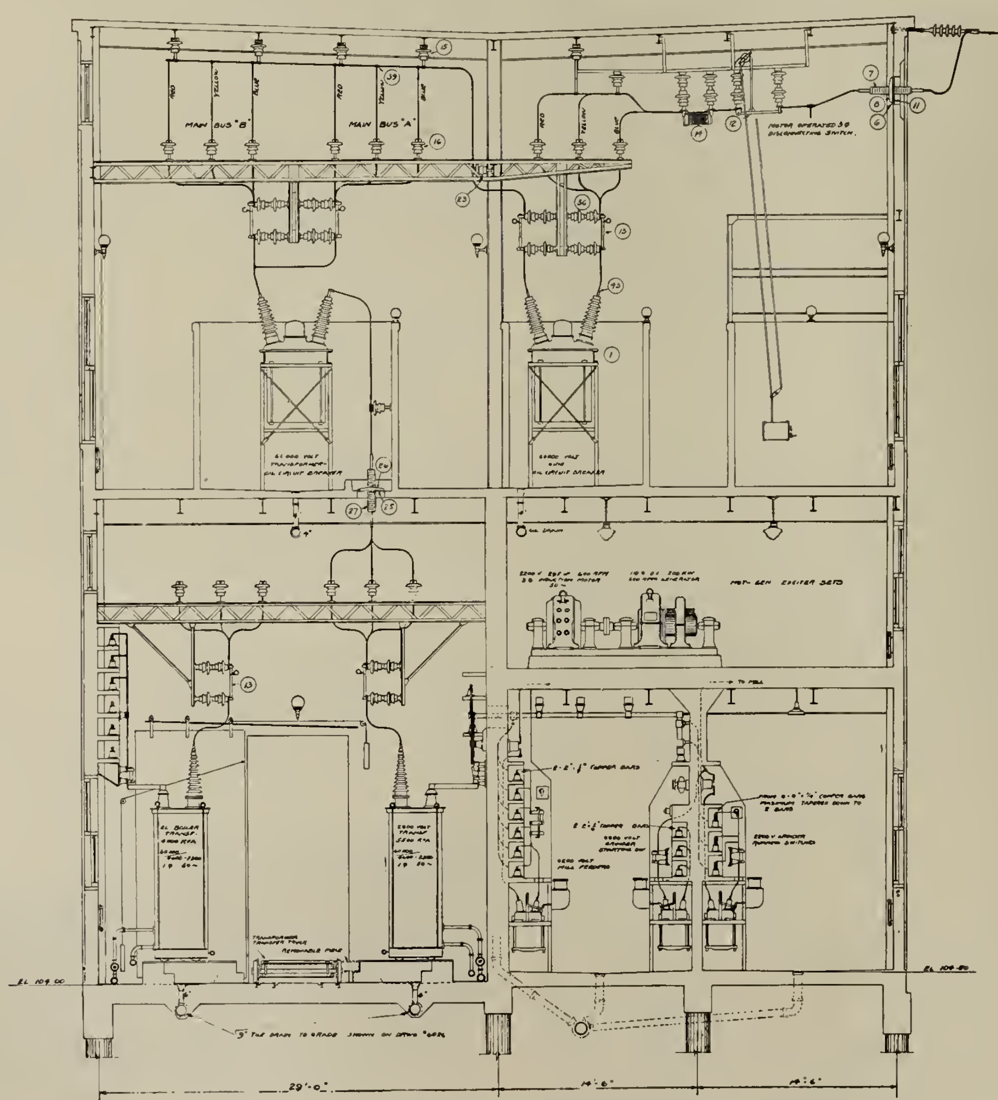

Figure No. 17.—Cross Diagram of Substation, Section A-A.

former room by a concrete wall. Insulator bushings are used on the 4,600-volt busses through the wall and are packed with oakum to prevent leakage of steam through the bushings into the transformer room. Owing to the long run of copper to the transformer banks farthest from the electric boilers, it was found necessary to provide expansion joints on these busbars. Also, all busbar clamps had their faces vaselined and were clamped up to a neat fit, but still allowed movement of busbars through them to take care of the contraction and expansion. Expansion joints were not considered necessary on the busbars having short runs to the electric boiler as expansion could be taken up by the flexibility of the fittings. Rubber washers were installed under all these busbar clamps to prevent breakage of any insulators in case one should seize the busbar and tend to move along with it. Experience to date has shown this scheme to be successful as not a single case of a broken insulator has been reported. All substation busbars are designed against short circuit stresses and bars are mounted in vertical position to take advantage of greater current capacity. Reinforcing rods in concrete bus structures were carefully arranged to avoid any possible short circuited loops.

The 2,300-volt and 600-volt transformers, as well as one spare transformer bay, make up the other side of the transformer room. The transformers are connected through disconnecting switches to the short 60,000-volt busbar sections located directly over the transformers. Low-tension power is taken from the transformers through the disconnecting switches directly through the wall on to the low-tension busbars. This arrangement provides for the shortest possible run from the transformers to the power busbars and gives in the same way as the electric boiler arrangement the minimum length of busbar required. All transformers are oil-insulated, water-cooled and the cooling water floor drains are arranged in such a way that any burning oil which might occur from trouble on the transformers will be drained away without spreading to other sections. All transformers are mounted on low concrete runways, open at the back, forming a pit under the transformers. Small concrete steps provide a passageway between the transformers. A transfer truck having removable sides provides facilities for moving the transformers. These sides can be quickly shimmed up to the exact level of the transformer rail, reducing the time element and the hard labour necessary to remove transformers when the height of the transfer truck rail and the transformer rail are not the same. The support for this side piece is made in the form of a step having a channel iron on top with the flanges embedded in the concrete. This and all other equipment has been designed from the operating point of view in order to arrange for speed and a small amount of labour when making changes. Eyebolts are provided in rear of transformers for pulling them into place. All water and oil piping is run in the rear of the transformers and all temperature indicators are located on the front of the transformers in easy view of the operator.

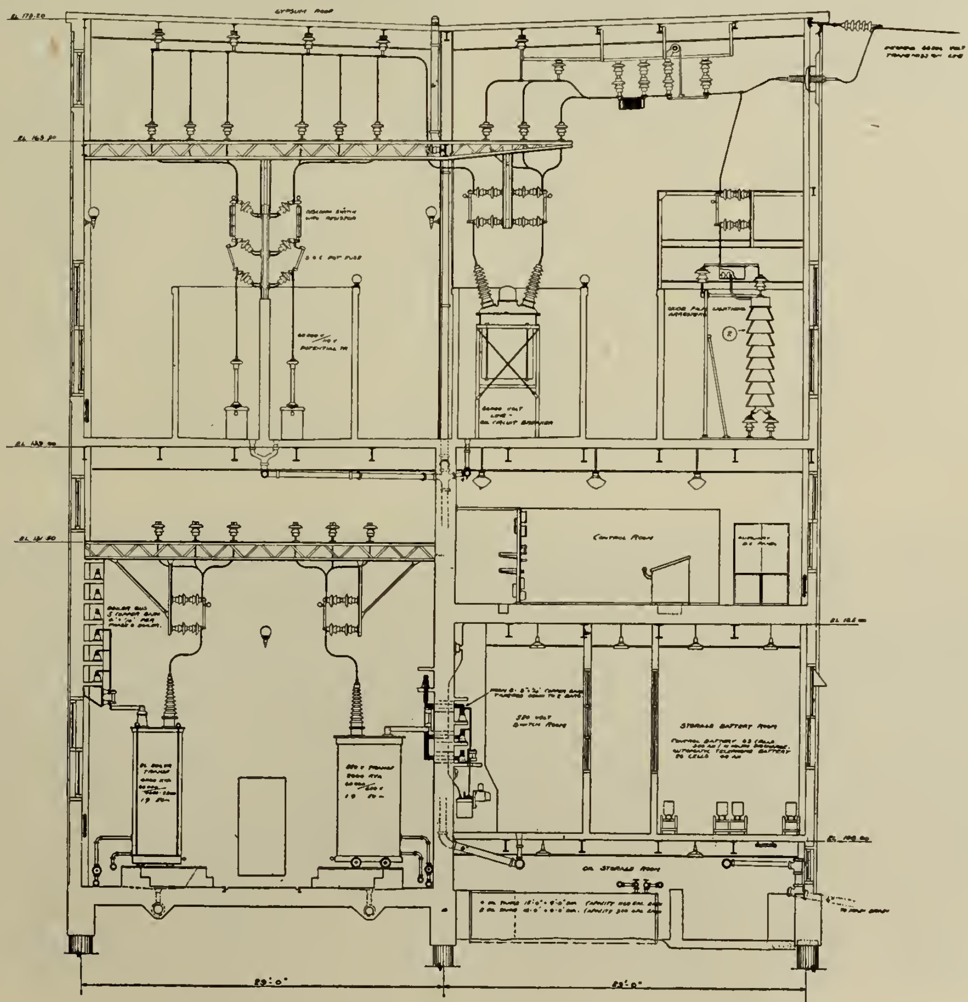

Figure No. 18.—Cross Diagram of Substation, Section B-B.

The transformers are connected delta on both high- and low-tension sides. This arrangement allows for operation of plant without appreciable delay in case trouble should develop on any single transformer. In paper mill operation it is very essential that all delays be cut to a minimum owing to the excessive expense of any appreciable delay, as the whole production of the Corner Brook mill is tied up in four units or paper machines and anything affecting any one unit affects very largely the total production output of the plant. It is always possible to carry on operations with slightly decreased load on the two remaining transformers of a delta-delta bank and necessary reductions of non-essential plant load until a spare transformer can be put into place.

Safety fire doors and light fireproof partitions are installed between all transformer banks, this arrangement being necessary in order that the plant could be passed by the fire underwriters who insured the whole mill property.

The low-tension leads from the two 2,200-volt transformer banks lead directly through the wall to the busses for the 2,200-volt feeder breakers. The twenty-two oil breakers on the starting and running positions of the eleven 2,200-volt synchronous grinder motors are located back to back in the centre portion of the low-tension switch room. Busbars for the running switches of these motors are divided into two sections, one section supplying five motors and the other section supplying six motors. The ends of these busbars are on the same busbar shelves and about 18 inches apart, and small busbar jumpers are available in case of emergency so that any grinder motor can be operated from either transformer bank under emergency conditions allowing for most efficient use of the equipment. Small light busbars are run over the starting switches for the grinder motors and receive power from two special auto-transformers which are used for starting all synchronous motors, one transformer being used as a stand-by. These auto-transformers are designed to start with one minute intermission between starts, eleven 3,100-kv.a. synchronous grinder motors and four 720-kv.a. synchronous motors for the paper machine drives, making a total of fifteen motors.

The starting circuit breakers for the grinder motors have disconnecting switches connected to them which tap directly through cable on to the running cables of the synchronous motors. By opening these disconnecting switches it is possible to work on any starting breaker at any time. The other side of the breaker is connected directly to the starting busbar and no disconnecting switches are necessary as the starting auto-transformer is only used during the starting period and can be taken off at any time, so that there is no possibility of danger to workmen working on circuit breakers.

The five starting switches for the smaller 720-kv.a. (800-h.p.) synchronous motors for the paper machine drives, of which one synchronous motor operates a spare generator set, are arranged directly behind the starting transformers. The running oil breakers are adjacent to the 2,200-volt feeder switches. This arrangement locates all starting synchronous motor oil breakers, starting transformers and running breakers for the grinders in one section so that no space is lost.

The 2,200-volt feeder oil breakers, as well as the paper machine running breakers, are designed to operate on the busbars connected to either of the 2,200-volt transformer banks. This is done simply with a double throw disconnecting switch and allows the balancing of loads on these two transformer banks.

In connection with the synchronous motors, it is interesting to note that all synchronous motors are started by push button signals located close to the motors, but that all starting operations are done by the substation switchboard operator, thus concentrating all necessary equipment in the smallest available space and saving large expense in starting equipment, cables, etc. The same auto-transformer as used for starting the 3,100-kv.a. synchronous grinder motors is also used for starting the 720 kv.a. synchronous paper machine drive motors, and these smaller motors are properly protected in starting through current transformers located in the starting busbar at such a point that they protect the paper machine motors only. These current transformers connect to relays which operate the circuit breaker controlling the auto-transformer. That is, two sets of current transformers (with different ratios), and two sets of relays, are used in the operation of the auto-transformer oil breakers and are arranged so that no matter which starting transformer is in service, its circuit breaker will be tripped out. At each synchronous motor a stop button signal is provided as well as an emergency trip button which is connected both to the motor and the starting auto-transformer relays. This provides protection to the motor by the person signalling the starting of same, in that he can trip the motor whether it is in a starting or running position. The substation switchboard has an ammeter located on the top of the board in such a way that it is visible to the operator when starting any synchronous motor

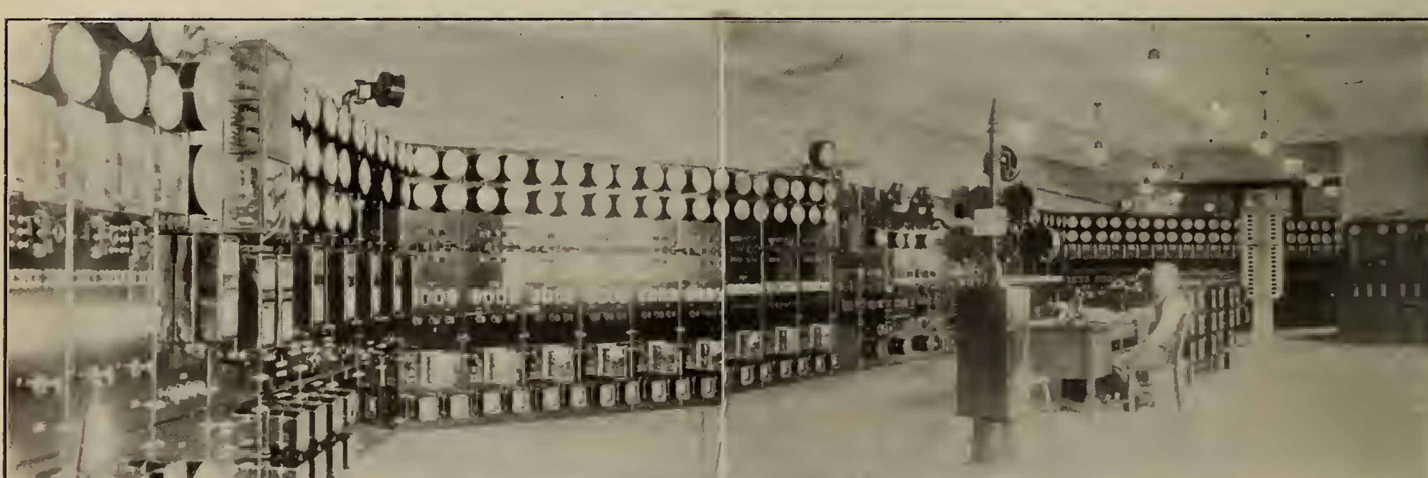

Figure No. 19.—Main Switchboard in Control Room.

Figure No. 20.—Part of Townsite showing Hotel.

so that he knows exactly the starting current and can see when it is time to go from the starting to the running position of the oil breaker.

Grinder running switches are of 1,500-ampere capacity and starting switches are of 900-ampere capacity, this lower capacity being entirely satisfactory owing to the short time in which they are in service. The current for these breakers depends on whether 50 per cent, 65 per cent or 80 per cent current taps on the two auto-transformers are used; one transformer is connected to 50 per cent and 65 per cent taps with double throw switches and the other transformer to 65 per cent and 80 per cent. These higher taps are only for use in emergency cases when the plant is suddenly shut down through interruption of power and the start may be exceptionally difficult.

The secondary leads from the 550-volt transformers go through disconnecting switches to the busbars located directly on the other side of the partition wall in the rear of the transformers. Three-pole single-throw disconnecting switches on one base are provided over each 550-volt feeder circuit breaker. The lower terminals on the disconnecting switches and the oil breaker terminals were supplied to take a ¾-inch iron pipe size copper tubing which is insulated by a split fibre tube extending between the disconnecting switch and the oil breaker. This allowed small ends of copper left over from the high-tension bus work to be utilized. Flat copper busbars connect the disconnecting switches to the main busbars.

There are twenty 550-volt oil circuit breakers of 900-ampere capacity for the numerous 550-volt circuits which are arranged to supply power to individual departments, so that the power consumption for the month for each department can be measured.

The eleven 2,200-volt feeder circuit breakers are all of 300-ampere capacity, which is also the capacity of the running and starting switches for the synchronous motors for the paper machine drives. This arrangement of circuit breakers allowed the minimum number of different capacities to be utilized so as to minimize the high expense of spare parts, which must be kept in stock in a plant such as this, which is isolated at times during the winter through lack of proper train accommodation.

Switchboard Room

The main switchboard consists of forty-six panels and is understood to be the largest switchboard shipped at one time from the British Isles. The slate panels have a baked enamel finish, with all control switches, test links and meters having nickel finish. Switchboards were purchased completely wired, with terminal boards and a colour scheme of wiring so that connection could be made by other than highly-skilled electricians. The eleven synchronous grinder motors and the five paper machine drive motors have each their own panel and the d.c. supply panels for these motors are situated approximately in the centre of the motor panels in order to be near the load centre and use a minimum quantity of copper bus. All other feeder panels carry meters, control switch, relays, etc., for two feeders, thus making the whole switchboard as compact as possible. The switchboard is in the form of an open " U " with the legs at an angle of 45°. This arrangement, owing to the size of the board, allows the operator the best possible view of all meters. A free standing signal pedestal, with red and green lamps, is used for all synchronous motors and has a bell attached to attract the operator's attention when it is desired to start any particular synchronous motor. Bells are provided near the synchronous motors and allow the switchboard operator to signal back the instant he is ready to close the starting breaker after he has put in his disconnecting switches. A white indicating lamp is also located on each synchronous motor panel so the operator has simply to go to the panel on which the white frosted light is shown, thus preventing him making a mistake in numbers after looking at a number on the signal post.

All essential a.c. and d.c. voltmeters are mounted on an instrument pedestal in close proximity to the operator's desk. Two small battery charging panels are located at one side of the main switchboard close to an entrance which leads into the substation control room. The substation is also provided with two 8½-k.w. motor generator sets and control battery for all control circuits.

The relay system provides for overload and reverse power on transmission line breakers, overload and differential relays on transformer banks and overload relays on all low-tension feeders.

A red tiled floor is supplied in the switchboard room.

The switchboard pit runs behind the switchboard and is arranged so that all conduits to the terminal boards are located directly under terminal boards. This pit was originally made larger than necessary so that it could be filled in after the switchboard was erected and the conduits correctly placed. This saved considerable time and trouble in trying to have conduits, which are located in the concrete, come directly in position and give a neat appearance. All conduits are fibre for 2-inch and larger and galvanized iron for the smaller sizes. Provision is made as far as possible for any future developments.

Owing to the fact that the substation and the whole mill are built on piles on filled ground, over which the tide originally flowed, two overhead passageways are used to

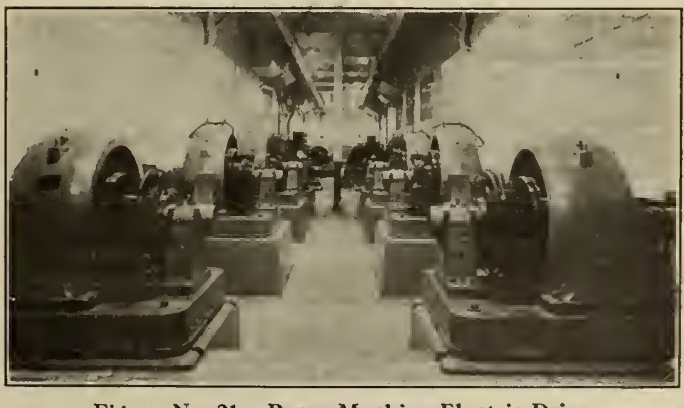

Figure No. 21.—Paper Machine Electric Drive.

conduct the power cables to the mill. The transformer station is located as nearly as possible to the load centre for the whole plant, that is, the whole plant is practically built around the substation, which was one of the first buildings designed. This arrangement reduces losses and installation cost to a minimum.

An automatic telephone exchange of 200-line capacity is located in close proximity to the switchboard in a special room so that the operator is available for correcting any troubles.

Conduit System

The mill and substation conduit system was laid out with the purpose of using fibre conduit as much as possible, in particular for the main feeders. All fibre conduits were embedded in concrete, utilizing air ducts and building walls wherever possible, so that the total amount of concrete required for such fibre conduits was kept to a minimum. It is interesting to note that there is no lead-covered cable in the mill and substation other than the paper-insulated telephone cables. A careful study was made for the design of the cable layout which allowed this arrangement to be made, as it was originally intended to use lead-covered cables in the grinder room, owing to the wet conditions in the vicinity of the floors, but by utilizing the walls of air ducts in the rear of the grinder motors, it was possible to do this work without using lead-covered cables. All duct sections are narrow so that they do not have more than two ducts together, thus giving high current capacity for all the cables in any duct section. Large-sized junction boxes were utilized throughout, giving easy access for pulling cables in order to cut down labour costs and also to ensure the cables from being damaged during installation. All conduit work throughout the mill and substation is entirely concealed, and no trouble has been experienced after one year's operation to indicate that the scheme of not using lead-covered cable is not entirely satisfactory. Only one case of a ground on a varnished cambric cable has occurred, and this was due to a steam pipe fitting breaking directly in front of a junction box which had its cover open as all cables had not been pulled in. Moisture getting into the cable duct gave a low resistance reading on the cable and immediate steps were taken to correct the trouble.

All lighting conduits, and wherever possible all other conduits, were made up in advance so that as soon as the form work was completed, the conduit was installed in the shortest possible time. A small portable motor-driven threading machine, threading conduit up to 2 inches and having a special cutter for conduit, was used to make up a large amount of small lengths of conduit. The steel work in the mill is such that the centre distances between columns are very nearly uniform so that a large number of lighting conduits could be made up in advance, as the lighting units were spaced at equal distances apart. Conduits were made up complete with locknuts and bushings and this saved time and reduced the cost of installation greatly, as unskilled help was able to install this conduit without any trouble.

Wire and Cable

Rubber-covered wire was used for all motor installations, except for large 2,200-volt size, and all cables were purchased in line with current capacity and insulation. That is, rubber-covered wire was ordered to certain sizes, which was found cheaper and more advisable to use, and over this point in current, varnished cambric cable was found to be much cheaper than rubber-covered wire and was used on all feeders. This gave the minimum cost for all cables installed in the mill and substation. Load centres were located throughout the mill for all departments, and distribution panels consisting of safety switch boxes were installed accordingly and feeders were run direct from the substation to the distribution panels.

The system of having the men move around their work as little as possible was utilized to a very large extent by having a special crew of men looking after the placing of all equipment on the spot so that electricians or skilled helpers were not sent to do any work until practically all required equipment was available for them. This allowed the most efficient use of skilled as well as unskilled help and resulted in a considerable saving as well as proper handling and responsibility being placed for breakage of any equipment.

The following are some interesting figures regarding electrical equipment in the mill and substation:—Over 120 miles of wire and cable are installed; over 23 tons of low-tension copper busbar ranging from 6 to 2 inches by ¼ inch; over 500 low-tension insulators; over 300 60,000-volt insulators; nearly 15 miles of fibre conduit ranging in size from 2 to 4 inches; over 40 miles of metal conduit of ½ to 2 inches; the number of lighting outlets is approximately 2,000; the number of lighting panel boxes 53; the number of motor safety switch boxes 298; the number of 550-volt distribution panels 41; the number of 2,200-volt power distribution centres 7; the number of switchboard panels, including substation, electric drives and grinder motor governor panels 120; 71 low-tension oil breakers; 13 high-tension oil breakers; 133 high-tension disconnecting switches and 213 low-tension disconnecting switches; the total number of connected motors 430 varying in size from ⅛ h.p. to 4,000 h.p. with necessary starting equipment.

These figures give a rough idea of the large amount of work required for the installation of this equipment, which, at the time, was the largest paper mill erected at one time.

The Characteristics and Utilization of Nova Scotia Coals

The extent of the Coalfields, the outstanding characteristics of the Coals, and a discussion of their Utilization.

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Nova Scotia Coalfields

The principal coalfields of the province of Nova Scotia are the Sydney, Pictou, Cumberland and Inverness, although there are others of much smaller extent.

Sydney Field

The coal areas of the Sydney field dip under the sea. The land areas are in the shape of a segment of a circle; the chord, along the coast line, being about 30 miles and the greatest depth inland about 9 miles, comprising an area of some 200 square miles. The extent of the field seawards is unknown, although it has been proven for an area of 70 square miles submarine by workings which extend 2¼ miles offshore and indications are that it extends much further.

There are nine seams of 3 feet and over in thickness, totalling 42 feet of coal, although only three of them are being worked at present. Quite 80 per cent of the coal produced is won from submarine areas, and this percentage will keep increasing. In the proximity of 130 million tons have been extracted, and it has been estimated that there are yet in this field 2½ billion tons of available coal within an economic mining distance. The daily output, with present openings and equipment, approaches 25,000 tons. This, of course, could be, in time, increased on demand.

It may be mentioned here that the Nova Scotia fields are the only coal deposits on the Atlantic seaboard, and of these the Sydney field is the largest. Shipping facilities are excellent at three ports, Sydney, North Sydney and Louisburg.

The mining methods in vogue are in accordance with best present-day practice. Both the room and pillar and the longwall systems are followed, depending upon local conditions.

Though by far the greater part of the area worked is submarine, very little water is made over that area, the water to be contended with all being made through the old land workings.

Pictou Field

This field is located some 9 miles inland from the Northumberland straits and in its centre is the town of New Glasgow. It is small in area, being only 30 square miles in extent, but is of great economic value, due to the number and thickness of its seams; one of which reaches 40 feet in height.

The field is rather complicated by reason of its geological contortions and numerous faults, and is usually divided into three series, the upper having five seams with a total thickness of 21 feet of coal, the middle having twelve seams with a total thickness of 193 feet, and the lowest four seams totalling 42 feet in thickness.

For reasons mentioned above, it is most difficult to estimate the amount of available coal in this field, but a figure of 200 million tons might be offered. This figure is conservative and further development may show much greater reserves capable of being recovered. Shipping facilities are provided for at Pictou.

Cumberland Field

This field consists of a basin-shaped strip of coal, measures 12 miles in width by 25 miles long, and stretches from the bay of Fundy to the town of Springhill. In this field, to date, there are only three proven areas—(*a*) at Joggins, (*b*) River Hebert district, (*c*) at Springhill, and of these the Springhill area is much the greatest, both in extent and as to thickness of coal. There are here some five seams proven, of a total thickness of 37 feet. These seams dip very steeply,—at about 30°,—and depth of cover will probably prove the limiting factor to the area possible to be mined. The total tonnage available from seams proved to date, within a limiting depth of 4,000 feet, would probably be in the neighbourhood of 70 millions. The daily output at present is about 2,000 tons. Shipping facilities for this field are provided at Parrsboro.

Inverness and Other Fields

Practically all along the northwestern coast of Cape Breton island can be found outcroppings of coal seams, varying in thickness from a few inches to as much as 13 feet. These have been located in four basins, the Chimney Corner-St. Rose, the Inverness, the Mabou and the Port Hood basins. Very limited attempts have been made to work the Chimney Corner-St. Rose basin. Openings of some importance were worked in both the Mabou and Port Hood basins, but these were unfortunately lost some years ago, due to an inflow of water. The Inverness field shows a number of seams rapidly dipping seawards, of which five show a total thickness of over 30 feet, including the 13-foot seam abovementioned; the extent being approximately 5 square miles. This is the only field in the group being worked to-day.

General Characteristics

The coals of Nova Scotia, with few exceptions, are of the first rank bituminous, (high volatile), with high calorific value, low moisture and ash content, possessing coking properties and are suitable for all general purposes, viz., steam raising, (hand, mechanical stoker or pulverized fuel installations and bunker), metallurgical by-product coking and gas.

While all Nova Scotia coals with the exception of Inverness coal possess coking properties, they are not caking coals. " Caking coals " is the name given to those that, when burned in the furnace, swell and fuse together, forming a spongy mass that may cover the whole surface of the grate. When these coals are burned, this mass must be frequently broken up with the slice bar in order to admit air needed for its combustion. " Free burning coal " is a class

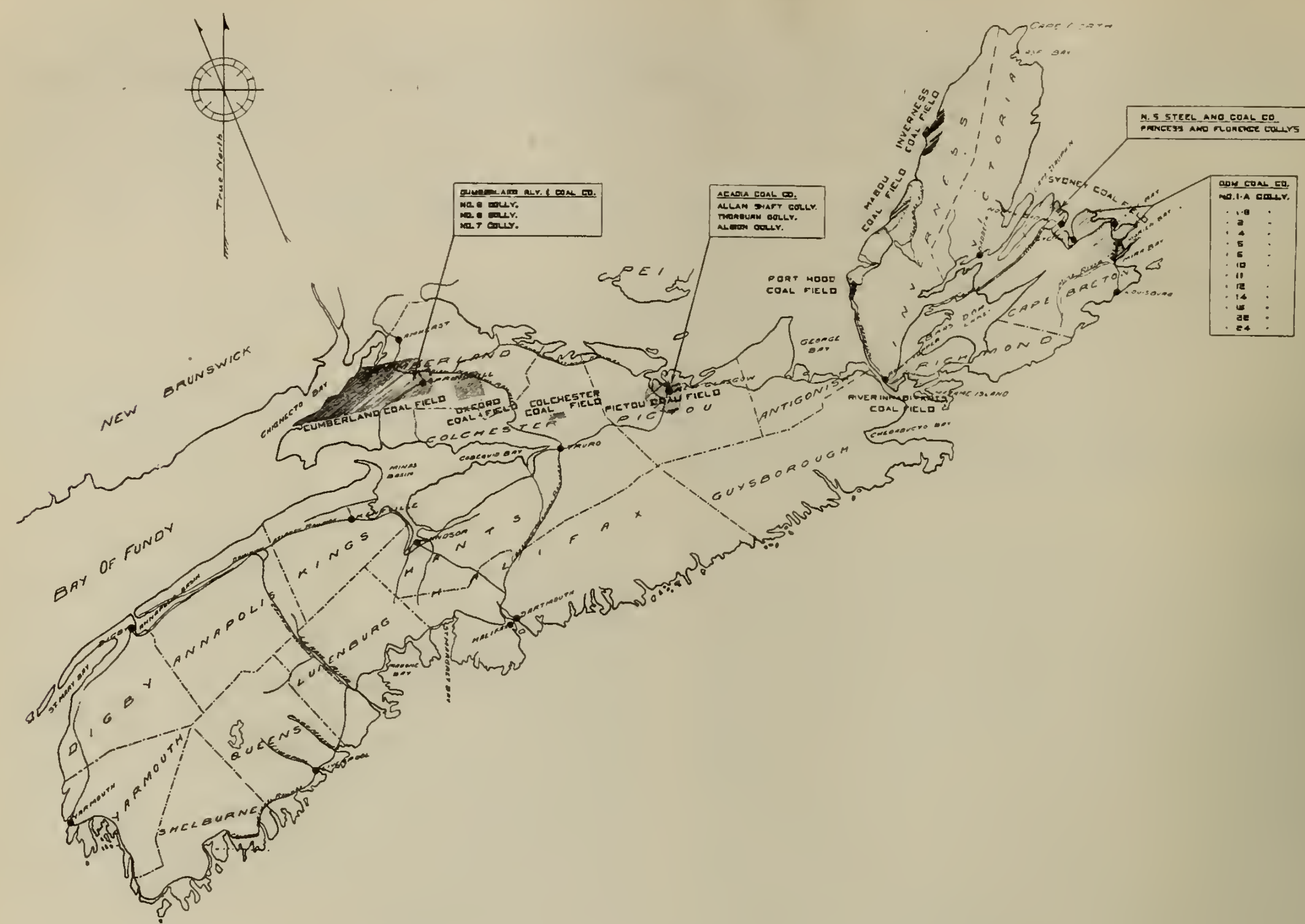

Figure No. 1.—Province of Nova Scotia showing Principal Coal Fields.

of bituminous coal that is often called non-caking from the fact that there is little tendency to fuse together when burned in a furnace at high temperatures. Nova Scotia coals shrink in the process of burning, and while they do fuse in a more or less marked degree, it is not necessary to agitate the fuel bed in order to admit air for its combustion. Recognition of this fact and handling of fires accordingly will go a long way towards removal of some complaints regarding Nova Scotia coals, as compared with some competing American bituminous coals. The fuel bed must be disturbed as little as possible,—it is not required.

The fact that a coal has coking properties does not mean that it will cake together in the furnace. (Domestic furnaces with low fire temperatures producing an oven effect are not included in this statement.) There are coals from the Pictou field which are very free burning and which do not fuse, and yet they possess excellent coking properties when distilled in coke ovens.

All of the Nova Scotia coals possess a high volatile content, up to 39 per cent, with a percentage of fixed carbon up to 60 per cent, and with a generally low percentage of ash. It is this high volatile content that provides such a large yield of by-products in coking, for which Nova Scotia coals are famed.

In burning these coals means must be provided for insuring combustion of the voluminous gases which are evolved. If this is not accomplished, black smoke may be seen issuing from the stack, which is not desirable, especially in cities that possess smoke ordinances. Smokeless combustion, however, is not necessarily an indication of efficiency, as the loss from visible smoke rarely exceeds 2 per cent. Dark smoke should be considered as visible evidence of incomplete combustion rather than as a loss in itself.

Ash

It is often stated that Nova Scotia coals contain a high percentage of ash. This is quite a mistaken idea, as study of the analyses will disclose. (See Table No. 1 for comparative analyses.)

Eliminating moisture, ash is the inorganic substance in coal and is that portion of the mineral substances in the coal which remains after the combustible has been burnt. It is valueless, a nuisance and represents a dead loss to the consumer, as it does not produce but actually absorbs heat units in reaching the temperature of the fire. Its removal, generally in a heated state, from the grates, together with a certain amount of unburnt fuel, is attendant with loss detracting in no small way from the efficiency of the furnace, especially if the ash content is high.

There are two kinds of ash, that which is inherent or fixed in the coal and the extraneous ash which can be removed on the picking belts or by mechanical cleaning. The latter kind has really nothing to do with the character of the coal as it is entirely foreign and represents pieces of shale or sandstone from the roof and bottom of the coal seams, which come down in the mining operations and which have escaped detection on the picking belts. There are, however, in some particular seams of the Nova Scotia coalfields, bands of " bone " or " bony " coal which are intimately associated with the purer substance, tending to make, on

Table No. 1.—Mine Sample Analyses of Nova Scotia Coal.

District	Seam	Collier No	Total Moisture %	Prox Analysis – Dry Basis: F.C. %	V.M %	Sulphur %	Ash %	Calorific Value: Dried at 212° F B.T.U.	Dry Ash Free B.T.U.	Fusion Pt of Ash: Initial Deg. Fahr.	Final Deg. Fahr.	Particular Uses
Sydney Field	Phalen Average of Seam		1.5	51.50	54.50	*3.70	8.00†	13620	14800	1950		Metal, Steam & Domestic
	Harbour		1.5	57.00	57.50	3.50	5.50	15920	14750			Gas
	Emery		2.0	57.20	35.00	2.50	7.80	13650	14800	2000		Steam
	Gowrie		5.0	57.40	36.00	2.75	7.40	15700	14800	2100		Steam
	Victoria		1.5	58.20	56.80	2.10	5.00	14100	14850	1900		Gas
	Lingan		1.5	58.40	55.40	2.30	6.20	13920	14850	1900		Gas
	Main		1.5	57.30	37.60	1.75	5.1	14100	14850	2000		Gas
Pictou County	Foord	Allan	2.0	58.00	30.00	1.00	12.00	13165	14960	2300		Steam and Domestic
	Foord	Albion	2.0	58.00	50.00	1.00	12.00	13165	14960	2300		
	Cage	Albion	2.0	58.00	50.00	1.00	12.00	13165	14960	2300		
	Third	Albion	2.0	58.00	50.00	1.00	12.00	13165	14960	2300		
	McGregor	Albion	3.5	58.00	30.00	1.00	12.00	13165	14960	2500		
		Acadia 1	2.0	57.00	30.00	2.50	18.00	12875	14800	2300		
	6 Ft.	Acadia 3	3.5	58.00	30.00	1.00	12.00	13165	14960	2500		
Cumberland County	Springhill	2	1.00	60.00	31.00	1.50	9.00	13560	14900	2170	2260	
	Springhill	6	1.40	50.00	33.00	1.50	8.00	13708	14900	2200		
	Springhill	7	1.50	60.00	34.00	1.50	6.00	14006	14900	2100		
	Joggins		1.5	46.00	36.00	5.00	18.00	11900	14540			
Inverness	1		5.0	44.00	33.00	5.00	23.00	11200	14540	2100		Steam and Domestic
	4		10.0	41.00	36.00	9.00	17.00	11720	14122	2100		
	Port Hood		6.0	53.00	36.00	8.00	11.00	12665	14230			
	Mabou		7.0	52.00	36.00	6.00	12.00	12700	14457			
	Saint Rose		5.0	52.00	37.00	6.00	11.00	12850	14431			
	Chimney Corner		9.0	53.00	36.00	8.00	11.00	12660	14230			

*The Sulphur content is variable ranging from 2.25 to 4.6% according to location.

Note:—Above analyses represent average analysis of coal taken from working faces of mines. Delivered car samples will generally show some increase in percentages of ash and surface moisture.

the whole, a higher ash coal. This "bony" coal presents a somewhat duller appearance, and although it might be classed as a semi-impurity, it has a beneficial effect upon the clinkering properties of these coals when burnt in mechanical stokers.

Sulphur

Another statement made is that Nova Scotia coals are high in sulphur, which element is often looked upon as sufficient, if in quantity, to seriously impair the quality of the coal. Nova Scotia coals are as a whole relatively high in sulphur. There are, however, both low and high sulphur coals in the province. The metallurgical coals are higher in sulphur than most coals of this continent, and washing to remove some of the sulphur must be resorted to. This practice is the rule in Europe.

In many cases, the statement "high sulphur" coals, (whether used correctly or not in the case under consideration), is made and even adjudicated upon without true knowledge of what it really means. A better way to state the case is as follows:—

> The greater percentage of Nova Scotia coals contain sulphur in excess of 1.5 per cent, but not so as to be materially detrimental to their value except in certain cases, such as metallurgical and domestic gas purposes.

That part of the sulphur content which is organic is combustible and that which is in combination with iron, calcium, etc., and which does not burn, remains in the ash. It is this latter part which has more to do with the ash characteristics as affecting the clinkering properties of the coal than the total sulphur content, as will be shown later.

The uncontroversial points in connection with the sulphur content are:—

(1) That which is incombustible is a loss.

(2) That which is combustible burns, but with lower B.t.u. emission than carbon, namely, 4050:14,540.

The above statements do not militate against use of Nova Scotia coals in general, except the two cases cited which are outside the general run. What, then, are the popular ideas regarding,—to use the popular phrase,—a "high" sulphur content?

(*a*) It is a widely accepted idea that it is the cause of spontaneous combustion. This is a very important matter because of the necessity of winter storage both at the mines and points of usage.

Now, the most that can be truthfully said about sulphur and spontaneous combustion, or firing of the coal pile, is that there is a possibility of sulphur being a *contributory* cause, but most certainly not the main one. That sulphur is the cause of this trouble is an old belief, and it has been definitely discarded by the highest authorities of to-day. This is what the Fuel Committee of the National Electric Light Association have to say upon this matter:—

> *"Several companies have requested that consideration be given to specifications of sulphur content in coal. These companies seemed to believe that sulphur content determined the suitability or unsuitability of coal for storage. For a long time there has been a general impression that the sulphur content had everything to do with the difficulties encountered in storage of coal. This is a vestige of an old belief. It is known, for example, that Texas lignite, having a sulphur content of 0.75 to 1 per cent, gives a great deal of trouble in storage, indicating that the sulphur content cannot be held entirely responsible for the difficulty in storing, but rather that the nature of the vegetable compounds or size of fuel may be more properly considered the troublesome factor. In addition, it is known that as the percentage of fixed carbon increases and that of volatile matter decreases, less trouble is generally en-

*See National Electric Light Association, 1924 Proceedings, Page 1212.

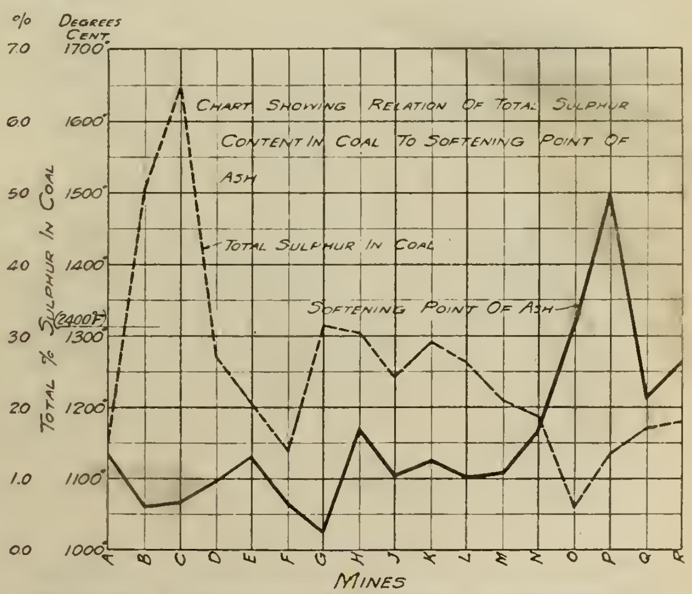

Figure No. 2.—Relation of Total Sulphur Content in Coal to Softening Point of Ash.

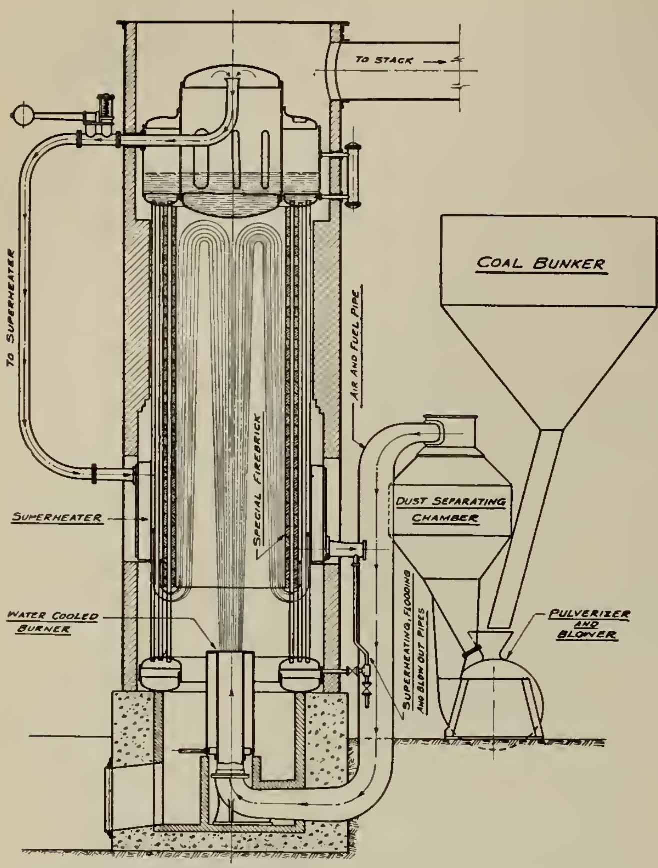

Figure No. 3.—Sectional View of Bettington Boiler, Waterford Lake Power Plant—Dominion Coal Co. Ltd.

countered in storage. Therefore the importance of specifying the sulphur content as being the sole important factor in determining the suitability of a fuel for storage is evidently questionable."

The Dominion Coal Company Ltd. have found from experience, (they have banked quantities up to 400,000 tons in one pile for periods up to eleven months without being lifted), that of all their coals, two of the highest sulphur coals, (one of which is not now worked), closely followed by a low sulphur coal, gave the most trouble. Their No. 6 mine, referred to as not now working, tested exceptionally high in sulphur, 5 per cent, and is therefore an extreme condition, and yet Mr. J. Mullins, the superintendent of the banking stations, states that from his extensive experience with banking coals:—

"We believe that fineness of coal is a bigger factor than its chemical constituents as a cause of fire, and might say, with past experience in mind, that we would prefer banking screened No. 6 coal to run-of-mine from any colliery in this district, even though No. 6 is our most dangerous coal."

It is not the intention to go any further than this here, but to deal with this subject more fully under the heading "storage," except to venture the opinion that the conditions under which the coal is stored and its physical qualities bear more relation to its liability to fire in the pile, than the sulphur content, which indeed plays a minor part in this matter.

(*b*) Another prevalent and erroneous idea is that the clinkering characteristics of a coal may be judged from analyses indicating the total amount of sulphur in that coal. Before enlarging upon this, let us consider the term "clinkering." Clinker is ash that has fused together. What tendency the ash has to form clinker and what kind of clinker it forms can only really be determined in one manner, and that is by burning that coal under the actual working conditions. Its tendency to clinker or otherwise may be minimized from knowledge of its peculiarities, and troubles in very aggravated form avoided, but nevertheless the determination of the clinkering characteristics of Nova Scotia coals can only be carried out as stated above. This is important.

Consideration of the softening or fusion point of ash is used by many authorities. Naturally, those coals having a high ash softening temperature are termed non-clinkering. It has been established that coals whose ash fused at temperatures over 2400°F., (1316°C), produce no objectionable clinkers. Below this point the formation of clinkers in more or less troublesome form may be anticipated. These rules are of immense importance to us because we have only one mine which produces a coal with an ash fusion point well over 2400°F., (1316°C.). Nevertheless, it is known by experience that there are several mines in Nova Scotia producing coals which do not form objectionable clinker, that is, clinker which adheres to the grates or brickwork and which is difficult to remove. This brings us back to the statement that actual trial is the only method by which Nova Scotia coals may be judged.

Dealing with these various points, the relation of total sulphur content in the coal to the ash fusion point will be considered. Figures gathered by the United States Bureau of Mines do not prove there is any direct relation. For instance, a coal was analysed having a sulphur content of 5.4 per cent, yet the ash fusion point was 2980°F.; another analysed 0.33 per cent sulphur and the fusion point of ash was 1990°F. This does not bear out the feeling that a high sulphur content means a low ash fusion point or vice versa. If reference is made to Figure No. 2, it will be seen that there is really no direct relation between the sulphur content and ash fusion point for Nova Scotia coals. In some cases, as the chart shows, the fusion point is lowered with the sulphur and again the opposite occurs, which emphasizes the futility of regarding the ash fusion point as bearing a direct relation to the sulphur content of the coal.

There is another point this chart reveals, and that is, with two exceptions, there is no great difference between the ash fusion point, and all of them except one fall under 2400°F., (1316°C.). Yet the best steam coals, and those which can be forced on mechanical stokers without trouble, are coals D, E, K & L. The ash fusion point is about the average of all of the coals shown. What is the reason for this? Why should these coals in particular, which are not low in sulphur and whose ash fusion point is in the clinkering region, act in this manner? Analyses of the ash reveals features which stand out consistently, and that is:—

These coals, namely, D, E, K & L on Figure No. 2, show *ash* analyses varying from 0.66 to 2.90 per cent lime and 0.14 to 0.60 per cent sulphur, while the other coals in the same field, while of a lower ash content and of better appearance, show an average ash analyses of 7.0 per cent lime and 2.25 per cent sulphur.

Generally speaking, the silica and alumina are a little higher and the ferric oxide a little lower, but the line of demarcation is not nearly so distinct as in the case of lime and sulphur.

These coals which are in the Sydney coalfield have a dull lustre and are not as good in appearance as others from the same field.

The foregoing are the only distinctive properties which might account for these coals being non-clinkering and against the generally accepted order of things.

In closing this matter it should be noted that even with the coals that clinker, no real trouble will ensue if the fires are not forced and intelligently handled, also that mixing of these different coals has had the effect of minimizing clinker trouble.

The foregoing emphasizes the fact that Nova Scotia coals have their own distinct peculiarities which must be recognized and prepared for. In some places, these coals have received a bad name simply because the conditions under which they were used were not suitable. In all but a few instances, where a supervised test was permitted and proper allowance made for these characteristics, Nova Scotia coals have proven equal if not superior to the same class of American coals previously in use.

Storing

This section deals with large storage of coal which is necessary in many plants on account of transportation requirements and other reasons. It is not intended to cover systems of storing, i.e., by drag scraper, conveyors, etc., which are purely mechanical features, but rather, to deal with those facts concerning the physical nature of the pile which should be considered, especially as affecting Nova Scotia coals.

Spontaneous combustion of coal in the pile is a very serious matter and the consequential loss from the pile firing may be large. In this connection, modern storage plants are designed with a view to preventing rather than combating this evil. All coals are subject to spontaneous combustion, some more than others and anthracite least of all. There has been much research work in this matter, and it will be sufficient to say in this paper that the main cause is considered to be absorption of oxygen from the air by the coal without sufficient means for carrying off the heat thus produced. It cannot be absolutely prevented, except by under-water storage. There are only a few plants that have this type of storage, and then it is generally in the nature of a reserve supply, such as provided for navies. In this climate it would not be very successful for industrial plants, and no doubt the reclaiming costs of coal stored in this manner would offset losses resultant from fires in the pile.

The experience gained by mine operators in Nova Scotia, where very large stocks are carried or " banked " in the winter months, should be of benefit to consumers, and some very instructive information is given in the following statement, which deals with the banking of coals in the Sydney field, by the Dominion Coal Company, Ltd.:—

"' Prior to the war, the coal stored consisted almost entirely of screened coal,—the quantity of run-of-mine was almost negligible. No attempt was made at systematic ventilation and no trouble arose from heating. Since the war, run-of-mine coal has been stored, and it is with this class of coal and slack that most difficulty is experienced due to heating. It was found that, generally speaking, no heat develops until after the coal has been stored for three months, and, further, that if no heat trouble occurs within five months, it is quite probable that the pile will remain indefinitely without heating, although it is doubtful if any run-of-mine coal can be stored to-day without ventilation and not heat after three months. In banking run-of-mine coal, it is essential to keep adding to the pile on a defined face slope and not in spots. In this way the coal naturally grades itself by gravity, the larger lumps going to the bottom, practically all the fines being confined to the topmost third. When banked in this manner, it is found that the heat, if any, develops at from 12 to 15 feet from the top of a 39-foot pile and rises slightly, but does not come to the surface, nor does it follow the larger coal to the bottom. Heat has never been found at a greater depth than 20 feet below the top of such a pile. At no time have we stored coal at a greater height than 39 feet. In storing slack coal, it has been found that it started heating practically at the bottom of the pile.

" It is evident from the above and from the known fact that a pile of screened coal does not heat, that immunity from fire in the base of a bank of run-of-mine coal is due to the larger coal being segregated at that section, thus affording better ventilation. This was demonstrated particularly in a pile at the Sydney steel plant made in recent years. In jacking up the track on this pile for one season, run-of-mine coal was used, each lift being about 20 inches to a total height of 34 feet. Heat developed throughout the whole section underneath the track. In the following year nothing but screened coal was used in jacking and there was complete freedom from heating under the track.

" Although no attempt is made at systematic ventilation to prevent heating, it has been the habit for the past ten years to ventilate once heating was discovered. It is quite an established fact that initially the pile does not heat throughout as a mass, but that heat occurs only in comparatively small isolated spots. Occasionally these spots are detected in the early morning by gases rising from them, but the practice to-day is to prospect the pile by test rods, after it has been in place for three months. These test rods are forced into the pile to a depth of 20 feet, left in place from 10 to 15 minutes and then withdrawn and the degree of heat judged by touch. When a hot spot is met, numerous test holes are made in the neighbourhood until its location is definitely fixed, both as to height and extent, and then it is ventilated in the following manner:—

" Pointed pipes, 1 to 1¼ inch in diameter, are

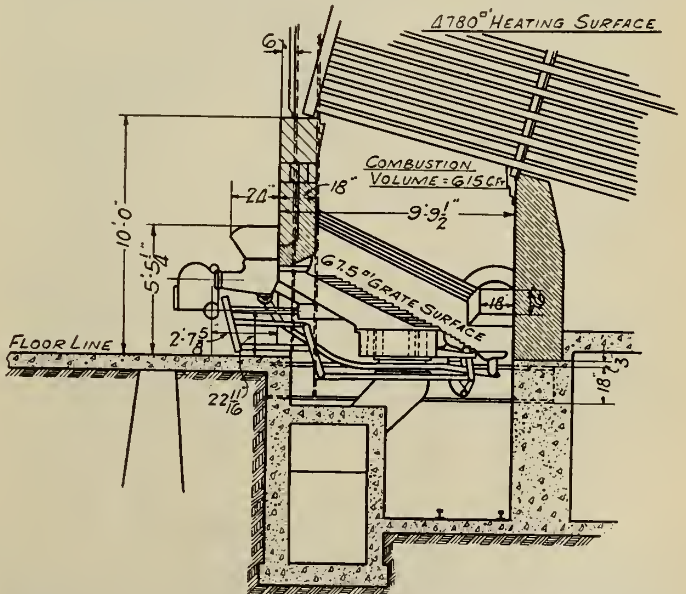

Figure No. 4.—Waterford Lake Power Plant—Dominion Coal Co. Ltd. Installation of Taylor Stokers under Babcock and Wilcox Boilers—Installed in 1912.

forced into the pile at 18- to 24-inch centres and below the known depth of the heat. These pipes are turned by a wrench so as to form a wall to the hole in the pile and a cone, of such material as ruberoid, is placed at the top of the hole to act as a casing and the pipe withdrawn.

"After an area has been so ventilated it usually begins to cool within 7 days and generally it has become quite cool in 10 days. Only occasionally is this followed by a second heating in the same spot, but it is thought that this, when it does occur, is due to the collapse of the holes and the consequent obstruction of the ventilation. It should be noted that water is not used for cooling.

"Perhaps the most serious objection to segregating into piles of slack and screened is that the screened pile might need re-screening when lifted, resulting in a greater ultimate percentage of slack.

"Our experience would lead us to recommend that only screened coal be stored, and we consider such coal could be banked to a height of 36 feet as a maximum without danger. Run-of-mine should not exceed 25 feet in height and slack piles not more than 14 feet. The largest stock ever stored by us amounted to 400,000 tons, mostly screened, with a height varying from 22 to 39 feet, and the longest period over which coal was stored without lifting was eleven months."

Very few complaints have been received on account of fires in ships' bunkers, resulting from spontaneous combustion, although 250,000 tons of bunker coal from Nova Scotia are used each year. The S.S. Wabana, 7,000 tons, took on sufficient bunker (2,158 G. tons) at Sydney to go to Vancouver through the Panama canal and back to New York. The round trip lasted three months, and there was not the slightest trouble from heating of the coal.

Apart from spontaneous combustion, coals suffer somewhat from "weathering," which is caused by oxidation of organic matter in the coal. The loss in heating value from this source, if any, has not been determined with respect to Nova Scotia coals. Experience shows, however, that "banked" coal becomes slower burning and therefore more adapted for use in furnaces not designed especially for Nova Scotia coals. Boiler operators have shown a decided preference for weathered Nova Scotia coals rather than freshly-mined coal, claiming equal efficiencies and better maintenance costs. This is borne out to some extent by tests made by the University of Illinois and published in their Bulletin No. 97. These tests show practically equal efficiencies and boiler ratings with weathered coals, after six years' storage, as compared with freshly-mined coal of the same class. Illinois coals are, however, inferior to those of Nova Scotia, being higher in moisture and ash and lower in fixed carbon and B.t.u. value.

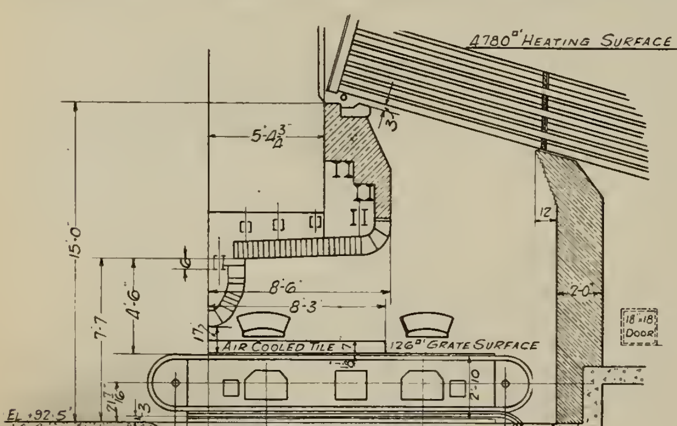

Figure No. 5.—Waterford Lake Power Plant—Dominion Coal Co. Ltd. Original Installation of Coxe Stokers under Babcock and Wilcox Boilers—Installed in 1924.

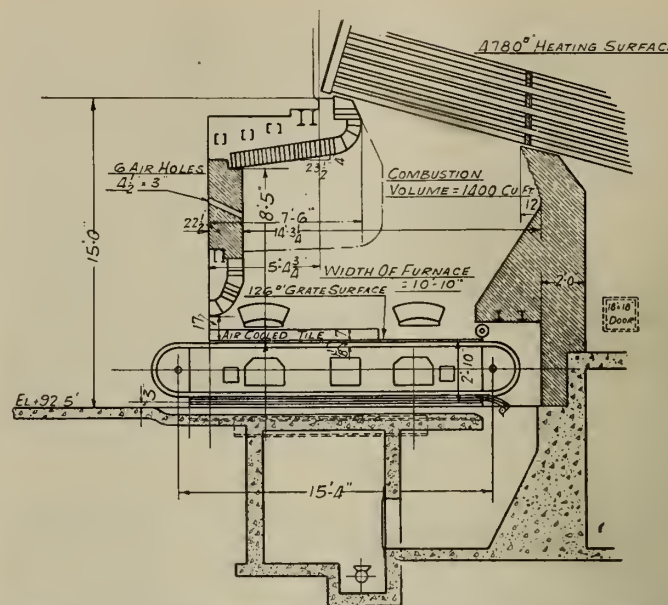

Figure No. 6.—Waterford Lake Power Plant—Dominion Coal Co. Ltd. Changes made to Setting for Coxe Stokers under Babcock and Wilcox Boilers.

It has also been found that weathered coal, if stored, is not so liable to fire in the pile as freshly-mined.

Utilization

Outstanding methods in which Nova Scotia coals are used and their adaptability will be touched upon in the order of relative importance, namely, by-product coking, steam raising by mechanical stokers and pulverized fuel.

Coke By-Products

The coking properties of the coals of Nova Scotia together with their high yield of by-products render them invaluable to the country. That by-product coke, as made from these coals, is a satisfactory but by no means an inferior substitute for imported anthracite for household fuel, is now generally accepted. The by-products obtained in distillation, such as gas, tar, motor fuel, sulphate of ammonia, etc., go a long way towards making a coking proposition commercially successful, and production of these materials would make us less reliant upon other countries for these necessary products.

For instance, a coking plant situated in Montreal, producing 385,000 tons of coke per year and replacing approximately half of the anthracite used in Montreal per year, would be the means of improving the trade balance of Canada by almost $10,000,000 per annum, represented by increased employment and increased production of valuable materials in Canada.

What is known as the regenerative by-product coke oven provides the means for producing coke most economically. The individual oven is a long narrow brick retort and is arranged in batteries with heating flues between each oven. Those at the Sydney coke plant are 37 feet 6 inches long, 17 inches mean width, 8 feet 7 inches from floor to top of coal. The coal charge is 11.25 net tons per oven. The volatiles are collected in mains and the gas is then stripped of its condensates and by-products extracted before being distributed. About 40 per cent of the total gas, or about 9 per cent of the total heating value of the coal charged, is used for heating the ovens and the remaining 60 per cent is available for other purposes.

The time taken in distilling the coal depends chiefly upon the temperature carried in the flues and the width of oven. At Sydney a minimum coking time of 16 hours is reached with an average temperature of 2600°F. in the flues. With an oven 14 inches wide, coking times of 12 hours may be reached with the same flue temperatures. This system is known as high temperature carbonization.

Low temperature carbonization is a different process altogether. When bituminous coals are carbonized at a temperature of 850°F. to 900°F., they undergo chemical and physical changes which are distinctly different to those brought about by the high temperature process. There is a lower gas and sulphate yield, but the tar yield is 100 per cent higher and the coke, which is in the form of soft semi-coke, contains about 10 per cent volatile. This semi-coke burns very readily and is smokeless. It requires briquetting for household fuel. This is done in Europe, but in America it is used in one or two places for pulverized fuel, for which it is very suitable. The tars are lighter and much more valuable than those obtained from the high temperature process, but how much so has not yet been ascertained. There are many operating difficulties to be overcome in this method of coking before it can be made successful, and after that, creation of a market for its products. As yet, there have been no investigations or experiments made with Nova Scotia coals along this line, although if this process is finally perfected it is only reasonable that these coals with their high volatile content will be very suitable. Mr. Henry Ford has built three coking plants, one of which is at Walkerville, Ont. It is understood that the Detroit plant is being dismantled to make room for a high temperature by-product coke plant.

The uses of coke are principally:—

(1) For metallurgical purposes, such as blast furnace and foundry.
(2) As a domestic fuel, replacing hard coal or anthracite.

Also in a lesser degree:—

(3) As a steam boiler fuel,—chiefly in the finer forms, such as coke breeze.
(4) In gas plants for making water gas, etc.
(5) In the manufacture of calcium carbide.

Only the first two, being the most important, will be considered here. The choice of coals for these cokes must be carefully made, and a policy of selection is necessary. For instance, all Nova Scotia coals with the exception of an Inverness seam are good coking coals. The best coking coals, that is, those producing coke with the best physical structure together with good yields, are those which test high in sulphur. Some of the low sulphur mines produce a poor coke physically. By blending various grades, different cokes may be obtained. Assuming that a certain coal or mixture of coals gives a satisfactory physical coke, the features that are the deciding factors are:—

(1) Percentage of ash in coal.
(2) Percentage of sulphur both in the coal and in the surplus gas.
(3) Yields obtainable.

The percentage of ash in coke for metallurgical purposes should be as low as possible. The ash percentage in the coke used at the Sydney blast furnaces averages around 7 per cent. The standard for comparison in the United States is Connellsville Beehive coke, which contains 11.5 per cent ash. The percentage of ash in domestic coke is not so important, provided the coke will burn well and the consumer pays on a proportionate B.t.u. basis. A high ash content will present many cleavage lines in the coke, producing too much fines, so that a higher ash content than 13 per cent should be avoided.

Sulphur is a very undesirable element in all metallurgical operations, especially in steel products. Injection of this element into the product by way of fuel must, therefore, be avoided. Metallurgical coke used at Sydney contains 1.8 per cent sulphur. A higher sulphur content than this in domestic coke is not at all objectionable in itself, but when it comes to the utilization of the surplus gas, the sulphur question comes up. If this gas is used purely for industrial purposes, such as firing boilers, etc., there is no practical limit to the sulphur contained in the gas. It is very objectionable in gas used for domestic purposes on account of the fumes that arise from its combustion. They are very obnoxious and smelly, and silverware tarnishes very readily if subjected to these fumes.

The volatile sulphur is driven off with the gas. The amount is variable, but is generally around 40 per cent of

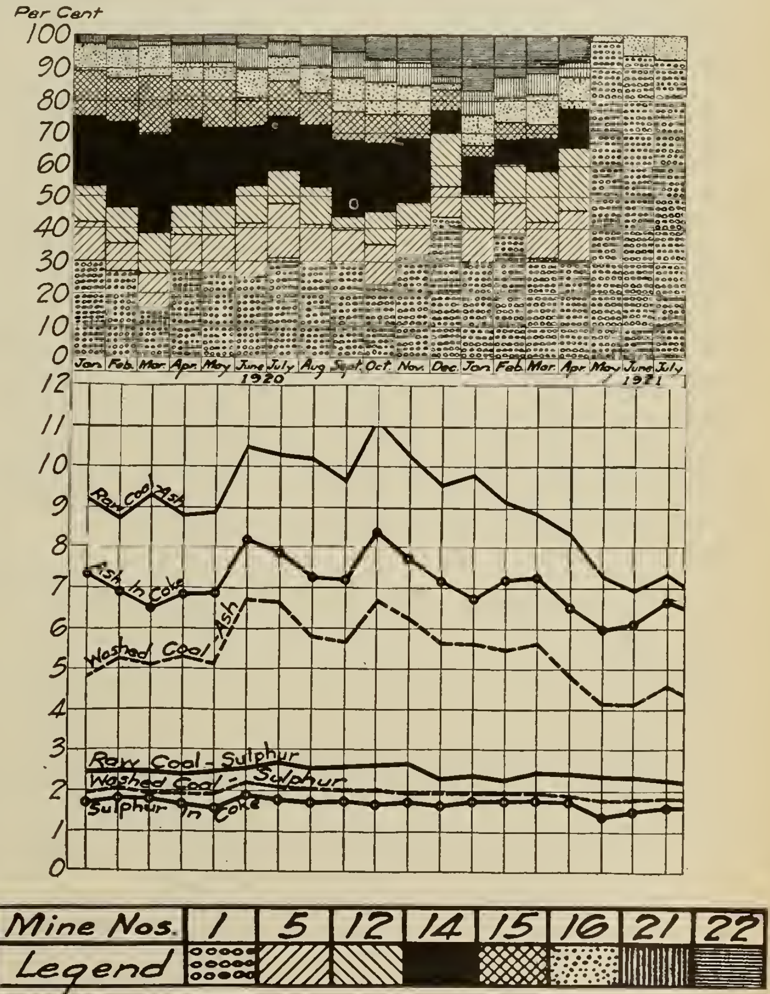

Figure No. 7.—Proportion of Coal by Collieries with Ash and Sulphur Contents of same, used monthly at Dominion Iron and Steel Company's Coke Ovens.

(From January, 1920, to August, 1921.)

Table No. 2:—Laboratory Washing Tests on Slack Coal

Mine	Raw Coal			Total Lighter than 1.30 Sp. Gr.			Total Lighter than 1.35 Sp. Gr.			Total Lighter than 1.40 Sp. Gr.		
	%	Analysis		%	Analysis		%	Analysis		%	Analysis	
		Sul.	Ash		Sul.	Ash		Sul.	Ash		Sul.	Ash
No. 1	100.0	2.07	7.08	87.3	1.33	2.82	91.3	1.40	3.05	93.0	1.52	3.46
No. 2	100.0	2.72	7.80	75.3	1.65	3.12	86.0	1.97	3.61	89.4	2.09	3.91
No. 11	100.0	2.69	10.18	65.9	1.57	3.26	75.8	1.83	3.97	81.7	2.03	4.46
No. 12	100.0	1.87	6.44	81.4	1.15	2.20	89.0	1.37	2.64	90.9	1.52	3.20
No. 16	100.0	3.00	8.95	61.4	1.73	3.42	80.4	2.11	4.08	88.1	2.36	4.65
No. 22	100.0	1.88	9.85	65.3	1.13	3.52	79.1	1.39	4.43	84.7	1.48	5.00

Note:—From above table, and taking mine No. 1 for example, rejection of 7% of total coal in washer removes 31.7% of total sulphur and 54.5% of total ash in coal.

the total amount of sulphur in the coal. This sulphur is contained in the gas in two forms, namely, sulphuretted hydrogen, (H_2S), and organic sulphur. For domestic uses the former must be eliminated and the latter kept down within 35 grains per 100 cubic feet of gas. H_2S is taken out in two ways. One is absorption by means of oxide of iron in the form of bog-ore. When the ore becomes " spent " or inactive, it is removed from the purifier and exposed to the air, when the sulphides are oxidized and the material is " revivified " for further use. The purifiers are simply cast iron boxes with trays or grids upon which the oxide is laid in layers eight inches or more deep.

Another process which is used is known as the liquefaction process. The gas is " washed " in towers by a solution of soda ash, later subjecting this to a process of revivification.

It is not known how to remove organic sulphur from the gases at the present time on a commercial basis, but it is found that when benzol towers were employed, i.e., towers in which the benzols are absorbed from the gas through the medium of absorbing oils, the organic sulphur is reduced by approximately 25 per cent. From tests made with Nova Scotia coals, it has been found that if the organic sulphur in the gas has to be kept within 35 gr. per 100 cubic feet, then the total sulphur in the coal as charged should not exceed 2.0 per cent, or if the benzol absorption towers are used, and they undoubtedly would be in a large plant, the total sulphur in the coal should not exceed 2.5 per cent. This refers strictly to production of domestic gas.

In order to meet these conditions, it is evident that selection of coals is necessary, depending upon the utilization of both the coke and the gas. If sulphur is the main consideration, then the coal must either be,—

(1) Selected from low sulphur mines, or
(2) Washed to remove excess sulphur, or
(3) Mixed with low sulphur coals.

Nova Scotia coals, owing to their variety, can meet condition (1), only being limited by the outputs from the low sulphur mines. However, taking the general run or mixture of different mines, as shipped from the Cape Breton fields, washing is necessary in order to meet the more rigid conditions. There are three coal-washing plants in the Sydney district. Washed coal for blast furnace coke-making has amply proven its desirability, and the economic advantages thus derived far outreach the cost of washing.

Washing processes are all based upon the fact that impurities such as stone, pyrites, etc., are heavier than the pure coal and the gravitation principle is employed. Washing is very effective in removing impurities foreign to the coal, as they are usually heavier. That part of the ash and sulphur which is integral with the coal may be removed, the percentage depending upon the rejects allowable. Table No. 2 gives examples of rejections necessary from different coals to give a product with the required sulphur content. In some European plants the washer rejects are used in gas producers for making the fuel gas for the ovens, also for low grade boiler fuel. Figure No. 7 is a record of the ash and sulphur analyses of the coals and coke as taken from

Table No. 3:—Coking Tests Showing Sulphur Content of Gas

Test No.	Coal			Coke		Gas	
						Organic Sul. Grains Per 100 Cu. Ft.	
	Mine	% Ash	% Sul.	% Ash	% Sul.	Raw	After leaving Benzol Towers
1	Washed slack to ovens general run............	5.0	1.8	7.0	1.5	22	16
2	100% Mine "2" unwashed slack...............	8.5	3.6	11.9	3.0	67.1	50 Est'd.
3	Mix from mines 12, 14 and 16 run mine, unwashed	6.55	2.07	10.2	2.07	25.42	19 "
4	Run-mine mixed unwashed from Mines Princess and Florence..............................	6.55	2.07	9.2	1.9	28.3	21 "
5	Washed slack Mines 2 and 4..................	5.76	3.47	8.2	2.61	50	37.5"
6	85% Ditto—15% American..................	6.05	2.45	8.40	1.77	40	30 "

Remarks:—Test No. 6 shows relative small proportion of American coal required to be mixed with high sulphur coals in order to produce gas containing less than 35 grains organic sulphur per 100 cu. ft.

the operating files of the Sydney coke plant. The uniform quality of blast furnace coke produced from mixed coals may be noted.

As regards mixing the high and low sulphur coals, this may be accomplished either by mixing with our low sulphur coals or else by addition of low sulphur American coals. It has been found by actual test that even our higher sulphur coals in an unwashed state can be successfully employed in this manner with a relatively small proportion of American coal. This is illustrated in table No. 3.

The yields that are realized at the Sydney coke plant from one net ton of coal are exceptionally high, and are as follows:—

Coke	1,360	lbs., of which approx. 7.5% is coke breeze.
Gas	11,250	cu. ft., of which 6,920 is surplus gas, 585 B.t.u. per cu. ft.
Tar	10.5	Imp. gallons.
Sulphate of Ammonia.	28	lbs.
*Motor Fuel	2	Imp. gallons (equiv. to total homologue yield of 3.0 Imp. gallons).

Typical Analyses
(By-product coke plant, Dominion Iron and Steel Co., Sydney, N.S.)

	Volatile	Fixed Carbon	Ash	Sulphur	Moisture
Raw coal.....	33.00	58.00	9.00	2.60	2.00
Washed coal..	34.50	60.50	5.00	2.00	12.00
Coke.........	0.75	92.25	7.00	1.70	2.50

Calorific value of coke=13,000 B.t.u. per lb. (average).

	C_nH_m	CH_4	H_2	CO.	CO_2	O_2	N_2	B.t.u. per cu. ft.
Gas (dry).	4.00	30.5	48.5	5.5	3.5	0.5	7.6	615 (585 Debenzolized)

The works of the Dominion Iron and Steel Company, Ltd., furnish an excellent example of various methods of utilization of Nova Scotia coals. The coals used in this plant are all taken at the present time from the southern Sydney fields, and are utilized in the following manner:—

(1) Slack coal after washing and crushing is coked, producing the following fuels:—
- *(*a*) Coke ....Blast furnace, foundry and domestic.
- (*b*) Coke breeze...Boiler fuel and recarburizing purposes.
- (*c*) Gas (585 B.t.u. per cu. ft.)....Heating ovens, steel-melting and reheating furnaces, ladle drying, steam raising.
- (*d*) Tar ....For further distillation, also used for boiler fuel and steel furnaces.
- (*e*) Benzols ....Motor fuel, etc.

(2) Screened coal is used in "Duff" gas producers giving gas 150 to 180 B.t.u. per cu. ft.; 75 per cent of heat value of coal is obtained in this process. This gas is used for steel-melting and reheating furnaces.

(3) Slack coal is used for steam raising in hand-fired boilers with undergrate blowers, also chain grate stokers with natural draft.

Use of Nova Scotia Coal for Steam-Raising on Mechanical Stokers

According to statistics given elsewhere in this paper, there are about a million tons of coal burnt annually among the larger industrial power plants throughout eastern Canada every year, at least 75 per cent of this being burnt mechanically. Of this amount, 20 per cent is or will be shortly burned in powdered fuel furnaces, the balance on mechanical stokers of the underfeed, overfeed or chain grate types, (see table No. 4).

By far the larger number of these plants have been installed within the last fifteen years, indicating a vast change in the complexion of the market that has now to be catered to by the coal emanating from Nova Scotia.

It is a significant fact also that about 40 per cent of the plants included in the list given are at the present moment using imported American coal.

The present condition, however, is that while eastern Canada is potentially a market for Nova Scotia coals, there is a disposition with American equipment through custom, habit or inclination, to burn American coal.

At one time, of course, before the War, the proportion of Nova Scotia coal used was much greater as regards the sum total used, but at the time when the incursion of the mechanically-equipped plant began to make itself felt, the troubles in burning coal from Nova Scotia on this new equipment were such as to have created a prejudice against the coal that persists to the present time.

The popular demand, however, from a national and economic standpoint for Canadian coal for Canadian industries, and the increased dependence of the producing companies upon the home market has led to a good deal of attention being focussed upon this question from both directions.

Table No. 4:—Summarized List of Principal Stokers and Pulverized Fuel Operated Boiler Plants in Eastern Canada, Including Newfoundland, Classified as to Type of Stoker and Boiler (Plants of Coal Producing Companies Not Included) as at June, 1926.

Approx. total amount of coal used per year...............	805,000
Total supplied by Nova Scotia....................	480,000
Total imported	325,000
Total listed boiler horse power (not including electric boilers hand-fired, oil-fired, etc.).........................	94,924

Stoker Types		B.H.P. Totals	No. of Furnaces	Av. Rating B.H.P.	Total B.H.P.
Pulverized Fuel—	Direct fired...	3,538	4	887	
	Storage system	11,050	10	1105	14,588
Overfeed—	Murphy type..	16,276	58	281	
	Sprinkler......	4,800	20	240	
	National......	450	3	150	
	Roney.........	250	1	250	21,776
Underfeed—	Taylor........	29,748	59	504	
	Jones..........	5,196	14	371	
	Type E........	3,712	8	464	
	Riley..........	860	2	430	
	Frederick......	3,101	5	620	42,617
Chain Grate—	B. & W........	10,469	28	374	
	Coxe...........	3,904	8	488	
	Laclede-Christy	1,000	2	500	
	Green..........	570	2	285	15,943
			Total - - -		94,924

Boiler Types		B.H.P. Totals	No. of Furnaces	Av. Rating B.H.P.	Total B.H.P.
Water Tube—	B. & W........	68,967	138	499	
	Cahall..........	2,250	9	250	
	Kidwell........	1,668	3	556	
	Badenhausen...	1,655	2	828	
	Stirling.........	1,650	4	412	
	Heine..........	1,000	2	500	
	Burroughs......	1,000	1	1000	
	Morien.........	500	2	250	
	Edgemoor......	400	1	400	79,090
Shell—	H.R.T..........	9,584	37	259	
	Lancashire.....	6,250	25	250	15,834
			Total - - -		94,924

*Note:—This is a water-white liquid consisting of 80% benzol, 12% toluol and 8% naphtha, having specific gravity of 0.873 and entirely distilling between 80° and 145°C.

*Of the coke used in the blast furnaces, which amounts to 2,200 lbs. per net ton of pig iron, 60 per cent of this is recovered in the form of gas having a calorific value of 110 B.t.u. per cu. ft. This gas is used for preheating the air blast and raising steam for power and blowing apparatus.

Investigation by operating companies revealed:—

(1) Prevalence of equipment designed in the United States to burn United States coal.

(2) A feeling that Nova Scotia coal could not give the same general all around satisfaction in operation on this particular equipment as the United States coal.

(3) Presence of a ready supply of United States coal at highly competitive prices.

(4) General lack of any authoritative information, both technical and practical, in regard to Nova Scotia coal.

(5) Lack of consideration of the nature of Nova Scotia coal, both on the part of the producer and the consumer, and also the manufacturers of stoker equipment in meeting the new conditions.

A good deal has already been done towards overcoming many of the above points, but considering the rapidity with which the art of steam generation is advancing at the present time, a good deal more yet remains to be done.

While United States designed equipment is still much to the front in this market, the tendency of design in this equipment is for it to become better adapted towards burning Nova Scotia coals. The Canadian manufacturers are making special studies of this subject and interesting developments are expected.

The problem of boiler plant design and operation resolves itself into possibly four factors:—(1) the coal; (2) the boiler; (3) the stoker; and (4) the furnace.

Each of these items will be briefly discussed upon the experience that has been gained this last two or three years in extensive visits to plants in the district reached by Nova Scotia coal.

The Coal

The characteristics of the coal available for the present purpose has been described elsewhere in this paper.

The coal as a whole, as distributed throughout Nova Scotia, varies widely in its characteristics, but it is the coal from Cape Breton that enters mostly into the consideration of this subject, being for the most part the coal that is shipped to the St. Lawrence district. This coal also, generally speaking, contains the highest heat content of all coals in Nova Scotia, but at the same time offers most difficulty in operating successfully on mechanical stokers.

However, the characteristics of this coal in itself vary widely, and by a policy of elimination and selection a coal is now offered of a high grade that is eminently suitable for mechanical stoker or general steam-raising purposes. This coal may be described, generally, as " a full bituminous coal of 34 per cent volatile matter, with low ash and low moisture characteristics, with a heat value of an average of 13,500 B.t.u. as mined." A general analysis would approximate as follows " as mined ":—

Moisture	2.0	per cent
Volatile matter	34.0	" "
Fixed carbon	58.0	" "
Ash	8.0	" "
Sulphur	3.0	" "
Calorific value	13,500	B.t.u.
Fusion point of ash	2100°F.	

The coal is a coking coal, non-caking, and shrinks in process of burning. (See coals in Table No. 1.)

The question of the influence of banked coal on the operation of mechanical stokers is one that can very well be discussed in this section.

Discussion with engineers at various plants shows the general experience to be that Nova Scotia coal that has been banked for any considerable period operates to much better advantage than freshly-mined coal. The coal is used in the slack form in any case, so that the question of size does not enter into the question.

Figure No. 8.—Coal Pile (250,000 tons) at No. 2 Colliery,

In storage the coal seems to lose some of the most highly volatile of its constituents, or they are in some way merged into the less volatile constituents by the action of the atmosphere and moisture, which apparently makes a hardly detectable difference in the calorific value of the coal, but in operation the flame in the fire is less intense, a better fuel bed is formed, less fuel is lost in the form of dust blown by forced draft into the rear passes of the boiler, there is less slagging of the tubes and in general consequence the heat efficiency of the coal is thereby raised.

The question of spontaneous combustion in the coal pile also enters largely into this question. It is a fact that banked coal in second storage seldom heats in the pile. This in itself is an important factor when considering Nova Scotia coal in general.

The Boiler

Turning to the second of the items entering into boiler plant operation and design, the boiler itself at the present time offers the least number of problems in obtaining the desired results. Gradually increasing pressures and size are the two main features that are to be taken care of in the design for new plants.

As regards size, the question of allowable ratings in boilers should be briefly discussed. When boiler rating is mentioned the term usually refers to the rating obtained by the complete unit, nevertheless the point should not be overlooked that the basis of these ratings is the number of square feet of heating surface in the boiler. This is usually taken as 10 square feet of heating surface per boiler horse power, which may be an arbitrary figure, but a convenient one.

The boiler itself is rarely the limiting feature in attaining high ratings, and it is not here that the difficulty lies. The boiler is the driven and the coal, the stoker and the furnace, the driver. In discussion of boiler ratings, it is very important to bear this in mind, because an understokered boiler should not be expected to give high ratings or an over-worked stoker and furnace to obtain good results with the coal.

It is noteworthy that the average boiler ratings carried on the boiler plants in the district under consideration seldom run more than 150 per cent of normal, in spite of the fact that many were originally designed to give higher ratings. Where this has been exceeded, no trouble appears to have been met with as regards the boiler. It is evident then that the fuel burning equipment of a boiler should in mum consumption of coal per square foot of grate per hour for any type should not exceed 35 pounds. This will decide the rating obtained from the boiler unit as a whole, and will indicate the point to which the stoker may be operated to give least trouble in operation and maintenance.

It is recommended that the following details in design should be followed where Nova Scotia coal is to be used:—

Underfeed:—Provision of *side wall air backs* to prevent adhesion of clinker and erosion on side walls.

Front wall cooling by Bernitz blocks or other devices.

Design of air tuyere that will leave no projection on which clinkers may lodge or adhere, the air space being large and so designed as to sweep the entire surface of the tuyere and yet avoid any blow torch action.

Design of ram extensions in same way to avoid adhesion of clinker and blow torch action where air-cooled.

Steam dumps and deep ash pits have proven a great help in the burning of this class of coal.

Overfeed:—Low bridge wall and large combustion chamber beyond with flat arch design over grate in some cases have overcome the chief objection to the operation of this class of coal on this type of stoker.

Dominion Coal Company, Limited, Glace Bay, N.S.

the first place be liberally designed to meet expected ratings, as the combustion rate of coal is not so flexible as the steam generating properties of a boiler. For example, there is a plant in New Brunswick which was re-designed to take care of increased plant operations, in which the stoker part only was increased in size. A continuous average rating of 200 per cent for the full boiler house is maintained, with peaks exceeding 275 per cent, and yet the boiler is the last thing to be heard of when considering repairs and maintenance.

The Stoker

As has been pointed out above, the question of boiler operation at the present time revolves generally around the stoker.

The question is often asked, in reference to Nova Scotia coals, as to the correct type of stoker to be recommended for burning these coals. The answer is that all types of stokers, including underfeed, overfeed and chain grate, are successfully burning Dominion coal.

The question is a matter of design of details in almost every case, coupled with the limits as imposed by size or grate area. The correct size of grate to specify for this coal is generally difficult to give, but as a general rule the maxi-

Steam jets under clinker grinders and lower end of grates prevent clinker trouble.

Ash pit doors open continuously where natural draft is used.

Chain Grate:—Natural draft chain grates generally operate without difficulty. Provision has been required in cases in side walls above grate to prevent clinker adhesion by provision of air or water cooling, or by special brick.

Provision is required for rear dump plates or waterback to prevent large proportion of combustible in the ash.

An instance is given of a change in a make of stoker where the addition of a waterback helped considerably in this respect. Figures Nos. 3 and 4 show this stoker installation at the Waterford Lake power plant of the Dominion Coal Company. The benefits obtained by the change were:—

(1) Longer life of arch.
(2) Less combustible in ash pit.
(3) Distribution of fire over entire grate surface.
(4) Inrush of cold air prevented at ash pit cleaning times.

Furnace and Setting Design

It is upon correct furnace design that most attention is being focussed at the present time. The problem of high rating at high efficiencies, with consequent higher furnace temperatures, has gradually forced the conclusion that the refractory materials used in furnace construction up to the present are not equal to the task unaided.

Increasing the size of combustion chamber to correct proportions for obtaining complete combustion of the furnace gases, has to a certain extent helped the brickwork situation, but has not solved it. Water-cooling, either by an independent water supply or by making the furnace walls part of the circulating system of the boiler, either water or steam, is the solution offered at the present time.

Undoubtedly the trend in this direction will be the gradual enveloping of the furnace entirely in the boiler construction. But for the present, considering existing plants and present plant design, the brick furnace offers the cheapest and simplest construction at the present time.

Correct volume for the combustion of the gases before reaching the cooling surface of the boiler, and proper provision for mixing of the gases to ensure this complete combustion are the two vital features. Considering the nature of the coal in question, large furnace volumes are essential, not less than one cubic foot for every 3 pounds of coal burned on the grate per hour for maximum rating.

Correct mixing of the gases is something not yet attained in the majority of plants. For underfeed stokers, with no provision for an arch, this is particularly difficult, especially in the larger sizes. For chain grate stokers, the arch should be expressly designed with the mixing of gases in view, as an arch as a means of ignition for Nova Scotia coal is not necessary except in a very small degree. For overfeed stokers the design of arch is very much a question

Table No. 5.—Miscellaneous Boiler Tests on Nova Scotia Coal.

Mark	Number	Boiler Data: Sq. Ft. H.S. and Type	Boiler Data: Stoke	Test: Date	Test: Duration Hours	Fuel: Kind	Fuel Analysis: Moisture	Fuel Analysis: B.T.U. As Recd.	Fuel Analysis: B.T.U. Dry	Evaporation: F or E	Evaporation: Lbs of Water per Lb. of Coal F&A 212°F As Recd.	Evaporation: Lbs of Water per Lb. of Coal F&A 212°F Dry	Boiler Rating Developed % Normal	Heat Balance: Heat Absorbed by Boiler	Heat Balance: Loss Moisture in Coal	Heat Balance: Loss due to Hydrogen	Heat Balance: Loss in Flue Gas By CO2	Heat Balance: Loss in Flue Gas By CO	Heat Balance: Combustible in Ash	Heat Balance: Unaccounted For
A	1	4904 B&W	Frederick	Dec. 1925	29	Dominion	3.01	13600	14023	1.23	8.913	9.188	132.0	64.16	.27	4.06	20.72		7.37	3.20
	2			Dec. 1925	50	Pocohontas	1.182	14638	14813	1.23	10.086	10.209	164.5	66.86	.10	3.37	16.86		5.71	6.93
B	1	1500 H.R.T.	Hand Fired	May, 1926	8	1-B. Dom.	1.00	13360	13490	1.22	9.642	9.739	181.6	70.03	.10	4.39	17.46		3.10	4.92
	2	" "	" "	" "	8	2 "	2.50	13470	13815	1.22	8.844	9.071	148.4	63.71	.23	4.22	17.93		3.82	10.09
	3	" "	" "	" "	8	4 "	1.60	13085	13295	1.22	9.163	9.312	147.2	67.95	.16	4.39	16.23		8.25	3.02
	4	" "	" "	" "	8	5 "	3.75	13109	13620	1.22	9.394	9.760	188.3	69.54	.37	4.36	16.98		3.23	5.52
	5	" "	" "	" "	8	12 "	2.00	13750	14030	1.22	9.864	10.065	158.8	69.62	.20	4.48	19.47		4.32	6.01
	6	" "	" "	" "	8	14 "	2.60	13850	14223	1.22	9.446	9.698	167.1	66.18	.24	4.19	17.06		4.47	7.86
	7	" "	" "	" "	8	16 "	3.45	12985	13450	1.22	8.585	8.892	163.7	64.16	.33	4.40	17.45		3.53	10.13
	8	" "	" "	" "	8	22 "	4.85	12598	13235	1.22	8.041	8.451	192.3	61.93	.44	4.58	16.15		4.18	12.72
	9	" "	" "	" "	8	24 "	2.60	12815	13157	1.22	8.657	8.888	163.2	65.56	.26	4.54	19.73		4.03	5.88
C	1	2823 B&W	" "	Sept. 1925	8	1-B Slack	1.70	14288	14535	1.29	9.10	9.25	150.0	61.80						
D	1	4780 B&W	Taylor	Sept. 1921	5½	22 "	1.94	13625	13894	1.124	9.47	9.657	104.5	67.45	.35	4.0 ±	13.79		5.62	8.79
	2				7¼	22 "	2.16	13630	13932	1.109	9.35	9.556	115.0	66.59	.36	4.0 ±	14.20		7.36	7.49
	3	1966 Bettington	Powdered Fuel	Sept. 1921	6¾	12 & 14 "	1.42	13733	13930	1.141	9.92	10 063	195.3	70.10	31	4.0 ±	16.08		Nil	9.51
	4		Powdered Fuel	Sept 1921	6¾	12 & 14 "	1.28	13420	13594	1.147	10.15	10.282	287.6	73.39	.30	4 0 ±	16.24		Nil	5.07
	5	4780 B&W	Taylor	Dec. 1921	5½	12 & 22 "	2.00	14053	14340	1.213	9.386	9.577	126.3	64.8	.34	4.0 ±	16.00		.08	14.78
	6				6¾	12 & 14 "	2.00	13462	13737	1.1925	9.47	9.663	149.6	68.26	.35	4.0 ±	13.57	2.0	Nil	11.82
E	1	200HP R.M.	Hand Fired	Nov 1920	7	Springhill Culm		12750	13400	1 0816	8.783	9226	99.0	66.92						
	2	125HP H F	" "	Dec 1920	7	Springhill Culm		12750	13400	1 0802	6 05	6.357	102.0	46 05						
	3	2250 B&W	" "	Dec 1920	7	Springhill Culm		12750	13400	1 1738	6.25	6.565	100 0	47.57						
F	1	2850 B&W	Chain Grate	May. 1924	192	Dom Slack				1 0761			214.0	82.0 with economizer						
G	1	2823 B&W	Hand Fired	June 1925	8	" "		13878	14161	1 14	8.53	8.704	151.3	59.6		4 1	22.9	3.09	.7	9.61
	2	" "	" "	" "	7½	" "		13253	13531	1 164	8 09	8.259	177.3	59.2		4.3	24.1	3.44	1.6	7.16
H	1	3654 B&W	Jones Stoker	Apr 1922	6	2 & 6 Dom	2.5 ±	12796	13093	1 222	9.482		113.12	71.88		4.2	14.5	1.4	1 5	6.52
	2		" "	" "	6	" " "	2 5 ±	13077	13412	1 222	9.84		133.7	73.00		4.2	17.4		1.25	4.15
	3		" "	" "	6	2 "	2 5 ±	13421	13765	1 2191	8 262		99.2	59.74		3 9	13.5	1.4	.78	20 68
	4		" "	" "	6	2 "	2 5 ±	13572	13920	1 2192	8.255		103 5	59.03		4.2	10.6	3.5	1.75	20.92
	5		" "	" "	6	2 & 4 "	2 5 ±	13583	13946	1 2189	8.12		116.5	58.02		4.3	11.2	2.4	1.25	22 83
	6		Hand Fired	" "	5¾	2 "	2 5 ±	13455	13799	1 2206	8.53		142.97	61 52		3.5	12.9	2.2	1.47	18.41
	7		" "	" "	6½	2 & 6 "	2 5 ±	12945	13277	1 2207	9 415		184.9	70.55		3.8	11.5	1 00	.56	12.59
J	1	2500 B&W	Chain Grate	Oct 1925	7	Dom Slack				1 08	9.095		162 8							
K	1	6180 B&W	" "	May. 1924	9 days	Dom Slack	8.15	12187	13274	1 10	8 041		144.0	64 03						
L	1	3100 Stirling	" "	June 1914	6 days	Albion R O M.	8.82						115.3							

of maintenance, the question of mixing of gases being taken care of in the combustion chamber, which, as stated above, should be of large proportions.

With regard to furnace settings, one point only needs to be emphasized, and that is the question of baffling as affecting draft. Instances have occurred where there has been a draft loss through the boiler of as much as 1½ inch W.G. High ratings are impossible in this plant if pressures in the furnace are to be avoided.

Instruments

In the operation of a boiler plant, nothing tends to better efficiency and general satisfactory operation so much as the provision of gauges and instruments for the guidance of the operators.

Draft gauges, CO_2 recorders and flow meters are indispensable adjuncts to the operation of a plant under modern conditions. These instruments now are fairly well standardized, and no difficulty should be experienced in selecting equipment that will give the necessary information and at the same time require little attention to keep them in proper working order.

One point only requires to be mentioned in this respect, having regard to CO_2 recorders with this particular coal, and that is the provision of a substantial filter for purifying the gas before it enters the registering apparatus.

A 6-inch pipe about 15 inches long partly filled with water, through which the gas bubbles, has been found very satisfactory in this respect. The gases from this coal are apt to contain excessive quantities of sulphur which readily attacks parts of any instrument with which it may come into contact. The water filter will remove most of this.

Pulverized Fuel

This is becoming a very popular method of firing boilers in the larger sizes, and the number of new installations has doubled itself each year for the past five years in the United States and Canada. Its novelty, coupled with its adoption in a number of the large super-power plants has given it a somewhat disproportionate place in the public eye, but there is no doubt it is here to stay.

It is by no means a new system. As a matter of fact, the first patent recorded was granted to one John Dawes, an ironmaster of the Black country, England, as early as 1831. This was contemplated for smelting iron. Pulverized coal was used successfully in the rotary kilns of the cement industry for ten years before the first really successful pulverized coal fired boiler was brought out. This particular boiler was designed by Mr. J. H. Bettington about 1907, and was successful in burning a variety of fuels with a degree of efficiency then unknown. Thermal efficiencies as high as 80 per cent with 20 per cent ash coal were recorded.

In 1912, an installation of these boilers, (four in number), was made at the Waterford Lake power station of the Dominion Coal Company, Ltd. This is now the principal generating station of this company. (For sectional view of one of these boilers, see figure No. 3.)

Compared with modern installations and practice in powdered fuel systems, it is interesting to note that:—

(1) The boilers are very small, 200 b.h.p. each, (1,966 square feet heating surface).

*(2) The combustion space or furnace volume is 424 cubic feet, or 2.12 cubic feet per rated boiler horse power. This is in contrast to other furnaces in use at the present time, which are mostly of large volume, the range being from 4 to 10 cubic feet per rated boiler horse power, with the majority between the limits of 6.5 and 8.5 cubic feet.

(3) There is no drying equipment. The coal is disintegrated in a pulverizer which is both crusher and blower combined. The pulverizer is driven by a 30 h.p. steam turbine, the exhaust from which is utilized in the feed water heater. There is a spare pulverizer for each two boilers driven by a 35 h.p. direct-connected motor.

(4) The flame is blown, not "fogged," directly upwards and thence it falls down and around the bottom of the brick baffle, having a "mushroom" effect. The flame travel is 35 feet.

These conditions are in general contradiction to the tendency of modern design, yet in one point Bettington was ahead of his time in that he built the boiler around the furnace, which is now the fundamental principle of the latest powdered fuel boiler installations.

In spite of deficiencies in the design of the boiler itself, which after all could only be expected in such a radical departure as this was, and after overcoming usual infantile troubles and others which were extraneous to the method of firing, these boilers have been in operation since 1912, and at the present are on the line giving excellent satisfaction. Ratings up to 300 per cent with corresponding thermal efficiency of 73.4 per cent have been obtained, and this without the aid of air preheaters or economizers. Lack of stack draft prevented even higher ratings being attained.

Slack from the adjacent collieries of the Dominion Coal Company is used. The characteristics of this coal, and they are in keeping generally with others in the Sydney coal field, make it admirably suited for powdered fuel firing. It possesses 14,000 B.t.u. per pound on the dry basis, it is readily pulverized and the action of the fused ash upon the brickwork of the combustion chamber is beneficial. This ash has a much lower fusion point than the brick, 2000°F. against 2900°F., and it forms a thin slag which first closes the interstices in the brickwork, and then, after giving the brickwork a protective coating of slag, it trickles down, and, cooling, falls into the ash pit below in small pieces from which it is easily removed.

Besides this installation of Bettington boilers at the Waterford Lake plant, there are—

Two Babcock & Wilcox boilers, 4,780 square feet heating surface each, fitted with Coxe chain grate stokers, (see figures Nos. 5 and 6), 126 square feet grate surface each. In operation since 1924.

Four Babcock & Wilcox boilers, 4,780 square feet heating surface each, fitted with "Taylor" type A.A.-4 stokers having active grate surface of 67.5 square feet each. In operation since 1912. (See figure No. 4.)

This plant provides an excellent demonstration of the adaptability of Nova Scotia coals to different systems of fuel-burning equipment.

The reasons why the coals of Nova Scotia are superior for pulverized fuel are:—

(1) High B.t.u. content,—less coal to pulverize.
(2) Low ash content.
(3) They are easily pulverized.
(4) The ash characteristics are suitable for this system of firing.

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*Note that at maximum ratings, (300 per cent), for these boilers there are 5 pounds of coal burned per hour per cubic foot of combustion space, whereas in the ultra-modern underfeed stoker plant at Hell Gate 3 pounds of coal is burnt on the grates per cubic foot combustion space per hour to give a boiler rating of 450 per cent. The average rating carried is high, (250 per cent), corresponding to 500 b.h.p. output.

THE

ENGINEERING JOURNAL

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Maritime General Professional Meeting

Sydney, N.S., August 17th, 18th and 19th, 1926

A general outline of the arrangements for the Maritime General Professional Meeting, which is scheduled to be held in Sydney, N.S., on Tuesday, Wednesday and Thursday, August 17th, 18th and 19th, 1926, appears on the editorial page of the July issue of the Journal.

The details for the meeting are now practically complete, and the programme as it now stands does not contain any material change from the tentative programme published in the last issue.

The technical sessions provide for the presentation of two papers: "The Humber Development of the Newfoundland Power and Paper Company, Ltd.," by H. C. Brown, A.M.E.I.C., manager of power development for the company, and "Characteristics and Utilization of Nova Scotia Coals," by W. S. Wilson, A.M.E.I.C., assistant chief engineer, and M. W. Booth, A.M.E.I.C., steam engineer of the Dominion Iron and Steel Company, Limited. Both of these papers appear in full in this issue of the Journal, and arrangements have been made for a thorough discussion of each.

The committee of the branch which is in charge of the arrangements for this meeting have spared nothing in their efforts to prepare a programme combining the various features which are so essential to the success of such a meeting, and all members who can possibly be in Sydney at the time of the meeting will find not only interesting and instructive technical discussions, but also arrangements for visiting the main points of interest in the Cape Breton district and ample provision for their entertainment.

Institute By-laws

There has recently been mailed to all members of The Institute, a copy of the revised By-laws of The Institute incorporating the amendments adopted by letter ballot on April 30th, 1926.

The booklet contains, in addition to the By-laws, a copy of the Charter and Code of Ethics of The Institute.

In past years, this information has formed part of the Year Book, containing, in addition, an alphabetically and geographically arranged list of members. This year it was decided to publish the By-laws separately from the list of members in order that the former might be available at an earlier date. The list of members is at present in the course of preparation, and will be ready for distribution early in the Fall.

Annual General and General Professional Meeting

Quebec City, February 15th, 16th and 17th, 1927

The Annual General and General Professional Meeting of The Institute will be held under the auspices of the Quebec Branch at Quebec city on Tuesday, Wednesday and Thursday, February 15th, 16th and 17th, 1927.

In accordance with the By-laws, the Annual Meeting will be convened at Headquarters in Montreal, and will be adjourned and re-convened at Quebec on the date mentioned above.

An active committee of the Quebec Branch has been at work for the past two months on the details of the programme, and it is expected that these arrangements will be available for publication in the September issue of the Journal.

The technical sessions and discussions will centre around the recent large hydro-electric power developments of Canada and the problem of the conservation and utilization of Canada's forest resources. A series of papers on both these subjects have been arranged, and will be available in advance proof form in order that thorough discussions may be prepared.

The city of Quebec offers exceptional facilities for the holding of such a meeting, and it is anticipated that there will be a very large attendance. All members are urged to make a special note of the date of this meeting, and plan well in advance to be present.

List of Members

The work of compiling the revised list of members of The Institute has been commenced, and as it requires a matter of about eight weeks before the list is ready for the printers, members still have opportunity to see that their names and addresses and official positions are properly recorded at The Institute Headquarters, so that they may appear in the Year Book as desired.

Members are therefore requested to forward to the secretary, as soon as possible, any changes they may wish made in this connection.

OBITUARIES

Henri Paul Lefebvre, M.E.I.C.

News of the death of Henri Paul Lefebvre, M.E.I.C., which occurred in Montreal, Que., after a long illness, on June 23rd, 1926, has been received with sincere regret.

The late Mr. Lefebvre, who received his education and diploma of "Ingenieur des Arts et Manufactures," Ecole Centrale de Paris, France, joined The Institute in the days of the Canadian Society of Civil Engineers, when he was elected Member on April 17th, 1909. He was born at Rouen, France, on October 3rd, 1854. After completing his academic studies in August, 1877, he was engaged on various works in France until the early part of 1882. The following year he spent in England studying the English language and railway conditions in that country. Subsequently in 1884 he opened an office at Elbeuf, France, as consulting civil engineer.

In 1885 he visited Canada; the following year he closed his office in France and returned to Canada, where, during the next seventeen years, he was employed in the vicinity of Cheneville and St. Andre-Avellin, principally on water works and telephone and telegraph construction. In 1909 he received his diploma as Quebec Land Surveyor.

For four years following 1906 he was engaged on investigation and study for the proposed lines of the Little Nation River Railway Company. In 1913 he joined the engineering staff of the city of Montreal, and was engaged on sewer work and later on reinforced concrete construction.

In addition to the diploma mentioned above, Mr. Lefebvre was awarded in 1874 the diploma of "Bachelier-es-Science" by the Academy of Caen, France. From 1898-1908 he was mayor of Cheneville, and in 1898 was appointed justice of the peace for the district of Ottawa.

George Walker Winckler, M.E.I.C.

George Walker Winckler, M.E.I.C., died at St. Michael's Hospital, Toronto, on June 30th, 1926.

The late Mr. Winckler was born at Cochin, India, in 1844, and received his degree of C.E. from Calcutta University in 1865. Continuing his studies, he attended the Sanitary Institute of Great Britain in 1870.

Mr. Winckler's early engineering work was as assistant engineer on the Great Indian Peninsula Railway, first on surveys, then on construction. He then served in the Public Works Department of the Indian Civil Service as assistant engineer, for eight years, on state railways, and later as executive engineer in charge of a division of the state railways then under construction. Subsequently he was transferred to the roads and buildings branch of the department in executive charge of the Chittledroog district. During the second Afghan War he was transferred to the Bolan Pass on railway surveys to Quetta. At the conclusion of the war, he was again transferred to Assam in executive charge of roads and buildings. He later returned to state railway surveys, and, following a short leave in Europe, returned to take charge of canal irrigation and conservation in the Mysore Province. His last work in India was in executive charge of roads and railways in the Assam Sylhet district, following which he retired from the service in 1893.

In the same year he came to Canada, taking up his residence in Winnipeg. Eight years later he moved to Collingwood, Ontario, and in 1916 he moved to Toronto, where he continued in his profession as civil engineer.

The late Mr. Winckler was elected Member of The Institute on January 30th, 1919.

Gilbert Tweedie Livingstone, A.M.E.I.C.

Gilbert Tweedie Livingstone, A.M.E.I.C., died at St. Paul's Hospital, Vancouver, B.C., on June 3rd, 1926, following an illness of some months.

The late Mr. Livingstone was born at Dresden, Ontario, on April 28th, 1881. His early education was received at the public school of Seattle, Wash., U.S.A., and at the Seattle High School. In 1906 he graduated from the University of Washington with the degree of B.Sc. in mining engineering.

Prior to graduation he was engaged in railway location and construction, general civil, mining and hydraulic engineering, principally in Alaska, and the following year opened an office as civil, mining and hydraulic engineer at Seattle, Wash. In 1910 he was appointed superintendent and engineer on the irrigation plant for the Columbia River Orchards Company, Wahluke, Wash., in connection with which he was engaged on the construction of one of the company's pumping stations. From 1911 to 1914 he was chief engineer for Uplands, Limited, Victoria, B.C., and in 1914 became interested in the preparation of irrigation and townsite development for the Barriere Land Company, Ltd., Barriere, B.C. Prior to his death he was with the Pacific Great Eastern Railway at Squamish, B.C.

The late Mr. Livingstone joined The Institute as an Associate Member on November 16th, 1915.

Thomas Franklin Bastedo, S.E.I.C.

It is with regret that we record the death of Thomas Franklin Bastedo, S.E.I.C., which occurred on May 30th, 1926.

The late Mr. Bastedo was born at Beachville, Ont., on November 24th, 1901, and joined The Institute as a Student member on February 3rd, 1922, while still attending Queen's University.

Alfred George Guscott, S.E.I.C.

Alfred George Guscott, S.E.I.C., of Toronto, Ont., died on February 18th, 1926, in the Toronto General Hospital, following a short illness.

The late Mr. Guscott was born in Toronto on September 5th, 1897, and graduated from the Faculty of Applied Science of the University of Toronto in 1922, since which date he had had considerable experience, having been engaged on the Queenston-Chippawa power development; on the staff of the location and construction department of the Canadian National Railways; on the valuation of the Toronto Street Railway, and on municipal work for the township of Etobicoke and county of York.

At the time of his death, the late Mr. Guscott was on the staff of the Faculty of Applied Science of the University of Toronto. He was admitted to The Institute as Student on November 23rd, 1921.

PERSONALS

H. V. Ellegett, S.E.I.C., is at present with the Goldie Construction Company, Limited, Toronto, Ont., on the construction of the Danforth Park Sewage Disposal Plant, for the township of East York.

Frank L. Grindley, S.E.I.C., who graduated from the University of Alberta with the degree of B.Sc. in civil engineering this year, is with the Canadian National Railways as transitman on location at St. Paul, Alta.

W. H. Stuart, A.M.E.I.C., formerly resident engineer on hydraulics, Western region, Canadian National Railways, has been appointed by the company supervisor of hotel, grounds and buildings with headquarters at Montreal.

Howard J. Williams, A.M.E.I.C., formerly assistant engineer on the design of the new Scituate reservoir for the water supply for the city of Providence, R.I., has joined the staff of Fay, Spofford and Thorndike, consulting engineers, Boston, Mass.

Edward Peal, S.E.I.C., formerly of the Bailey Meter Company, Limited, Montreal, has been appointed to the engineering staff of the Canada Sugar Refining Company, Limited. Mr. Peal graduated from Queen's University with the degree of B.Sc. in 1924.

M. N. Hay, Jr.E.I.C., who has been on the engineering staff of the Aluminum Company of Canada at Shawinigan Falls, Que., has been transferred to the staff of the United States Aluminum Co., Massena, N.Y. Mr. Hay graduated from Queen's University in 1923.

Charles F. Gray, A.M.E.I.C., who has since 1912 been practising as consulting engineer in Winnipeg, Man., is at present located at Miami, Fla., where he has opened an office, and gives his temporary change of address as 701 Realty Board Building, Miami, Florida.

Professor C. R. Young, M.E.I.C., of the University of Toronto, has been appointed consulting engineer on the design and construction of the bridge over the Don river between Leaside and Todmorden, near Toronto. Frank Barber, M.E.I.C., is the engineer in charge of the project.

Hugh J. Leitch, S.E.I.C., of Westmount, Que., who graduated from McGill University with the degree of B.Sc. in civil engineering this year, has been appointed to the staff of the Steel Gates Company, Limited, at Hamilton, Ont. This company is at present working on a contract for lock gates for the Welland ship canal.

H. H. James, A.M.E.I.C., has accepted a position on the engineering staff of the American Steel and Wire Company at Donora, Pa. Mr. James was for a number of years with the Montreal Locomotive Works as engineering draughtsman in the office of the maintenance engineer, and for the past year has been located at Worcester, Mass.

W. D. Lee, A.M.E.I.C., who was formerly resident engineer on the construction of the transprovincial highway for the Department of Public Works of British Columbia, Spuzzum, B.C., is now located at Squamish as maintenance-of-way engineer with the Pacific Great Eastern Railway. Mr. Lee was for a number of years resident engineer on the staff of the construction department of the Canadian Pacific Railway.

L. R. Brown, A.M.E.I.C., who has been in Sault Ste. Marie, Ontario, for the past ten years, having been associated with the Toronto Chemical Company; the Algoma Steel Corporation; the Dominion Tar and Chemical Company as road engineer; and city engineer since 1921, has resigned as city engineer to accept a position with the Newfoundland Power and Paper Company, at Corner Brook, Newfoundland.

F. E. Winter, S.E.I.C., who graduated with the degree of B.Sc. with honours in electrical engineering from McGill University this year, and who was awarded the British Association Medal and the first prize of the Montreal Light, Heat and Power Consolidated, is now located with the General Electric Company at Schenectady, N.Y., where he is taking the student course in the company's school for graduate engineers.

A. C. D. Blanchard, M.E.I.C., is resident engineer on the construction of the power development for the Saint John River Power Company at Grand Falls, N.B., having severed his connections with the New Brunswick Electric Power Commission to accept his new position. Prior to his appointment to the New Brunswick Electric Power Commission as hydraulic engineer in September, 1924, he was for several years engaged as chief field engineer in charge of surveys, field engineering and inspection on the Queenston-Chippawa power development.

CLARENCE V. CHRISTIE, M.E.I.C.

T. V. McCarthy, A.M.E.I.C., has moved from Toronto, Ont., to Grand Falls, N.B., and is with Messrs. H. G. Acres and Company, Limited, who are consulting engineers for the Saint John River Power Company on the Grand Falls development. Mr. McCarthy was some years ago assistant laboratory engineer for the Hydro-Electric Power Commission of Ontario.

W. A. Bucke, M.E.I.C., manager of the apparatus sales department, Canadian General Electric Company, Limited, spent two weeks of last month on a tour of the Maritime Provinces. During his stay in Halifax he visited the Nova Scotia Power Commission and others interested in the electrical industry. At Bathurst he was the guest of the Bathurst Company, Limited; at Sydney, Mr. Bucke conferred with the engineers of the Coal Company and Steel Company, and at St. John, N.B., visited the engineers of the New Brunswick Power Commission.

Professor C. V. Christie, M.A., B.Sc., M.E.I.C., Heads Electrical Engineering Department of McGill University

Professor C. V. Christie, M.E.I.C., associate professor of electrical engineering at McGill University, has been appointed Macdonald professor of electrical engineering and head of the department, succeeding the late Dr. L. A. Herdt, M.E.I.C.

Professor Christie was born at Couva, Trinidad, B.W.I., and in 1902 received his degree of B.A. at Dalhousie University and the following year was awarded his degree of M.A. from the same university. In 1906 he graduated from McGill University with the degree of B.Sc. Immediately following graduation, he was appointed lecturer at McGill, and in 1908 became assistant professor and in 1913 associate professor in the department of electrical engineering.

For the past eight years he has acted as consulting engineer for the Shawinigan Water and Power Company. Professor Christie is an authority on electrical engineering, and his text book on that subject has been widely used by students in both the universities in Canada and the United States. He has taken an active interest in the affairs of The Institute, and is at present vice-chairman of the Montreal Branch.

G. GORDON GALE, M.E.I.C.

General Manager, Gatineau Power Company

G. Gordon Gale, M.E.I.C., vice-president and general manager of the Hull Electric Company, has been appointed general manager of the Gatineau Power Company, and while assuming his new duties, retains his former position as head of the Hull Electric Company.

Mr. Gale is a graduate of McGill University in mining engineering in 1903, and electrical engineering in 1904, receiving the degree of B.Sc. in each case, and in the year 1905 he received the degree of M.Sc. from the same university.

From 1904 to 1906 he was assistant engineer with the Canada Rubber Company, and in 1907 he was resident engineer at Deschenes, Que., for Messrs. Ross and Holgate. The same year he was appointed superintendent of power with the Hull Electric Company. In 1909 he was promoted to acting general superintendent, and the following year was made general superintendent. In 1914 he became general manager of the Hull Electric Company, and since 1917 he has been vice-president and general manager of the company.

Mr. Gale was chairman of the Ottawa Branch of The Institute in 1918, and a member of Council during the years 1919, 1920 and 1921. He was president of the Canadian Electric Railway Association during the year 1921-22, and president of the Rotary Club of Hull in 1922.

Addresses Wanted

A revised list of members is being prepared for publication in the form of the Year Book, and it is desired to have this list as complete as possible. The following is a list of members for whom there is no address on file at headquarters. The Secretary would appreciate any information as to the present address of any of these members.

Members

A. Angstrom	J. H. Gray	A. E. Johnson
J. R. Barlow	J. F. Guay	H. Longley
T. B. Campbell	E. F. T. Handy	A. H. Smith

Associate Members

W. A. G. Adams	H. B. Fisk	F. W. Pearson
P. I. Baker	J. L. Franzen	G. M. Ponton
A. N. Ball	J. S. Galbraith	H. H. Robertson
W. L. Ball	W. H. Jones	C. R. Scott
W. H. Blanchet	L. W. Lester	C. F. Szammers
D. M. Bright	H. Lindsay	W. E. Tidy
G. A. Emslie	H. Macneil	T. W. Webb
J. Erskine	C. W. McCarthy	J. L. Wilson
R. J. Fisher	W. M. Miller	W. G. Wilson

Juniors

G. N. Allen	T. Clarke	J. A. M. Penrose
J. S. Arbuckle	J. H. Hewson	L. A. Perry
F. D. Austin	C. Mackay	J. H. Ryan
E. Bryant	R. G. MacKenzie	
R. A. Campbell	C. A. McConville	

Students

W. W. Abernethy	W. J. Evans	B. E. Martin
J. M. Allen	J. W. Fagan	J. B. McCaw
A. G. Anderson	R. W. Farmer	A. F. McKellar
M. Balbour	R. E. Fetter	G. McKindsay
P. E. Bauman	L. B. Feetham	J. W. Noyes
C. M. Benett	R. H. Foss	E. M. O'Brien
C. L. Blackmore	J. M. Fraser	J. H. Oliver
C. M. Bowyer	C. H. Frid	H. J. Pearson
Leo B. Brown	L. Gareau	R. J. Rainnie
G. F. Bryant	A. J. Grant	L. J. Scott
E. W. R. Butler	J. H. Halliday	T. G. Sillers
A. T. Byram	S. B. Hansuld	W. L. Simpson
H. Carignan	D. A. Henderson	D. F. Smith
J. A. Circe	C. B. Jandrew	E. M. Van Koughnet
F. L. Code	T. W. Kennedy	D. M. Vye
H. Crutchfield	W. L. Lewis	F. M. Waddell
W. V. Delaney	R. E. Lindsay	S. W. Williams
C. D. Evans	R. St. C. Low	F. E. Wilson

Members' Exchange

Back Numbers of The Engineering Journal

The Secretary will be pleased to receive spare copies of the May, June, July, August, September, October, November and December, 1918, May and December, 1919, January, February, March, April, May, June, July and September, 1920, issues of the Journal to complete library sets.

ABSTRACT OF PAPER

The Generation of Steam at Critical Temperatures

Dr. Mark Benson, F.R.G.S.
Vancouver Branch, June 8th, 1926.

Dr. Benson proceeded to give the results of five years of intensive study and experiment directed towards the improvement of the overall efficiencies of steam generating power plants. He first went back over the history of steam generation, tracing its commencement from about one hundred and twenty-five years ago to the present time, and stated that the best efficiency obtainable in even the most modern plants, approximated 12 per cent from fuel to bus bar, and also stated that were it possible under present conditions to maintain this as an average efficiency it would be considered very satisfactory indeed.

It would appear that this condition was forcibly brought to his attention some years ago and that he then formed the determination that it was time this was changed and a more efficient use made of the fuel in steam generating plants, and he stated that to-day, after five years of study—average overall efficiencies of between 30 and 50 per cent are definitely in sight. He stated also that the day of the Diesel engine is also definitely past, although that is at the present time the most efficient means of generating power from fuel.

Dr. Benson's address was divided into several parts and was profusely illustrated with lantern slides showing charts and the calculations upon which his high temperature-pressure system of steam generation is based, and he stated that his plans for such extremely high efficiencies as are now promised are based upon the use of steam at a pressure of 3,200 pounds per square inch and at a critical temperature between 700 and 800 degrees Fahrenheit. For practical reasons, however, it would be necessary to superheat the steam to approximately 1,200 degrees Fahrenheit. The principle involved is that generating steam under these conditions involves no latent gradual vaporization, the vaporization, or in other words, transition from water into steam being instantaneous and involving practically no losses, as there is no latent heat of vaporization at this point. The acceptance of the general principle, however, brings forward a very large field for study in the development of the practical features involved in the use of steam at such high temperatures and pressure. It is claimed, however, that the plant is greatly simplified and in spite of the high pressure the risk of explosion is greatly decreased, due to the fact that there is no storage of energy in the form of large bodies of steam or water. Only a few pounds of water at any one time being actually under the temperature-pressure condition proposed.

A great deal of work has been necessary in the development of a suitable steel for tubes and at the present day suitable metal is only made at the Krupp plant in Essen, Germany. It is anticipated, however, that a number of the larger steel plants will recognize the opportunity that lies for them in this system in the immediate future.

Another section of Dr. Benson's address dealt with the experimental work that has been already done and referred to the plant which has been built and is operating on this system at Rugby. Numerous variations of arrangement were shown graphically dealing with various conditions to be met with in steam plant design and operation and included problems of feed pump installation; various arrangements for superheating and re-superheating the steam in the various stages of its use and also showed the possibility of translating existing steam plants, adding to them the critical cycle and re-arranging the part for use under the new conditions without fundamental or expensive alterations.

Reference was also made to the possibility of using the system in connection with locomotives, and while it was admitted that it cannot be as readily applied to reciprocating engines as to turbines, possible arrangements were shown and described and particular reference was made to the development of a metal for pistons and cylinders in which the steam itself would act as a lubricant, thus doing away with the principal inherent defect of high pressure steam in cylinders under high temperature conditions.

In conclusion, and with particular reference to a large power plant which is being designed for the California Edison Company, Dr. Benson stated that wherever at present 400 kilowatt can be developed per barrel of oil fuel, it is now confidently expected to be able to develop 900 kilowatt to the barrel.

BRANCH NEWS

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

Visit to Alberta Wood Preserving Plant

On June 19th a party of members of the Calgary Branch gathered at the plant of the Alberta Wood Preserving Company, in West Calgary. Despite the inclement weather, the visit through the works proved of considerable interest. Following the inspection of the process of preservation from the untreated lumber to the finished article, Manager J. H. Dixon gave a short instructive address, in which he related the history of the lumber treating business from its origin in 1837.

Mr. Bethel was the discoverer of the effect of creosote on timber in England. While his process was crude, it is fundamentally the same in standard use throughout the world today. The method of application differs, however, on account of the advancement in mechanical apparatus. A Mr. Burnett, in 1838, made the first use of zinc chloride as a preservative of wood. This method is also in use at this plant and a 50 per cent solution is forced under pressure in a similar manner to the creosote through the wood cells. In this up-to-date plant, air is forced through these cells when the lumber is stacked in large tubular airtight compartments, and is afterwards extracted, leaving a slight vacuum, which is replaced by the preservative solution, also under pressure.

Mr. Dixon explained carefully the cell formation of various timbers, the pine variety, as an instance, having open cells running lengthwise of the tree, whereas those in the hardwoods, such as white oak, are plugged. He stated that preserved sapwood is today considered just as good, if not better, than the hardwood varieties.

Lodge pole pine was practically not in general use five years ago. Today this is a splendid lasting timber when treated, and as telegraph poles should last 75 years, at a cost of only 15 per cent increase for the treatment. He went on to say that there is really no such thing as dry rot in this country at least, as moisture and warmth must be present to cause fungus growth. Zinc chloride is soluble in water, whereas creosote is not, and therefore timber treated in each manner has its particular uses. He stated the fact that a Louisiana railroad trestle bridge, six miles long, was built in 1882 of preserved yellow pine, and is in use today under main line traffic. Referring to untreated ties, he gave the lives of various kinds of timber used.

Following the address, J. H. Ross, A.M.E.I.C., chairman of the branch, thanked the speaker and staff, and stated that, in his opinion, this branch had never spent a more instructive and interesting afternoon on any of their visits to various industries in Calgary.

Dinner in Honour of General Secretary R. J. Durley, M.E.I.C.

Members of the branch showed their pleasure at meeting general secretary R. J. Durley, M.E.I.C., by turning out in full force at a dinner in his honour on June 24th. A very enjoyable evening was spent, the dinner being followed by a varied entertainment. Mr. Durley spoke on matters of considerable interest concerning the internal affairs of the Institute as a whole and also had a few words of commendation for the activities of the Calgary Branch. During the evening short speeches were delivered by Chairman J. H. Ross, A.M.E.I.C., B. L. Thorne, M.E.I.C., A. L. Ford, M.E.I.C., and R. S. Trowsdale, A.M.E.I.C.

Community singing and solos were enjoyed and a comical sketch along the style of Shakespeare's "Henry IV" was put on, the parts being taken by C. C. Richards, M.E.I.C., W. B. Trotter, A.M.E.I.C., and W. St. J. Miller, A.M.E.I.C., and amusing references were made throughout to members present.

Mr. Durley met the executive of the branch prior to the dinner and exchanged views on Institute matters, explaining many points of importance hitherto not clear.

News Items

A hole-in-one episode was recently pulled off in local golf circles, when our worthy late secretary, G. P. F. Boese, A.M.E.I.C., achieved distinction in this respect, having neatly done the trick.

The reconstruction of and additions to the Alberta Flour Mills Plant in East Calgary is progressing rapidly. This mill has been taken over by Messrs. Spillers (Canadian) Ltd., who are sparing neither pains nor money to make it an up-to-date plant in every respect.

Vancouver Branch

E. A. Wheatley, A.M.E.I.C., Secretary-Treasurer.

Executive Meeting

A regular meeting of the Executive Committee was held at the University Club on June the 29th, when the meeting took the form of a dinner to general secretary R. J. Durley, M.E.I.C. After dinner the regular meeting was held.

In the absence of the chairman, F. W. Alexander, M.E.I.C., took the chair and the president of the Institute, Major Geo. A. Walkem, M.E.I.C. was present.

The Library Committee reported that the joint library maintained by the branch and the professional engineers was now installed in the University Club building and was proving of great value to the members.

The secretary reported that the Association of Professional Engineers had submitted, by letter, the details and extent of their participation in the maintenance and development of the library. The offer of the Association was accepted and the secretary instructed to take whatever steps he deemed necessary to complete the indexing of the library.

The presence of Mr. Durley was taken advantage of by having an intimate discussion on various topics of engineering work. Mr Durley was of great assistance to the executive and from the discussion held, improvements of the Branch Executive are looked for.

The Walter Moberly Memorial Prize.

The second recipient of this prize which was granted to commemorate the life and work of Walter Moberly was obtained by Francis Gilbert Aubrey Tarr, for his essay on "The Stave Falls Hydro-Electric Development of the B.C. Electric Railway Company."

The Executive meeting then adjourned and the regular meeting of the branch was held in the rooms of the auditorium of the Board of Trade.

Address by Mr. Durley

W. H. Powell, M.E.I.C., the chairman, introduced the speaker and guest of the evening, the general secretary of the Institute, R. J. Durley, M.E.I.C., and referred to the fact that as there was no business there would be ample time to have, not only a long address from Mr. Durley, but a discussion on Institute affairs.

Mr. Durley, who was received with great applause, gave an account of a number of activities of the internal administration of the Institute and touched on the fact that a number of members had recently been dropped from the Institute and he submitted that this actually made for greater strength. There was a reduction in paper strength, but an improvement in the actual strength of the Institute. He referred to the fact that the Institute organization was not only decentralized, but was of a very flexible nature. He showed that the branches were practically autonomous. The difficulties that existed were generally geographical difficulties. He stated it was his opinion and the opinion of many other engineers that another difficulty was that the requirements for admission by examination to the Institute are higher than for admission into many of the American societies and thus American societies found it easier even in Canada to form organizations where the Institute found it impossible. He showed that the existing number of members of the Institute, 4,500, of a population of 9,000,000, compared favourably with American societies who had a membership of some 50,000 of a population of 120,000,000. He invited members who were impressed with the technical value of certain American societies' magazines to take advantage of the reciprocal arrangements and thus to purchase the magazines in question. He pointed out that the Institute fee, together with the cost of the American magazine, was less than the cost of the American society fee.

Mr. Durley referred in terms of sorrow to the death of the treasurer of the Institute, General Bertram, and in terms of appreciation to his work. He mentioned the appointment of F. P. Shearwood, M.E.I.C., to this position.

Mr. Durley stated that while the transactions of the Institute have not been published since 1917 he had happiness in announcing the republication this year; the work of the volume would cover some 300 pages and would contain selections from papers given in the last three years, and would cost $3.00 per volume. He advised that a satisfactory number of applications for the volume had been received and urged further subscriptions.

Mr. Durley paid tribute to the work of Fraser S. Keith, M.E.I.C., and spoke in terms of admiration of the staff and organization that Mr. Keith had developed. He referred to the devotion and self-sacrifice of the staff at headquarters.

Mr. Durley referred to the inadequate way all application forms are filled in and he urged that members sponsoring applications and the Membership Committee see that the requirements as printed on the application forms are carried out by the applicants.

The president, P. H. Buchan, A.M.E.I.C., H. B. Muckleston, A.M.E.I.C., F. W. Alexander, M.E.I.C., J. F. Frew, M.E.I.C., S. F. Ricketts, A.M.E.I.C., and A. C. R. Yuill, A.M.E.I.C., all took part in a discussion of Institute affairs and made a number of suggestions for the improvement of the branch work.

E. A. Wheatley, A.M.E.I.C., addressed the meeting on his appointment as secretary and moved a vote of thanks and appreciation, which was seconded by Mr. Walkem, to his predecessor, P. H. Buchan, A.M.E.I.C. Mr. Wheatley implored the active support of the membership.

A very hearty vote of thanks was extended to Mr. Durley for his most interesting address.

The three new students of the Institute, Messrs. K. W. Hicks, Steed and Timmleck, were introduced to the members, and Mr. Hicks replied briefly.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

A regular meeting was held on June 25th, 1926 at the Y.W.C.A. rooms at 8 p.m. C. H. Speer, M.E.I.C., chairman, called the meeting to order and disposed of the regular business. General satisfaction was expressed by the members when it was announced that R. J. Durley, M.E.I.C., the general secretary of the Institute, would be in the Soo on July 16th. A discussion led by C. H. E. Rounthwaite, A.M.E.I.C., on the recent sad drowning accident in St. Mary's river on June 20th, resulted in the following resolution.

> "That the Sault Ste. Marie Branch of the Engineering Institute of Canada wishes to express its desire that a thorough investigation be made into the causes and circumstances surrounding the sad drowning accident in the St. Mary's river, Sunday, June 20th, and that every precaution be taken to prevent a recurrence of such an accident and that the advisability of placing rescue apparatus at various places along the water front be investigated."

The Operation of Fish Hatcheries

Mr. C. Hartman, superintendent of the Provincial Fish Hatchery, addressed the meeting. He outlined the different methods used in gathering the spawn and the hatching of it for the various species of fish.

Speckled trout eggs, he said, are collected from brood fish, kept at the hatcheries having ponds. The fish spawn in the fall and great care must be taken not to injure the female fish; the male fish being more hardy may be handled with more safety. In ordinary spring water the eggs hatch in about six weeks. A three-pound female trout will give between 3,000 and 3,500 eggs and under ordinary conditions 75 per cent of these were a good hatch and the growth to fingerlings a little less, due to disease, parasites, etc. One point that he stressed was that the troughs must be thoroughly cleaned to prevent disease and fungus by washing with salty water.

The rainbow trout which were planted in the waters around the Soo by the Michigan State Fish Hatchery do not drive the speckled trout from the streams, according to Mr. Hartman's belief. The increase of the number of rainbow trout was due, he thought, to spring spawning when the water was warmer and better hatching conditions prevailed. A five-pound rainbow trout will give about 3,000 eggs, and these are hatched in troughs in the same manner as speckled trout. The rainbow are harder to handle while taking spawn than are the speckled owing to their strength and the consequent danger of injury to the fish and spawn.

The salmon trout or grey trout, from which the spawn is taken, are caught in gill nets and the percentage of the eggs which hatch is low owing to the action of the nets upon the parent fish. They hatch in troughs also, and the fry must be released earlier than the young of the other trout owing to earlier feeding habits.

Pickerel are hatched in jars insted of troughs and about 55 per cent of the eggs hatch. The hatchery at Sault Ste. Marie, Ont., this year had about 3,000,000 pickerel spawn. The eggs run about 175,000 to the Imperial quart. He said that the pickerel fry have to be planted earlier than the trout fry owing to the fact that they start to feed as soon as hatched and would feed on the weaker fry.

The jar system of hatching is also used for white fish and the eggs are taken from fish captured in pond nets. About 35,000,000 fry were handled at the Sault Hatchery this year according to Mr. Hartman.

There is only one bass hatchery in Ontario, he said, and that was at Mount Pleasant. The bass hatch in nets in gravel prepared by themselves. The fry must be planted early owing to their cannibalistic tendencies.

Regarding 'lunge,' the fish have to be netted and are hard to handle as they are so large and strong. It is hard to keep from injuring them during the operation.

A lengthy discussion followed and some of the points brought out by Mr. Hartman were that a wounded fish, unless its gills are torn, will go to the bottom and roll itself in the mud which keeps the fungus off and helps the healing.

As it is almost impossible to handle small trout without killing them, he advised the anglers when they strike an area frequented by small fish to leave it alone and find the large ones elsewhere.

L. R. Brown, A.M.E.I.C., moved a hearty vote of thanks to Mr. Hartman for his address on a subject that is most interesting to Algoma residents and W. J. Fuller, A.M.E.I.C., seconded it.

London Branch

Francis C. Ball, A.M.E.I.C., Secretary-Treasurer.

Regular Meeting and Motor Trip

Motor trip to Woodstock and meeting held at Hotel Oxford, Saturday, May 15th, 1926, in connection with which the programme was arranged by the Woodstock members.

The party from London left the London city hall at 2 p.m., and met the other members at Hotel Oxford at 3.30 p.m. The party left for the plant of the Independent Concrete Pipe Company, being conducted through the plant by Mr. Carnwath. The Woodstock sewage disposal plant was visited and the details of operation of this activated sludge plant were described by W. G. Ure, A.M.E.I.C. Under the guidance of Mr. Archibald, the members motored to the waterworks pumping plant and to the springs from which Woodstock gets its water supply. On the return of the party, dinner was served at Hotel Oxford.

Meeting opened with W. P. Near, M.E.I.C., in the chair. His Worship Mayor Parker, of Woodstock, was introduced by W. G. Ure, A.M.E.I.C., and expressed his pleasure in meeting with the members of the London Branch.

Engineering and Public Health

Jas. A. Vance, A.M.E.I.C., introduced the speaker of the evening, Wm. Storrie, M.E.I.C., of the firm of Gore, Nasmith and Storrie, of Toronto. Mr. Storrie's subject was "Engineering and Public Health." He emphasized the importance of the engineer's work in regard to public health, and explained the relation of the work of the biologist to that of the engineer. To safeguard public health, it is the duty of the engineer to impress on a municipality the danger of drawing its water supply from a polluted source without purification.

On the subject of sewage disposal, Mr. Storrie said that for large municipalities it is generally agreed that the activated sludge method is best, but such a plant should be installed only where constant supervision and an uninterrupted power supply are available. The great difficulty with this system is in the disposal of the sludge. The vast expense of preparing sludge for fertilizer was so far not justified by the results as obtained in Milwaukee. The activated sludge system, with some separate form of sludge digestion, is a desirable method. Sludge does not digest when its temperature gets below a certain point. In temperate climates, this lower temperature may obtain during seven or eight months of the year, necessitating tanks of large capacity for the storage of sludge. To allow of the use of smaller tanks, the sludge may be heated during the winter months, thus providing continuous digestion through the whole year.

Where a municipality is faced with the problem of treating either its water supply or its sewage, it is advisable to first purify the water, because this method removes the possibility of pollution from sources other than the sewage effluent of the municipality under consideration.

Contrary to the common belief that water and milk obtained in the country are purer than are obtainable in the city, it has been found that the smaller towns and villages have more disease traceable to these two sources than the larger cities. It is known that rural municipalities often get milk from a source of supply that has been condemned by the veterinary inspectors of an urban municipality.

The present generation is devoting its energies to the treatment of water supplies and sewage. The next generation must attempt to clean up atmospheric conditions as they now exist in our large cities. As a matter of preventive engineering, more attention must be given to ventilation. To carry out his duty to the public, the engineer should give more thought to the development of public speaking, and should use this means, along with others, to educate the public to the inauguration and use of engineering services for the promotion of better health.

In the discussion on the treatment of sewage by the activated sludge method, F. J. Ure, A.M.E.I.C., spoke of the satisfactory results obtained from the plant at Woodstock, making special reference to the ease in disposing of the sludge from such a plant in a small city. Mr. Veitch spoke of the desirability of providing daily scientific supervision for an activated sludge plant.

The chairman tendered to Mr. Storrie and the Woodstock members a vote of thanks moved by E. V. Buchanan, M.E.I.C., and seconded by F. M. Brickenden, A.M.E.I.C.

On motion by W. M. Veitch, A.M.E.I.C., and J. R. Rostron, A.M.E.I.C., the secretary was instructed to advise the reception committee for the London Centennial Celebration of the willingness of the London Branch of The Institute to co-operate with the Centennial Committee in entertaining visitors belonging to the engineering profession.

Meeting of April 22nd

A regular meeting of the branch was held Thursday, April 22nd, at 6.15 p.m. The branch had the pleasure of a visit from general secretary, R. J. Durley, M.E.I.C., on Thursday, April 22nd. He explained to the members of the branch various points in connection with administration methods as carried out at headquarters which proved most interesting to those present.

W. E. Piper, of The Dorr Company, engineers, New York City, gave a short talk on the principle and performance of the paracycle pump and paracycle compressor.

The application of paracyclic motion to a pumping machine was invented by Lieutenant-Commander C. H. Varley, of the British Navy.

The Dorr Company has taken up Canadian and United States patent rights, and is developing the machine as an air compressor as well as a pump.

London, Ontario, has the first commercially-built compressor. Toronto has the second. Both are for aerating sewage in activated sludge plants. London's machine has a guaranteed output of 450 cubic feet per minute of air with a 15-h.p. motor. It has delivered 590 cubic feet per minute at maximum motor speed, direct-connected to a 15-h.p., 1,445 r.p.m. motor.

The pump shows correspondingly high efficiencies, a 100-gallons per minute pump giving better than 80 per cent overall efficiencies through a wide range of pressures.

The paracycle is a positive displacement blower or pump, its output varying but little with the pressure, like a reciprocating pump. It has a rotary shaft which permits of direct motor coupling where the speeds are appropriate, like a centrifugal pump, but its capacity and pressure are not interdependent like the latter.

Its unique motion principle of operation, variant forms, and points of expected superiority were illustrated by a "chalk-talk" at the blackboard.

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

On June 30th, general secretary, R. J. Durley, M.E.I.C., visited Victoria, and after calling on several of the local members of The Institute during the morning, addressed the branch at a luncheon presided over by the chairman, J. N. Anderson, A.M.E.I.C.

The progress and present standing of The Institute generally were dealt with, together with the relationship of The Institute to the various provincial associations of professional engineers, and special emphasis laid on the large amount of work done and time given for the benefit of the profession by the members of council.

In the discussion that followed, the question of remuneration arose; it was suggested that The Institute could do more than has been done in this regard, but some felt that while The Institute might be able to be of assistance in any particularly flagrant case of unfair remuneration, it was a matter that depended mainly on the members themselves.

Other points of view expressed were that engineers as a rule were not in touch with the financial and commercial interests, and did not therefore obtain the recognition they might otherwise have, that generally speaking engineers are inclined to underrate their capabilities and value to the community; that whereas a commercial man feels satisfied that if one job turns out unsuccessful, he can soon succeed elsewhere, an engineer often loses advancement through the fear of losing his position.

In a specific case of a municipality requiring an engineer, it was pointed out that the range of salary asked for by applicants varied from $120 per month to $300; it appeared that there was a willingness to pay $200 per month to a qualified engineer, and it was suggested that if engineers would co-operate, (and the British Columbia Act makes such co-operation possible), to the extent of agreeing as to what would be reasonable remuneration for such positions when they became vacant, the standing of the profession would be materially bettered.

After a visit to the city hall and a chat with the city engineer, F. M. Preston, A.M.E.I.C., Mr. Durley enjoyed some of the beauties of Victoria under the aegis of the branch chairman, and in the evening met the past and present secretaries of the branch.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
Stanley A. Neilson, A.M.E.I.C., Branch News Editor.

Visit to the Saguenay District

Over the week-end of June 25th to 27th, some fifty-eight members and friends of the Montreal Branch visited the large industrial developments in the Lake St. John district at the head of the Saguenay river.

The visit was the occasion of the annual summer excursion of the Montreal Branch, and by those who have followed the development of the district visited, it will be readily appreciated that from the standpoint of general interest to engineers it would be difficult to find a more interesting district for such an excursion. While for many years this district has been the centre of a great pulp and paper and lumber industry, the recent developments, particularly the hydro-electric plant at Isle Maligne, the new pulp and paper mill at River Bend, the enlargement of existing mills, and, lastly, the establishment of the Aluminum works and the construction of the new town of Arvida in connection with these works, has created an intensive industrial activity in the district.

The party left Montreal on Friday evening, June 25th, and, through the courtesy of the officials of the Canadian National Railways, three special cars, attached to the regular train to Chicoutimi, were provided for accommodation. The party arrived at Chicoutimi about 9 a.m. on Saturday, and were met by Councillor E. Lavoie, M.E.I.C., officials of the Saguenay Branch, and Mayor Desbiens, of Chicoutimi., and after partaking of breakfast the members were conveyed in automobiles to the plant of the Port Alfred Pulp and Paper Company, where they were received by R. C. McCully, A.M.E.I.C., superintendent of the plant, and were afforded an opportunity of inspecting the new plant.

From Port Alfred, the party were motored to the new Portage des Roches dam of the Quebec Streams Commission, which controls the outlet of lake Kenogami. This dam, which was entirely designed by members of The Institute under the direction of O. O. Lefebvre, M.E.I.C., is an example of the excellent engineering work being carried on by the Commission.

The party then returned to Chicoutimi for lunch, following which the members were taken by automobiles to the new townsite of Arvida, where the Aluminum Company of Canada have under construction their new plant and town. Upon arrival, the members were welcomed on behalf of the company by R. E. Parks and H. R. Wake, A.M.E.I.C., and were conducted in groups by various members of the staff on a tour of inspection of the new plant, which is rapidly nearing completion.

To describe the extent of this development would require much more space than is available in Branch News, and it is expected that the branch will be favoured with a paper describing this work during the coming fall. Such a paper, no doubt, will give a general idea of the development which is being undertaken by this company, but a true conception of the extent of this work can only be secured by a visit to the site.

From Arvida, the party were motored to Isle Maligne, arriving about 5 p.m., where a reception was tendered by officials of the Quebec Development Company. At 7 p.m., the members of the party were the guests of the Quebec Development Company at a dinner and dance at the Staff House. At the conclusion of the dinner, F. H. Cothran, vice-president of the Quebec Development Company, welcomed the members on behalf of the company, and, in reply, O. O. Lefebvre, M.E.I.C., on behalf of The Institute, and Professor C. V. Christie, M.E.I.C., on behalf of the Montreal Branch, expressed the thanks of the members for the very hearty reception they had received.

During the afternoon, the special cars which had been placed at the disposal of the party for the entire trip were moved from Chicoutimi to Isle Maligne, and were available for the accommodation of the members.

On Sunday morning, the party were afforded an opportunity of inspecting the Isle Maligne power plant of the Duke-Price Power Company, Limited, which is another work that must be seen to be appreciated. This plant embodies the latest features of design, and many favourable comments were made on the superior type of construction evident throughout the plant. Through the courtesy of the Quebec Development Company, the party then were conveyed by rail to No. 4 dam, where the final closure was made in connection with the Isle Maligne development. This trip afforded an opportunity of securing a general idea of the complete development, and to appreciate further the vast undertaking which has been achieved by the engineers of this district.

The members were again the guests of the Quebec Development Company at luncheon at the Staff House at Isle Maligne, following which they journeyed by train to the River Bend mill of Price Brothers and Company, Limited, where they were welcomed by C. N. Shanly, A.M.E.I.C., chairman of the Saguenay Branch of The Institute, and where, through the courtesy of the company and the kindness of the manager of the mill, they were taken on a tour of inspection of this modern and up-to-date paper mill.

Following the inspection tour, the party was entertained at dinner at the Staff House at River Bend as the guests of the company, and during the course of the meal Mr. Shanly extended a welcome to the visiting members, and very briefly reviewed the extensive developments which have taken place in the Saguenay district over the period of the last fifteen years. Following Mr. Shanly's remarks, the secretary of the Montreal Branch expressed the appreciation of the members for the reception and hospitality they had received. The party then returned to the train, which left River Bend at 9 p.m., arriving in Montreal on Monday morning.

The trip was acclaimed most enjoyable and most instructive, and will long be remembered by all members who were fortunate enough to be present.

Saskatchewan Branch

R. W. E. Loucks, A.M.E.I.C., Secretary-Treasurer.

Joint Meeting with Sections of Canadian Institute of Mining and Metallurgy and the American Institute of Electrical Engineers, at Estevan, Sask.

The annual summer meeting of the Saskatchewan Branch took the form of a joint meeting with the Saskatchewan Section of the American Institute of Electrical Engineers and the Southern Saskatchewan Section of The Canadian Institute of Mining and Metallurgy, and was held at Estevan, Sask., on July 8th, 9th and 10th.

The members attending, many of them accompanied by ladies and children, were accommodated under canvas at River Park, an ideal camp site on the banks of the Souris river about two miles south of the town and opposite the Prairie Nurseries.

Here such conveniences as electric light, running water, swimming pool and a large dancing pavilion were placed at the disposal of the visitors. Electric lights were installed in each tent, and the members and their friends availed themselves of the swimming, boating, golfing and dancing when not otherwise engaged on the programme provided.

The majority of the Saskatchewan members motored from Regina and other points in the province, and were joined by the visitors from Alberta, Manitoba and eastern Canada. Despite the fact that heavy rains set in on Wednesday afternoon, July 7th, the majority of those who had signified their intention of attending the meeting commenced their journey. Some arrived Wednesday evening, some in the wee small hours of the following morning and some later in the day. Recollections of the enjoyable summer meeting held at this point some three years ago spurred the motorists on over roads almost impassable on account of mud and water, and the inhospitable nature of the elements was not allowed in any way to dampen the spirits of the inner man. The total adult registration numbered fifty-five, and to this must be added about ten children.

On Thursday the party visited points of local interest, including the Souris Creamery, Estevan Bottling Works, International Clay Products Company's plant and the Estevan power station.

On Thursday evening the members were guests of the Town of Estevan at a banquet given in River Park pavilion. The guests at the banquet numbered approximately one hundred and twenty-five, and included a number of Estevan's prominent citizens.

D. Bannatyne, who worked unceasingly to make the meeting a success, was chairman. Mayor A. M. Taisey gave an address of welcome which was responded to by R. N. Blackburn, M.E.I.C. He expressed his great belief in the future of Estevan.

E. J. Campbell, president of the Estevan Board of Trade, proposed the toast to the guests, and traced the progress made by the Engineering Institute since its inception in keeping pace with the requirements of the country. E. W. Bull spoke in response, and assured the committee in charge of arrangements that everything had been done for the guests' enjoyment.

D. W. Houston, A.M.E.I.C., outlined the great possibilities of the town in a toast to Estevan which was replied to by Councillor Norman McLeod.

The toast to the ladies was proposed by Councillor J. H. McFadden and responded to by W. T. Hunt.

In addressing the convention, S. R. Parker, A.M.E.I.C., chairman of the Saskatchewan Section of the A.I.E.E., made the prediction that the town of Estevan would one day rise to be one of the great industrial cities of the prairie provinces. The subject of his address was, "Electrical Development of Southern Saskatchewan."

Mr. Parker traced first the development of steam power and afterwards the gradual change to electrical power which is now proceeding, without which the present very intensive development of industries in the twentieth century, which is without doubt the *electrical era,* would not have been possible. A number of figures were then quoted showing the horse power employed in different industries and the percentage of each which have been electrified in the north central states of the United States. Although these percentages run up as high as 88.5 per cent, Mr. Parker stated that the only reason they are not higher is because of the lack of available power, due to the phenomenal demand for electricity exceeding the available output.

"Coming now to the local situation," said Mr. Parker, "as it affects southern Saskatchewan, a survey of industrial history shows that all great industrial developments have taken place on the coal fields if and where they are near a constant supply of good water. On a cursory survey of the situation, this location must be within a very limited radius of the town of Estevan."

Mr. Parker then outlined the designing of a power plant, stressing lower cost and pointing to the feasibility of establishing a power distributing plant at the mine head, Estevan. With such a plant, manufacturing would be developed and periods of depression in agriculture would be obviated. At the outset, owing to small population, losses might occur, but in the end it would be the solution of economic development.

W. H. Greene, M.E.I.C., acting city engineer of Moose Jaw, Sask., and chairman of the Saskatchewan Branch of the Engineering Institute of Canada, gave an address on "Industrial Development of Southern Saskatchewan."

Agriculture, thought Mr. Greene, would continue to be our chief industry, but he saw the time within a few years when the United States would cease to be a grain exporting country, which will mean increasing markets for Canada.

Clay products he saw as being exploited but moderately at present. "Our climate requires well-built houses," he said, "and there should be a good market for brick if the price can be lowered through the use of cheaper local coal. Again, lumber prices are steadily increasing, and the spread between a brick building and a frame one will gradually decrease. Clays suitable for the making of pottery and some classes of china at least exist and are beginning to be used. China clays are very scarce in Canada, so these deposits may on development prove valuable."

He described Saskatchewan's water power, estimated at 1,800,000 horse power, "as wholly undeveloped," but thought it would prove a valuable aid and standby to any scheme of central station electric production utilizing our large coal resources. "The transmission of electric power throughout the province would be of great benefit to the rural community," he said. "The hand labour required for carrying on much of the work incident to diversified agriculture can be largely abolished by systematic use of appliances operated by electric power. It is pretty well established that cheap power is necessary to and will attract industries to a locality that would otherwise be passed up. Certainly we in this province need industries to stabilize year-round employment.

"This lignite can be successfully used throughout the province, and mass production will help solve its preparation for export, partly because ample funds will be provided for research and experimental work. Its solution in the near future is important because an Eastern market will soon be open. Ontario and Quebec together import over 13,000,000 tons of coal annually from the United States. Already there is, in the States, a strong and growing sentiment against the further export of coal.

"The migration of industries to sources of cheap and abundant power has already begun. With such a beginning, and realizing our enormous coal reserves, why should we not expect the building of industries in the vicinity of the coal fields, or, if a central power scheme is developed, then throughout the whole province?"

Following the banquet, many of those attending joined in the dancing at the Pavilion, the numbers being considerably augmented by the younger set of the town.

Visit to Columbus, N.D.

On Friday the members, accompanied by the ladies and the mayor of Estevan and other local citizens, motored to Columbus, North Dakota, and visited the Truax mines. There they inspected the open pit mining or stripping of the lignite, which operation is being performed by steam shovel. A 4½-yard shovel with an 85-foot crane similar to those used on construction of the Panama canal was seen in operation. On this field the coal is located at an average depth of 25 feet below the surface and the thickness of the seam averages about 9½ feet. A movable tipple with special loader, which is placed in the box car for this purpose, enables a car to be loaded in 8 minutes. Maximum daily production is 2,500 tons, with an average yearly production of 200,000 tons. Following this inspection, the party were entertained at luncheon given by the owners of the mines.

The visitors then returned to Estevan, via North Portal, and gathered in the evening at a banquet given by the institutes in River Park pavilion.

Mining Problems in Saskatchewan

Dr. Charles Camsell, of the Department of Mines, Ottawa, delivered a short address in which he discussed various problems confronting the people of Saskatchewan and how the Department of Mines is assisting in the solving of the problems. The road problem might be solved by the working of oil possibilities in the province, and Dr. Camsell stated that two parties of investigators are at present working along the border between Alberta and Saskatchewan developing oil claims. He had recently seen samples in Regina of oil found in the Carrot River country and Lake of Rivers. A detailed study of the secrets of the rocks, their structure and character was essential to the discovery of oil. Although the water supply in this district was not a very acute problem, Dr. Camsell believed that before very long Regina and Moose Jaw would soon be faced with a shortage, and in this work the Department of Mines was conducting researches in underground water supply.

Preservation of Wood

R. D. Prettie, of the Alberta Wood Preserving Company, of Calgary, spoke at length on the preservation of wood. Wood preservation was the art of protecting wood from decay. The speaker outlined the history of this art, which dated from the days of the Egyptians. Its importance was shown by the fact that there are now 162 wood preservation plants in the United States. In 1924, in Canada 2,086,180 telephone, telegraph and power line poles were treated to save them from the ravages of the fungi.

Describing the fungi and their activities, Mr. Prettie said he had often heard telephone engineers remark that the poles now do not last like the poles they used to get. These engineers have not taken into consideration the fact that the new poles were set in soil permeated with the mycelia of wood-destroying fungi. Creosote was the treatment most successfully used for the preservation of wood, although zinc chloride was also very successfully used.

Visit to Mines Near Estevan

On Saturday the party visited some of the more important mines in the Estevan field. Trips were made to the Crescent collieries, where a new shaft is being sunk. The party then divided into two groups, headed by R. J. Lee, Dominion inspector of mines, and E. Pierce, provincial inspector of mines. The former visited the Manitoba and Saskatchewan collieries at Bienfait and the latter the Western Dominion collieries at Taylorton. Both groups descended the mines and inspected the various operations underground. Much interest centred around the electrically-driven cutting machine and mechanical box car loading equipment. The coal seams at both of these mines average about 12 feet in thickness and are located about 80 feet below ground. The coal is considered of a better grade than in the Truax mines of North Dakota, the selling price of each being the same at tipple, viz.: $2.50 per ton for best lump.

Luncheon was given by the M. & S. and Dominion collieries in the community hall of the former company, where slides illustrating the mining operations were shown by Mr. Galloway, manager of the M. & S. collieries.

The return trip to Estevan was made via Roche Percée. Here the party inspected the pierced rocks, a peculiar geological formation caused by the weathering of the sandstone rocks, from which the village obtained its name. On some of the protected faces of these rocks ancient Indian drawings are to be seen.

Later a visit was paid to the Prairie nurseries, the largest nursery in western Canada, comprising over 700 acres. Many of the plots were inspected under the direction of Mr. Torgeson, president of the nurseries. The guests finally assembled at the nursery headquarters, where they enjoyed a sumptuous repast. Each lady was presented with a bouquet of white peonies taken from the nursery plot, where 40,000 of this species of flower alone were in bloom.

Some of the party left for their homes on Saturday, while others remained in camp over Sunday. All voted the meeting a great success, despite the inclemency of the weather and consequent condition of the roads. The citizens of Estevan spared nothing in catering to the success of the gathering.

Preliminary Notice

of Applications for Admission and for Transfer

July 19th, 1926.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in September, 1926.

R. J. DURLEY, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BRUCE—WILLIAM JOSEPH, of Maniwaki, Que., Born at Gamebridge, Ont., Jan. 6th, 1888; Educ., C.E., Univ. of Toronto, 1907; during undergrad. course constrn. and location as chainman, rodman, instrman and topographer with C.N.R.; 1908, mining claim surveys, Haileybury, Ont.; 1910, asst. engr., Dom. Land Survey, Peace River; 1911, res. engr. C.N.R., Cobourg to Deseronto. Ont.; 1912, asst. engr., city surveys and bridges and docks dept., Toronto; 1913-19, asst. engr., Dept. of P. W., Sault Ste. Marie, Ont.; 1919-21, asst. engr. i/c dredging and constrn. for Great Lakes Power Co., Sault Ste. Marie; 1921-23, dist. engr., Northern Devel. Branch, Swastika, Ont.; 1924, topographical survey, Watabeag Lake area; 1924-25, engr. and supt., Chisholm Constrn. Co., Cornwall, Ont.; at present, engr. i/c surveys for Foundation Co. of Can. Ltd.

References: H. T. Routley, A. E. Pickering, H. V. Serson, W. J. Bishop, J. W. LeB. Ross, R. A. Baldwin.

FISHER—FREDERICK SORLEY, of Montreal, Que., Born at Edmonton, Alta., Nov. 19th, 1901; Educ., B.Sc., University of Alberta, 1924; 1919 (summer), testing and installing meters, City of Edmonton electric light dept.; 1920-21 and 22 (summers), inside and outside telephone mtce., Alta. Gov't. telephones; 1923 (summer), power plant installation at Edmonton and Calgary for constrn. dept., Can. Westinghouse Co.; 1924 to date, equipment engineering, Northern Electric Co. Ltd., Montreal, manual telephone equipment.

References: W. C. Adams, R. W. Boyle, R. S. L. Wilson, J. D. Peart, W. L. Dawson.

FRASER—ARCHIBALD NORMAN, of Ottawa, Ont., Born at Coaticooke, Que., June 26th, 1885; Educ., B.Sc., McGill Univ., 1909; 1909-14, Allis-Chalmers-Bullock Ltd. (Can. Allis-Chalmers) as, 1919, shop course in elect'l dept.; 1910, dfting and engrg. offices, several months i/c elect'l testing dept.; 1911, i/c installation of elect'l plant and apparatus, inc'l. supervision of acceptance tests, testing and installation of elect'l pumping plant for municipal use; 1914, joined Radio-telegraph Branch of Naval Service; 1915, asst. on constrn. of medium power wireless station at Barrington Passage; 1915, enlisted as sub-lieut. R.N.C.V.R. and appointed officer i/c Barrington station; 1917, supervised enlarging of Barrington station, lieut. R.N.C.V.R.; 1918, tsfd. to Halifax Dockyard, i/c dept's East Coast wireless organization; 1920, returned to civilian status as asst. radio elect'l engr.; 1921, tsfd. to Ottawa; 1922, promoted to elect'l engr.; 1926, promoted to senior radio elect'l engr.

References: C. P. Edwards, W. A. Rush, J. D. Craig, K. M. Cameron, T. C. Phillips.

KING—HARRY MOLYNEUX, of Niagara Falls, Ont., Born at Brooklyn, N.Y., Sept. 12th, 1877; Educ., Common School; 1903-06, substation constrn. for Narragansett Electric Lighting Co., Providence, R.I.; 1906-10, erecting apparatus for Westinghouse Electric & Mfg. Co., Buffalo; 1910-20, elect'l supervisor, Ont. Power Co., i/c elect'l constrn. and mtce.; 1920-23, as above and inc'l operation; 1923 to date, operating supt., Ontario Power Plant, H.E.P.C.

References: E. T. Brandon, H. L. Bucke, G. E. Kewin, N. R. Gibson, W. Jackson, T. H. Hogg, H. G. Acres.

LEDGER—WALTER, of Birchcliffe, Ont., Born at Sheffield, England, March 16th, 1892; Educ., univ. matric., Sheffield Royal Grammar School, 1910; 1907-10, mech. dfting, Edgar Allen & Co. Ltd., Sheffield; 1910-18, surveying and dfting, Toronto Electric Light Co. Ltd.; 1919 to present time, surveyor for Toronto Hydro-Electric System, includes supervision of location and constrn. of overhead and underground extensions, and doing necessary supervisory engineering and surveying for building constrn. and extensions.

References: P. E. Hart, J. A. Tilston, G. A. McCarthy, C. A. Scott, F. B. Goedike.

MOUNTFORD—GEORGE COLLEDGE, of Chippawa, Ont., Born, Birmingham, Eng., April 6th, 1875; Educ., Saltly Coll. School, 1886-91; 5 yrs. apptceship with John Hand & Son, engrs., Birmingham, 1891-1896; 1896, landed in New York; 1896-1910, on constrn. as mech. at Edison plants and steamship companies, on road erecting for Harrisburg Engine Co., erector for New England Engrg. Co., New York, and Am. Supply & Constrn. Co., New York, i/c constrn. and installation of machry, elect'l and mech'l installation at Ont. Power Co., Niagara Falls, for Can. Gen'l Electric Co.; 1912, master mech., Can. Niagara Power Co., Niagara Falls, Ont., i/c plant mtce and installation of 7, 8, 9, 10 units; 1917-19, in Can. Navy at Halifax, N.S., ch. engine room artificer, 1st class second engr. on H.M.C.S. Acadia, ch. engr. on H.M.C.S. Arras; 1919, mech. supervisor, Ont. Power Plant, Niagara Falls Hydro-Electric Power Co.

References: T. H. Hogg, F. H. Farmer, J. R. Bond, A. D. Huether, G. E. Templeman.

NORRIS—RICHARD NORMAN BOND, of Montreal, Que., Born at Manchester, Eng., Dec. 10th, 1884; Educ., 1901-04, Bolton Tech. School, mech. engrg. course, 1904-06, apptce., Hick Hargreaves, engine builders, Bolton, Lancs., 1906-09, apptce., Dick Kerr & Co., Preston, elect'l engrs.; 1909-12, ch. asst. contract engr., Dick Kerr & Co., i/c complete installation work on various power installations; 1912-19, mgr. for Glasgow branch of Harland Engrg. Co., responsible for design and constrn. of all work covering private industrial power plant, colliery installations, shipyard elect'l equipment, etc.; 1913, with W. G. Warburton, did all development on Harland patent sectional electric drive for paper machines; 19 4-19, organized shell works, Glasgow, and operated some throughout War period, engineering design for company manufacturing magnesite bricks, organized 5 brick plants, including building design and mach'l installations; 1919-21, director, Harland Engrg. Co., England; 1921 to present time, managing director, Harland Engrg. Co. of Canada Ltd., responsible for conduct of this business in Canada.

References: H. Kay, H. S. Taylor, F. O. White, John Stadler, F. T. Peacock, G. F. Hardy, H. S. Ferguson.

SCHREIBER—JOHN W., of Pittsburgh, Pa., Born at Pittsburgh, Pa., June 15th, 1884; Educ., M.E., Univ. of Pittsburgh, 1907; 1907-08, dftsman for Jones & Laughlin Steel Co., Pittsburgh; 1908-09, structural designer and asst. ch. engr., Darley Engrg. Co., structural steel design and i/c field constrn.; July to Dec. 1909, engr., A. Laughlin & Co., design and special investigation of open-hearth and heat-treating furnaces; 1909-17, engr., Aluminum Co. of America; 1909-14, general industrial work; 1914-17, i/c all mechanical engineering; 1917 to date, asst. to ch. engr., Aluminum Co. of America, i/c all engineering design and field constrn.; for past year, consulting engr. for Aluminum Co. of Canada Ltd., on design and constrn. of new plant and townsite at Arvida, Que.

References: F. C. Newell, F. P. Shearwood, D. C. Tennant, G. H. Duggan, F. H. Kester, W. S. Lee, LeR. Wilson, H. R. Wake.

WARING—JOHN KNOX, of Toronto, Ont., Born at Bolton, England, Sept. 5th, 1901; Educ., 12 mos., Univ. of Toronto (engineering), 1919 and 1920, Gov't course, 1924 and 1926, 2 yrs., inc. final years in maths., Toronto Tech. Schools; 1921-22, dftsman, Can. Fire Underwriters; 1922-26, dftsman, sewer section, Dept. of Works, City of Toronto.

References: G. Phelps, L. L. Campbell, S. G. Talman, F. J. Hancox, G. F. Paterson, J. H. Curzon, J. H. Irvine.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

McPHAIL—DONALD STUART, of Lahore, India, Born at Tulloch, Jamaica, B.W.I., May 23rd, 1893; Educ., B.Sc., McGill Univ., 1920; 1913 (summer), asst., Jamaica Gov't Ry.; 1914 (summer), asst. with Canada Geological Survey (topographical section); 1915-19, with Royal Engineers, Captain; May to Dec. 1920, asst. engr. with Fraser Brace & Co. Ltd. on constrn. of 4,500 h.p. hydro-electric power plant at Cornwall, Ont.; 1921-22, sr. asst., Jamaica Gov't Ry., on preliminary and reconnaissance surveys; 1922-23, asst. engr. with United Fruit Co. in Guatamala, C.A., location and constrn. of rys. and steam tramways, general surveys, etc.; Oct. to Dec. 1923, i/c topographical survey for dam reconstruction for Jamaica Public Service Co., including plan, elevation and sections of existing dam; 1924-25, asst. engr. with Sir W. G. Armstrong-Whitworth & Co. Ltd. on constrn. of paper mill, laying out and general supervision of substation, wood room, slasher-mill, conveyor system, mill-roofing, etc., at Corner Brook, Nfld., March to June 1924, with same company in London, England; at present time, executive engr. i/c hydraulic project division of the Mandi hydro-electric scheme.

References: H. M. Mackay, E. Brown, J. B. Hayes.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

COLLYER—ERNEST, of Toronto, Ont., Born at Fort Ellice, Man., Jan. 18th, 1899; Educ., B.Sc., Queen's Univ., 1923; 5 mos. constrn. work on power house and dam; 5 mos. in experimental labs. of General Motors Co., Detroit; 5 mos. instrumentman on power development survey, Northern Ont.; 15 mos. test course with General Electric Co. as student engr.; 1923-24, i/c tests, General Electric Co.; 1924-25, inspector and architect's representative on Univ. of West. Ont. college bldg. constrn., and asst. to H. P. Elliott, consulting engr., London, Ont.; 1925 to present time, erecting engr., Can. General Electric Co., Toronto, Ont.

References: D. M. Jemmett, G. N. Thomas, W. A. Bucke, L. M. Arkley, R. R. Knight.

COSSITT—LAWRENCE SULIS, of Montreal, Que., Born at Smith's Cove, N.S., May 3rd, 1899; Educ., B.Sc., McGill Univ., 1924; May to Jan. 1919, cadet in R.A.F.; 1920-21, machine shop work with Clarke Bros. Ltd., Bear River, N.S.; 1922-23, dftsman, Atlantic Sugar Refineries, St. John, N.B.; 1924-26, Production dept. of Northern Electric Co., Montreal; since April 1926, dftsman in estimating dept. of Robert Mitchell Co., Montreal.

References: G. Alan, J. S. Cameron, H. H. Vroom, C. M. McKergow, A. R. Roberts.

GRAY-DONALD—ERCELDOUNE, of Montreal, Que., Born at Amoy, China, Dec. 29th, 1900; Educ., B.Sc., McGill Univ., 1926; 1917-19, clerk, Vickers Limited, London, England; 1919-21, clerk of works & asst. engr., Dept. of Public Works, Gov't. of Palestine; 1922 (summer), asst. to res. engr., Lockwood Greene & Co. of Canada, Valleyfield, Que.; 1923-24, dftsman, Toronto Hydro-Electric System; 1925 (summer), electrician on inspection and installation, Toronto Hydro-Electric System; at present time, apprenticeship course with Shawinigan Water & Power Co.

References: H. M. MacKay, E. G. Burr, E. Brown, C. V. Christie, H. W. B. Swabey, G. J. Dodd.

PARKER—WALTER J., of Preston, Ont., Born at Toronto, Ont., Jan. 14th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1921; 1916-19, overseas with Can. Engrs. attached to div. signal co.; 1920 (summer), instman, Roadways Dept., City of Toronto; 1921, inspector, Dept. of Public Highways of Ont.; 1922-23, vice-pres. and supt., Stewart Constrn Co., of Preston, highway and general concrete work; 1924-25, estimating engr. for Metal Shingle & Siding Co., Preston, building materials and light steel structures; 1925 to June 1926, asst. engr. on survey of Lake Maracaibo, Venezuela; at present time, res. engr., Dept. of Northern Devel., Prov. of Ont., on highway work.

References: H. L. Seymour, C. H. Fullerton, A. K. Grimmer, A. H. Greenlees, I. P. MacNab.

POLLOCK—FRANK JONES, of Walkerville, Ont., Born at Almonte, Ont., Mar. 8th, 1896; Educ., B.A.Sc., Univ. of Toronto, 1922; 1916-19, overseas, Can. Field Artillery; 1920-22, Dept. of Militia & Defence as rodman, chainman and instrumentman on militia surveys; 1922 to present, transmission tower dept., Can. Bridge Co., Walkerville, detailing and checking shop drawings, supervision of tower tests and assisting in tower and substation design.

References: P. Gillespie, G. F. Porter, F. H. Kester, A. E. West, A. J. M. Bowman, C. M. Goodrich, J. B. Cochrane.

RICHARDSON—RODERICK McDOUGALD, of Montreal, Que., Born at Eureka, N.S., Apl. 19th, 1897; Educ., B.A., Dalhousie, 1922, B.Sc., McGill, 1924; summers of 1920-21 and 22 on erection, mtce. and operation electrical machinery, Intercolonial Mining Co., Westville, N.S.; 1923 (summer), operating engr. in power house of same company; 1924-25, asst. field engr., Montreal div., plant engr's dept., Bell Telephone Co.; Aug. 1925 to date, foreman, cable mtce. in constrn. dept., Bell Telephone Co., Montreal div.

References: A. M. MacKenzie, G. M. Hudson, A. D. Ross, A. A. Turnbull, C. V. Christie, W. P. Copp, G. A. Wallace, E. Brown.

STAIRS—HENRY GERALD, of Temiskaming, Que., Born at Halifax, N.S., Jan. 8th, 1904; Educ., 1921-25, Dalhousie Univ. in engrg; May to Sept. 1921, chainman, N. S. Prov. Highway Board; 1922-23, chainman and rodman on constrn. of Interprov. and James Bay Ry.; 1924-25, instrumentman, N. S. Prov. Highway Board; 1925-26, ch. of party and dftsman, Bridgeman & Collen, civil engrs., West Palm Beach, Fla.; at present, rodman, Town Dep't., Temiskaming, Que.

References: W. P. Copp, A. R. Babbitt, H. R. Theakiston, H. S. Johnston, C. J. G. Luck.

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The Stability of Masonry Dams

A Review of Theories of Stresses in Dams, the Results Obtained in the Investigation of Stresses by Various Methods, the Factor of Safety and the Necessity of Further Investigations and Research

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The principles underlying the design of dams will be readily admitted to be of great importance, and particularly so in Canada and to Canadian engineers, because no other country has the construction of as many dams to look forward to as has Canada, and it is to be hoped and expected that these Canadian dams will be designed and built by Canadian engineers. This paper has been written in the hope of stimulating investigation and research in regard to these principles, with particular reference to conditions encountered in this country.

Practically the whole theory of dam design, in so far as internal stresses are concerned, has been developed by French and English engineers, and Canadian dams are of a class distinct from Europe in that, generally speaking, European dams are high dams on small streams and generally impound water for municipal supply or for the operation of canals, whereas it might be said that there is not a single high dam in Canada, and the great bulk of the important dams are from thirty to sixty feet high, and are built on streams of heavy discharge for power purposes.

There is perhaps no definition of the dividing line between high and low dams, but it might conveniently be considered as the point at which in a solid, purely gravity section it becomes necessary to flatten the downstream slope in order to keep the compressive stresses within the limits set. The exact height at which this would occur would vary with the characteristics of the profile as well as with the compressive stresses allowed, but would generally be about 150 feet.

The fact that Canadian dams are usually well below this height alters the problem from the European one of limiting the compressive stresses at the faces to safe values, to one where safety against overturning is the principal consideration.

The fact that there are many low dams in Europe on streams of considerable discharge is not here overlooked, nor is the fact that high dams must also be safe against overturning, but a study of European writings on the subject makes it evident that the limiting of compressive stresses has received greater attention there.

Review of Theories of Stress in Dams

The scientific investigation of stresses in masonry dams without reinforcement was begun by DeSazilly, Delocre and Bouvier in France, and Rankine in England between 1853 and 1875, and, so far as any tangible effect on the conception of stresses as affecting the design of dams is concerned, it might almost be said to have ended there.

DeSazilly introduced the "profile of equal resistance," and produced general differential equations for this profile. He was, however, unable to integrate these equations.

Delocre refined the profile and introduced the method of basing calculations on a slice of dam of unit thickness. He produced formulæ which were workable, although involved.

Rankine enunciated the middle-third rule, and pointed out that the maximum vertical pressure on horizontal planes is not the maximum compressive stress encountered.

Bouvier, basing his reasoning on LeBlanc's earlier work on the stress in arch rings, derived an expression for the maximum compressive stress, which he found to be the maximum vertical stress on the horizontal plane divided by the square of the cosine of the inclination of the resultant to the vertical.

The great bulk of the work which has been done in later years has been devoted to attempting to find general formulæ for facilitating design and to the consideration of external forces, such as uplift and ice pressure, and to the development of the various types of hollow and arched dams.

The exception to this statement is found in the work of Atcherley and Pearson, Sir Benjamin Baker, Ottley and Brightmore, Wilson and Gore, Unwin and Cains. This was done between 1905 and 1908. It dealt both theoretically and experimentally with the internal stresses in solid dams, and, although it seems to have had no practical effect on dam design, it might very well have done so.

The first experiments in this series were those of L. W. Atcherley, carried out at University College, London, " with some assistance from Prof. Karl Pearson." Two models were made to scale from the dimensions of a dam actually built. They were of wood, one being laminated horizontally and the other vertically. Weights were applied to each to represent water pressure, and it was found that the vertically laminated model failed at a lower pressure than the horizontally laminated model. From this fact, and from the fact that the vertically laminated model, in failing, first opened up cracks at the downstream toe, Atcherley and Pearson were led to the conclusion that tension would exist in actual dams on vertical planes before, or rather than, on horizontal planes.

Proceeding to verify this conclusion theoretically, the authors commenced with the rather bold statement that as the trapezoidal law was generally assumed, " it might with almost equal validity be assumed " that the shear on horizontal planes varied as the ordinates to a parabola. The expression *trapezoidal law* refers to the assumption of uniformly varying normal stress on horizontal planes which makes the stress diagram a trapezoid.

In an appendix to the memoir, in which the authors further elaborate their reasons for the assumption of parabolic distribution of shear, the following appears,—

> " If it be asked why is our parabolic distribution of shear on the base any more justifiable than the linear, the answer must be three-fold,—
>
> "(1) We have not confined our attention to a parabolic distribution, but considered also a linear distribution as another extreme;
>
> "(2) Both lead to a sensible tension in the tail;
>
> "(3) If the dam were built with vertical tail, it would show shear on the vertical line at the junction with the foundation."

The term *base*, as used above, appears to have been intended to cover all horizontal planes. This answer is not conclusive, and seems to have been widely criticized at the time. It must be understood in this connection that once the trapezoidal law is accepted and a shear distribution is assumed, the whole state of stress at any point in the dam is virtually determined. The total shear on a horizontal plane is not a matter of conjecture; it must equal the total force imposed by the water pressure down to that plane, and, a parabolic distribution of this shear being assumed, the value at any point is determined, and the excessive tensions on vertical planes at the tail found by Atcherley and Pearson follow at once.

The results obtained attracted wide attention, particularly in Europe. The remarks made by Sir Benjamin Baker, in the course of discussion at the Institution of Civil Engineers, indicate that the proposal to increase the height of the Assuan dam was postponed on this account, and Mr. E. Mattern stated that important works were in contemplation at the time in Germany, and doubt arose whether they could be economically carried out on the sections indicated as necessary by the Atcherley experiments.

Sir Benjamin Baker also made models, which were much more impromptu affairs than those of Atcherley and Pearson. They were made of ordinary jelly and the experiments covered only a few hours. No attempt was made to obtain quantitative results, the idea being to demonstrate the general nature of the distortion of an elastic mass when subjected to forces similar to those which act upon a dam.

Sir Benjamin commented very favourably on the work of Atcherley and Pearson, in so far as it had drawn attention to phases of the relationship of stresses in dams which required further investigation. He did not, however, agree with the conclusions as to tension on vertical planes.

At a meeting of the Institution of Civil Engineers in January, 1908, a paper was read by Sir James Ottley and A. W. Brightmore, and another by J. C. Wilson and Wm. Gore. These described further experiments with model dams. They represented a great deal of work, Ottley and Brightmore's researches having occupied some fourteen months.

The model used by Ottley was made of plasticene, a substance whose chief characteristic is its plasticity, but which was found to be elastic beyond the point to which it was stressed in the experiments. The model was of considerable size and weighed over 100 pounds. Water pressure was applied by means of a rubber bag filled with water. The cross-sectional face of the model was ruled off into squares, and, after water pressure had been applied, the distortion was measured. In this way, from an assumed stress-strain relationship, the stresses were obtained.

The experiments of Wilson and Gore were carried out with a model of India rubber blocks. It was comparatively small and forces representing weight and water pressure were applied externally. The construction of the model was carried out with great care. Each block had a hole drilled through its centroid. This hole was fitted with a bronze liner through which in turn was passed a steel rod to the extremities of which the weight for increasing the weight of the model was attached by cords. There were about 180 weights attached to the model, including those representing water pressure.

A careful set of observations was made to establish the stress-strain characteristics of the India rubber used, and the anticipated distortion calculated. The model was then built in such a form that when the weights were applied it would arrive at the form desired, which was a scale model of a dam already built. The cross-sectional face of the model was marked off into squares, and photographs of the cross-section were taken with and without the weights representing the forces acting. The differences between the two sets of photographs were measured to give the distortion. Measurements were made to the 1/1000th of an inch, and great care was taken in all the details of the experiments. It will be noted that these experiments, as well as those of Ottley and Brightmore, gave quantitative results and assigned values to the stresses, as distinguished from those of Atcherley and Baker, which only attempted to discover their nature.

The result of the experiments of Ottley and Brightmore, and Wilson and Gore, and the calculations made by their authors and by others at about the same time, notably Maurice Levy, E. P. Hill and Prof. Unwin, was to reverse the finding of Atcherley as to the existence of tension on vertical planes at the downstream toe of a dam designed so as to place the resultant pressure with reservoir full at the extremity of the middle-third of the horizontal plane.

All the calculations made at this time assumed the trapezoidal law to be practically true, (this being also in accord with the measured results obtained with elastic models), and, as indicated above, the whole question of the nature and amount of the internal stresses then reduces itself to one of shear distribution. The action of the models

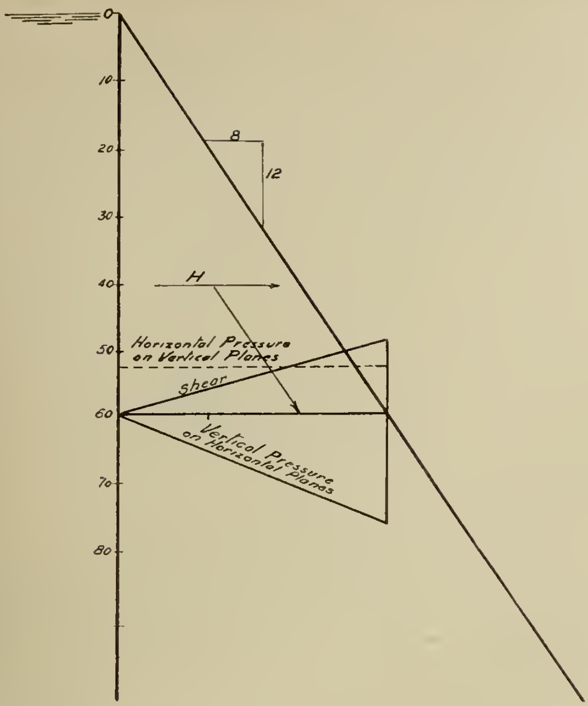

Figure No. 1

showed a triangular distribution of shear for triangular dam sections, except at elevations sufficiently near the foundation to be affected by the abrupt change of section.

Calculations made by Prof. Unwin, and by Hill and Cains, (and previously and independently by Levy in France), bear out this triangular shear distribution. The method of Cains* is perhaps the most easily worked.

Figure No. 1 indicates the distribution of vertical pressure on horizontal planes, shear, and horizontal pressure on vertical planes, as outlined above.

Relative Value of Compression and Shear

As methods of deriving the shear distribution and thence the complete state of stress at any point in the section have been given elsewhere, it is not the intention to recite them at length here. Cains' method, applied to a purely triangular profile with vertical face and water level with the top, and with the resultant at the extremity of the middle-third, gives the results tabulated in table No. 1, the stresses being in masonry units.

A purely triangular section has been used because, with this section and with water level with the top, all stresses vary proportionately to the distance from the top, and a solution on one plane can be transferred to another by using a suitable factor. Also, the higher powers which appear in the equations for more complicated profiles are not encountered. Much labour is thus saved and the results, from a theoretical standpoint, are not altered.

The corresponding ellipses of stress are shown in figure No. 2, along with some intermediate ellipses derived from them. It will be noted that the ellipse at the downstream face is a straight line, as it must of necessity be because there would be nothing but atmospheric pressure to resist any normal pressure. Also, if the general method of deriving inclined stresses from ellipse of stress be followed with regard to the principal stress at the downstream face, then the vertical pressure on the horizontal plane is $\frac{86.67}{1\times\tan^2\Theta}=60$. It will be noted that Bouvier's expression for the maximum compressive stress would be $86.67\times\cos^2 33°40'=60$. This exact agreement would only appear in a triangular section and at the downstream face. The vertical stresses obtained from the trapezoidal law do not represent the vertical component of the maximum compressive stress. They represent the vertical component of the total stress on the horizontal plane, which is quite a different matter.

Table No. 1:—Distribution of Stress Obtained Through Application of Cains' Method, as Applied to a Purely Triangular Profile with Vertical Face and Water Level with Top, and with Resultant at Extremity of Middle-Third.

h	x	p	s	q	f	f'	Θ
45	.0	.0	20.	.0	20.	.0	90°
45	3.75	5.625	20.	3.75	20.9	4.725	76°16'
45	7.5	11.25	20.	7.5	24.3	6.95	60°8'
45	11.25	16.875	20.	11.25	29.8	7.1	48°52'
45	15.	22.5	20.	15.	36.3	6.2	42°37'
45	18.75	28.1	20.	18.75	43.2	4.9	38°49'
45	22.5	33.75	20.	22.5	50.4	3.34	36°30'
45	26.25	39.4	20.	26.25	57.6	1.75	34°46'
45	30.	45.	20.	30.	65.	.0	33°40'
60	.0	.0	26.67	.0	26.67	.0	90°
60	5.	7.5	26.67	.5	27.88	6.3	76°16'
60	10.	15.	26.67	.10	32.41	9.26	60°8'
60	15.	22.5	26.67	.15	39.70	9.47	48°52'
60	20.	30.	26.67	.20	48.40	8.26	42°37'
60	25.	37.5	26.67	.25	57.63	6.53	38°49'
60	30.	45.	26.67	.30	67.20	4.46	36°30'
60	35.	52.5	26.67	.35	76.83	2.33	24°46'
60	40.	60.	26.67	.40	86.67	.0	33°40'

h=distance of joint from top of dam and water level.
x=horizontal distance from upstream face.
p=intensity of vertical pressure on the horizontal plane.
s=intensity of horizontal pressure on vertical plane.
q=intensity of shear on horizontal or vertical plane.
f=maximum principal stress=major axis of ellipse of stress.
f'=minimum principal stress=minor axis of ellipse of stress.
Θ=inclination of f to the vertical.

It will also be observed that the shear intensity $q=p\tan\Theta$, and as, at the downstream face, Θ must equal ϕ, where ϕ represents the inclination of the downstream face to the vertical, it follows that at the downstream face the shear equals the vertical stress on the horizontal planes multiplied by the tangent of the angle of inclination of that face. This gives a larger intensity of shear than is usually allowed for. After citing the shear thus obtained, one author neglects it on the ground that there is disagreement as to the correctness of the theory.

It may be true that there is disagreement, but it is as well to examine where the disagreement lies. It must be admitted that shear on the horizontal plane exists, and that it must be distributed. The question then narrows to one of the manner in which the distribution shall be made, leaving a choice between the parabolic distribution of Atcherley and Pearson and the triangular distribution. The former gives excessive tensions on vertical planes, and the latter high shear values. The fact that there is disagreement as to which of these two should be provided for, does not seem a sufficient reason for not providing for either of them.

One feature of the stress relationship derived from the Wilson and Gore experiments, which appears significant but which seems to have escaped notice at the time, is the value and arrangement of the minor axes of the stress ellipses. It will be seen in figure No. 2 that a line (yz) on which the normal stress is only about one-third of the hydrostatic pressure, runs into the profile. The effect of this, in the event

*Transactions of the American Society of Civil Engineers, Vol. LXIV, p. 208.

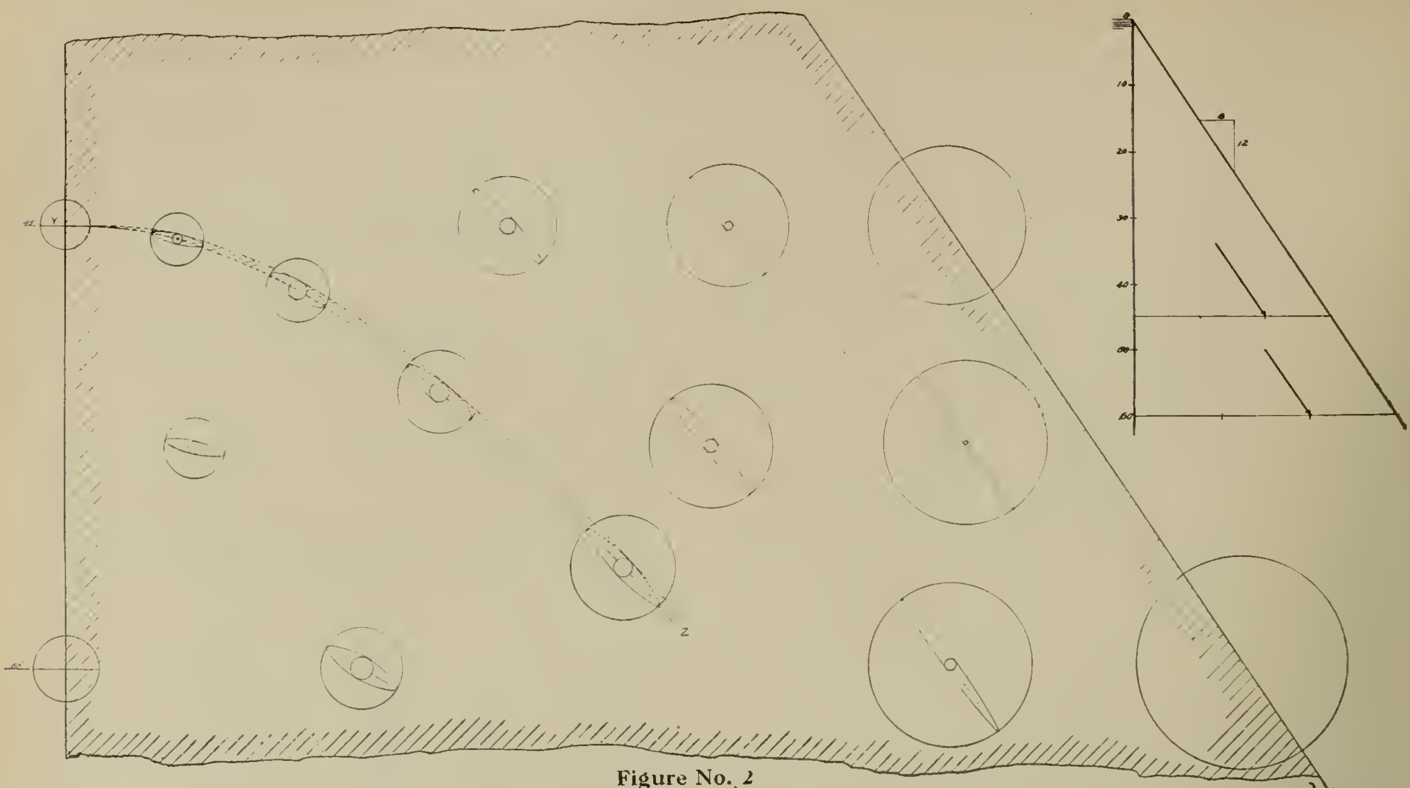

Figure No. 2

of water pressure entering a faulty construction joint, might conceivably be serious.

Factor of Safety in Dams

There is no point in connection with dam design about which there is more confusion, or at any rate conflicting opinions, than the factor of safety. A general survey of text books would perhaps lead to the conclusion that with the resultant at the extremity of the middle-third, there is a factor of two against overturning, plus an unknown but considerable value due to the tension strength of concrete, and minus the overturning effect of water entering horizontal cracks where the concrete has failed in tension.

It is obvious that the assistance due to tension strength and the additional overturning due to increased uplift will not in general be coincident, so that the factor would be 2± a considerable value. The first item is always disregarded in the calculations, but its value as a reserve of strength is probably counted upon more than it should be.

The second item is also usually disregarded in considering the factor of safety, but until we have more information as to whether tension cracks actually occur while the resultant remains within the profile and, if so, whether they are sufficiently large to permit water to enter, the stability should properly be considered with full head to the point where tension ceases.

It is not a difficult matter to integrate the compressive stress on the downstream face, and in connection with the stress-strain relationship obtain the contraction of this face, and a corresponding value for the increase of length of the upstream face, (which increase would be extremely small), but there might be a small number of relatively large cracks or a large number of relatively small ones. The total extension of the upstream face of a triangular dam 60 feet high with a 40-foot base with the water pressure increased so as to bring the resultant half way between the middle-third point and the downstream face would be of the order of 1/500th of an inch.

Apart from considerations of the possible effect of additional uplift in reducing the factor of safety, let us examine the effect upon the stress of multiplying the overturning moment by 2.

Let figure No. 3 represent the cross-section of a triangular dam in which the resultant cuts the base at the extremity of the middle-third of all horizontal planes. It follows from the fact that the section is triangular that the

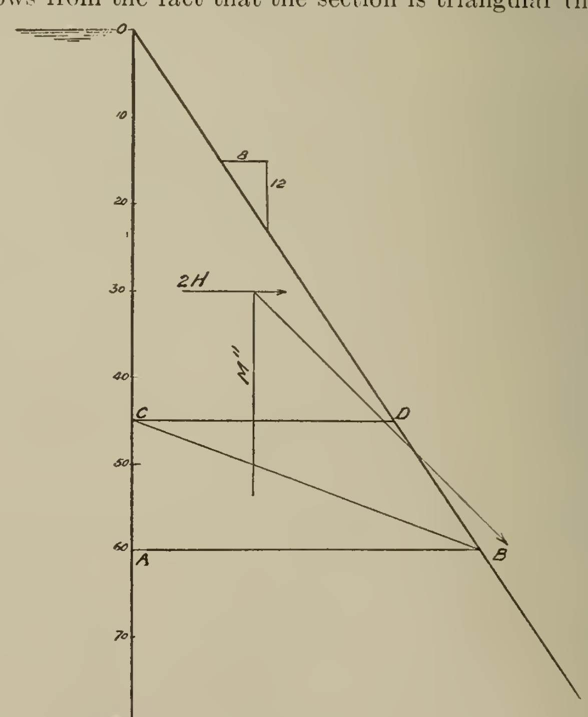

Figure No. 3

resultants of forces from above each horizontal plane will be parallel to the downstream face. If then the water pressure and hence the overturning moment be multiplied by 2, the resultants will cut each horizontal plane at its extremity. For simplicity in calculation, let it be assumed that the specific gravity of the masonry is such that a batter of 2:3 satisfies the condition that the resultant cut the base at the extremity of the middle-third, under ordinary water pressure.

Thus for a plane 60 feet from the top,—

OA = 60

AB = 40

M = weight of the section above AB = 1,200 (masonry units),

—the resisting moment = 32,000,

—the ordinary water pressure

$$H = \frac{Wh^2}{2} = \frac{.444 \times 60 \times 60}{2} = 800 \text{ masonry units}$$

and the overturning moment = 16,000.

Thus the factor against overturning = 2.

If now the water pressure be multiplied by two, the overturning moment = 32,000, and the factor against overturning will be 1.

Let CD represent a horizontal plane 45 feet from the top,—

OC = 45

CD = 30

M′ = weight of the section above CD = 675

—the resisting moment = 13,500

—the ordinary water pressure

$$H = \frac{Wh^2}{2} = \frac{.444 \times 45 \times 45}{2} = 450$$

and the overturning moment = 6,750.

If, as before, the water pressure be multiplied by two, the overturning moment = 900 × 15 = 13,500, and the factor is again 1.

Now consider the stability of the section above CB against overturning about B with water pressure × 2.

M′ = weight of the section above CD	= 675	
weight of triangle BCD	= 225	
M″ = weight of section above CB	= 900	
and the resisting moment = 675 × 30		= 20,250
225 × 16.66		= 3,750
		24,000
The overturning moment = 900 × 30		27,000

Evidently under ordinary water pressure the factor of safety of the section above BC against overturning about B is less than 2.

It can be shown that this result, obtained entirely from external forces, agrees with the results obtained from internal stresses.

From the definition of stability, if the resultant of the external forces acting on the section, (including its own weight but neglecting the supporting forces), cuts the base, then the section is stable and the moment of the resultant about the side of the base nearest it is a measure of the stability.

Similarly, if the moments of the external forces be taken about the side of the base nearest the resultant, their sum, (or difference), must be a measure of the stability.

Also, in figure No. 3, if the plane *AB* be considered as the base, the difference between overturning and resisting moments is a measure of the stability, and if the diagram of vertical stress on the plane *AB* be drawn, its moment about B is a measure of the stability, whether the diagram be drawn with or without tension.

Thus with ordinary water pressure and the resultant cutting the extremity of the middle-third, the difference of moments is 16,000 in foot-masonry units as given above, and if the vertical stress diagram be drawn, its area is 1,200 acting at 13.3333 from B or 16,000 foot-masonry units.

With water pressure multiplied by 2 and resultant cutting base at B, the difference of moments is zero, and if tension be disregarded the moment of the stress diagram is also zero, for the load would be concentrated at B.

Also, if tension be included we have,—

$$\text{Pressure at A} = \frac{M}{AB}\frac{(1-3\,AB)}{AB} = -\frac{2M}{AB} = -\frac{2400}{40} = -60,$$

$$\text{and at B} = \frac{M}{AB}\frac{(1+3\,AB)}{AB} = \frac{4M}{AB} = \frac{4800}{40} = 120,$$

and the moment of the tension diagram about

$$B = \frac{60 \times 13.333}{2} \times 35.55555 = 14{,}222,$$

and the moment of the compression diagram about

$$B = \frac{120 \times 26.666}{2} \times 8.88888 = 14{,}222,$$

The difference being zero, the moment of the stress diagram, whether tension is included or not, agrees with the moments of external forces.

Figure No. 4 represents the normal stress on the plane BC of figure No. 3. The ellipses from which the stresses are obtained are also drawn in figure No. 4, and the stresses tabulated in table No. 2.

The moment of the tension portion of the diagram = 9,950, and that of the compression portion = 7,000, leaving an unbalanced moment of 2,950, which agrees substantially with the results obtained from the moments of the external forces.

Table No. 2:—Distribution of Stress with Water Pressure Multiplied by 2.

h	*x*	*p*	*s*	*q*	*f*	*f′*	θ
45	.0	— 45.	40.	.0	40.	—45.	90°
45	3.75	— 28.15	40.	7.5	40.8	—28.8	83°48′
45	7.5	— 11.25	40.	15.	44.4	—15.2	72°42′
45	11.25	+ 5.63	40.	22.5	51.1	— 5.9	63°49′
45	15.	+ 22.5	40.	30.	62.5	0.	53°9′
45	18.75	+ 39.4	40.	37.5	77.2	+ 2.2	45°14′
45	22.5	+ 56.2	40.	45.	94.	+ 2.4	39°51′
45	26.25	+ 73.1	40.	52.5	110.8	+ 1.5	35°41′
45	30.	+ 90.	40.	60.	130.	0.	33°40′
60	0.	— 60.	53.33	0.	53.33	—60.	90°
60	5.	— 37.5	53.33	10.	54.5	—38.5	83°48′
60	10.	— 15.	53.33	20.	59.21	—20.88	72°42′
60	15.	+ 7.5	53.33	30.	68.16	— 7.83	63°49′
60	20.	+ 30.	53.33	40.	83.33	0.	53°9′
60	25.	+ 52.5	53.33	50.	102.91	+ 2.91	45°14′
60	30.	+ 75.	53.33	60.	125.06	+ 3.26	39°51′
60	35.	+ 97.5	53.33	70.	147.77	+ 2.06	35°41′
60	40.	+120.	53.33	80.	173.33	0.	33°40′

Note:—See foot of table No. 1, for explanation of signs.

If now the same conditions as before are assumed as to batter and location of resultant under ordinary water pressure, i.e., a factor of safety of two against overturning on horizontal planes, and if the water pressure and hence the overturning moment be multiplied by 1.5, the resultant will cut the base half way between the extremity of the middle-third and the downstream face. That is ED (figure No. 5) = CD ÷ 6.

Overturning moment = 450 × 1.5 × 15	= 10,125
and the resisting moment as above	= 13,500
Stability	= 3,375
Factor of safety = 1.333	

and this relationship will be true on any horizontal plane.

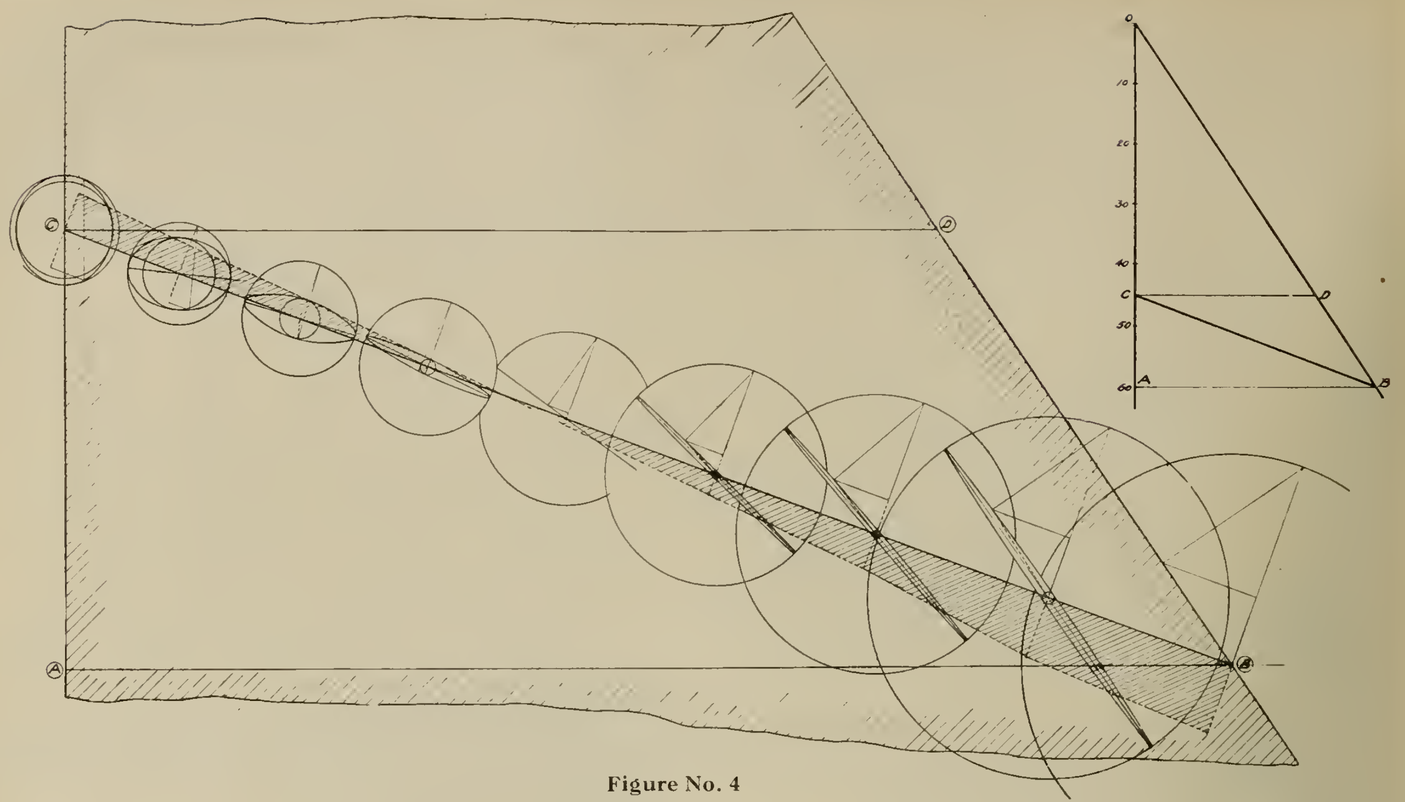

Figure No. 4

But if AB be the horizontal plane 70 feet from the top, consider the stability of the section above CEB.

M′ = the weight of the section above CD	=	675.
the weight of the triangle BED	=	62.5
M″ = the weight of the section above CEB	=	737.5
and the resisting moment = 675 × 36.66	=	24,750
62.5 × 13.77	=	850
		25,600
The overturning moment = 675 × 40		27,000

The section is therefore unstable with the overturning moment multiplied by 1.5. Hence, while the factor of safety against overturning on horizontal planes is 2, it is something less than 1.5 on CEB.

The stress diagram verifying this result is shown in figure No. 6, which also shows the stress ellipses. Stresses are given in table No. 3. It will be noted, however, that the stress diagram is drawn with B at the extremity of a plane 60 instead of 70 feet from the top, at which point the section is just stable. The moment of the tension portion of the diagram =3,620, that of the compression portion =3,813, and stability=183, and from the external forces the stability evidently equals the moment of the weight of the triangle BED=37.5 × 8.33=310, (because the line EB is the continuation of the resultant of the external forces above the plane CD and it passes through B), which result agrees substantially with the moment obtained from the stress diagram.

It may seem on first inspection that CEB is an unlikely line for a fracture to follow, but it coincides essentially with the line of fracture of the Bouzey dam. The result would not be greatly altered if ED were slightly increased, and the fracture might leave the profile anywhere between the intersection of the resultant with the downstream face and the point B.

So far as the author is aware, no dam has ever been known to fail on a horizontal plane, (other than its foundation), and if dams, when they fail, do not do so on horizontal planes, this in itself would seem an excellent reason for investigating other planes of weakness.

In connection with the above method of considering stability against rotation, about points on the downstream face at the extremity of downward inclined planes, it may be pointed out that the fracture can never cross the resultant. In triangular dam sections its application is limited to the examination of the factor of safety, because in a triangular section the resultants, (if they cut the horizontal planes at or inside the middle-third), will not, if produced, cut the downstream face. Sometimes, however, this method will show instability in headworks or the piers of stop-log dams, even when the resultants on horizontal planes are within the middle-third. Such cases are indicated in figures Nos. 7 and 8, which are self-explanatory.

The method does not lead directly to quantitative values for the stresses induced, but where the overturning moment exceeds the moment of resistance, stability must depend upon the tensional strength of the concrete, and the structure is evidently in a dangerous condition.

If the overturning effect of water entering cracks in the upstream face due to tension be allowed for, the factor of safety which has been shown to be less than 1.5 will be further reduced. It may almost be said that the factor of safety with the resultant at the extremity of the middle-third is 1.

One of three methods may be adopted for providing an increased factor,—

1. The resultant may be kept a sufficient distance inside the middle-third to give the desired margin.

2. The factor may be applied to the estimates of probable forces acting against the structure and the resultant kept at the middle-third with the increased forces.

3. The dam may be sufficiently reinforced on the upstream face to provide for tension resulting from multiplying the overturning forces by the factor.

Table No. 3:—Distribution of Stress with Water Pressure Multiplied by 1.5.

h	x	p	s	q	f	f'	Θ
45	0	—22.5	30	0.	30.	—22.5	90°
45	10	+ 7.5	30	15.	37.5	0.	63°26′
45	15	+22.5	30	22.5	49.06	+ 3.44	49°44′
45	20	+37.5	30	30.	64.	+ 3.52	40°22′
45	25	+52.5	30	37.5	80.4	+ 2.1	36°39′
45	30	+67.5	30	45.	97.5	0.	33°40′
60	0	—30.	40	0.	40.	—30.	90°
60	5	—15.	40	7.5	41.	—16.	82°22′
60	10	0.	40	15.	45.	— 5.	71°34′
60	15	+15.	40	22.5	53.3	+ 1.76	59°32′
60	20	+30.	40	30.	65.4	+ 4.58	49°44′
60	25	+45.	40	37.5	80.1	+ 4.91	43°07′
60	30	+60.	40	45.	96.1	+ 3.90	38°40′
60	35	+75.	40	52.5	112.8	+ 2.16	35°48′
60	40	+90.	40	60.	130.	0.	33°40′

Note:—See foot of table No. 1, for explanation of signs.

The first two methods may seem at first to be the same, but consider the case of a non-overflow section designed to resist water pressure with water level with the top.

Neglecting considerations of uplift and ice pressure, a factor of 2 by the first method would bring the resultant to the edge of the middle-third at the horizontal plane 60 feet from the top with 20 feet of water flowing over the top, at the horizontal plane 30 feet from the top with 10 feet of water flowing over the top, and so on, whereas the second method would assume a constant super-elevation of water for all planes. It will be seen that the section required would be quite different under the two assumptions.

A dam, or at any rate a dam under 100 feet high, would seem to demand different treatment as regards its factor of safety from other structures. In designing steel structures, for instances, the steel is stressed up to a point giving a definite factor on its elastic limit, but in a low dam the compressive stress is always so far below the elastic limit

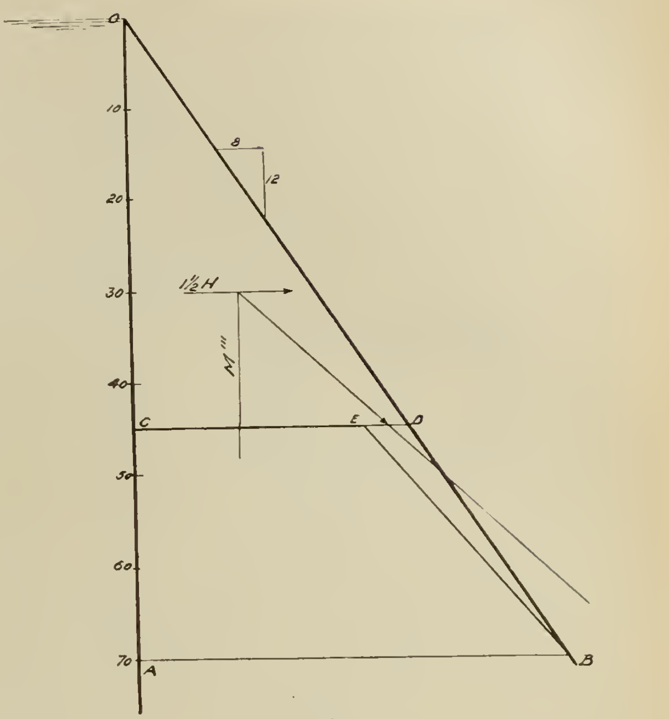

Figure No. 5

that a factor applied to it would have no practical meaning. The basis of design for low dams is really tension, and, as the tension stress allowed is zero, a factor cannot be applied to it. The factor must then be applied to overturning forces. These consist of the horizontal component of the water pressure, the uplift and ice pressure. The latter is something to which we are not now able to attach even an approximate numerical value, and it is quite likely that we shall never be able to do so. In these circumstances, a

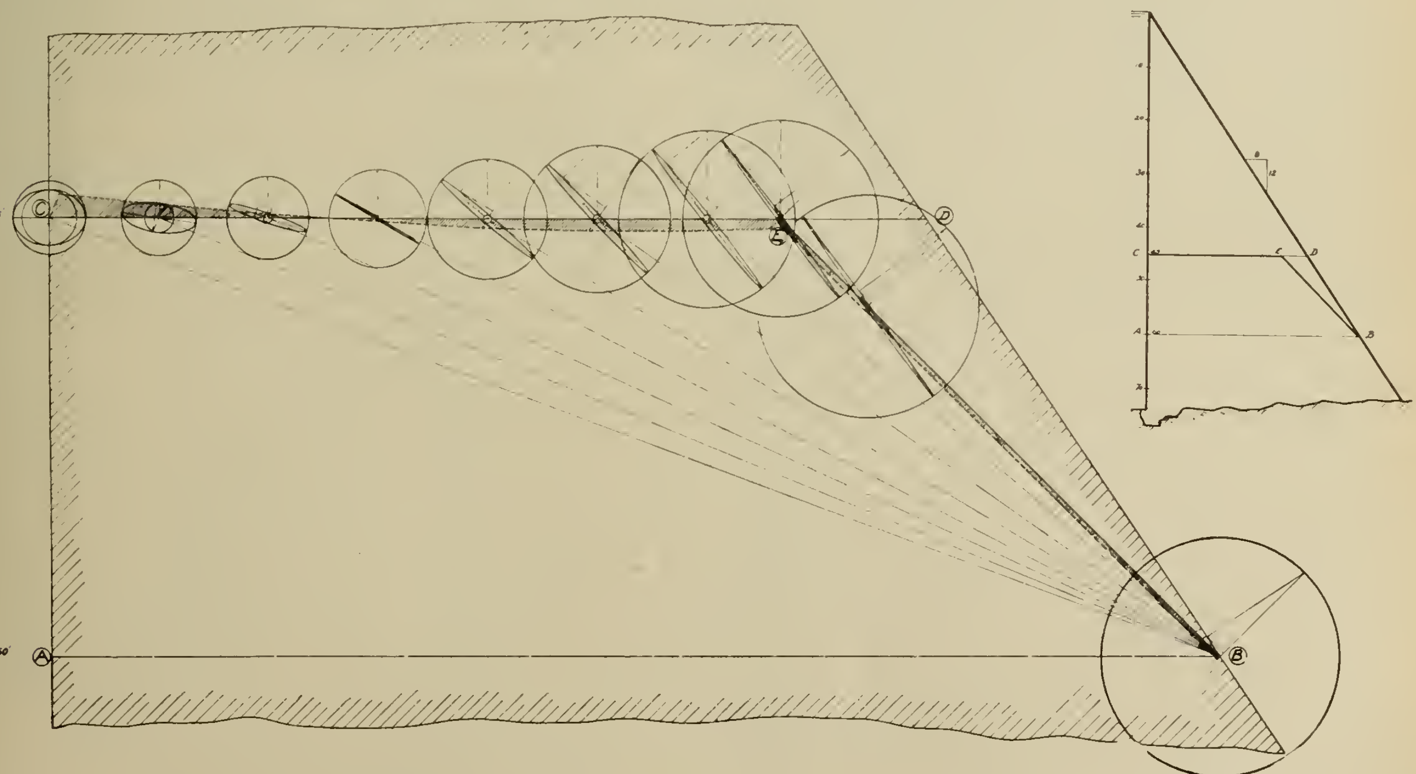

Figure No. 6

factor of safety is without significance; the ice pressure allowance might as well be assumed once and for all at the start. Both the uplift and the water pressure increase with the head, so that in increasing the head used in calculation, a more rational margin of safety is provided than by applying a factor to the overturning moment at each section. The latter method is really applying a margin of safety against increase in the specific gravity of the water.

An important advantage in the method of increasing the head calculated for, so as to provide the margin of safety, lies in the fact that in this way the upper portions of the dams are made proportionately stronger, and as most of the events which can be imagined as occurring to draw upon the factor of safety would impose stresses near the top, this seems desirable. It is not the intention here to go into the question of numerical values suitable for a factor to be used in this way. Any margin provided, however, must, if it is to be understood as corresponding at all to the meaning usually associated with the term *factor of safety,* represents an additional elevation of the water above anything that can be expected to occur. Merely to provide for an elevation that may be expected in the course of a few years to occur is to provide a factor of safety of one. It may be legitimate, however, not to consider the ice pressure as acting co-incidentally with the additional elevation of water in cases where co-incident action is manifestly impossible.

The third method mentioned, that of providing a factor of safety by vertical reinforcement of the upstream face, has already been advanced, but has been condemned, although reinforcement is generally used in the upper portion to provide for ice pressure and also in spillway crests. Two principal points were advanced against the general reinforcement of the upstream face,—first, a doubt as to the permanency of reinforcement imbedded in concrete near the face where it is constantly saturated with water, and, second, the difficulty of continuing the reinforcement into the base.

Data on the first of these objections should soon be available, if it is not already so, because it should be possible to judge from the changes in steel similarly imbedded for twenty or twenty-five years what change could be anticipated over the much longer periods which a dam is supposed to stand. In any case, all reinforced hollow dams are subject to this same action.

The second difficulty would be greatly reduced by the use of large bars at considerable intervals, the size of the bars being determined by the depth to which it is considered necessary to imbed them, from considerations of the physical structure and condition of the rock foundation. The deeper the hole, the larger the rod upon which the necessary bond strength can be developed. The holes in the foundation would in certain circumstances be a valuable source of information as to the condition of the rock.

The procedure would be to design the section to bring the resultant to the middle-third under the anticipated external forces. The section would then be fixed. The desired factor would then be applied to these forces, (or the water level increased as outlined above under the second method), and the steel required calculated under the method given for " flexure and direct stress " in various text books. The cost of providing a factor of two by this method for a sixty-foot dam would be about 10 per cent of the concrete cost, as compared with 40 per cent by method one. These percentages are, of course, not general. They are intended to indicate the difference in the cost of providing a factor of safety of two, (over and above any factor which is present when the resultant cuts the base at the middle-third), for a triangular dam section 60 feet high under water pressure only. They would represent the starting point of an investigation, not the end of one.

It may be remarked that French engineers, in their specification for high dams, allow a factor of safety of one, provided there is no chance of the assumed overturning forces being exceeded.

Here another, and perhaps the most important, difference between the high dam in the small drainage basin and the low dam on the large basin appears. To adequately estimate the overturning forces is not difficult in the first case, but it is extremely so in the second.

As an example, consider the effect upon the overturning moment at a plane 150 feet from the top of a dam 1,000 feet long on a river having a basin of 316 square miles of increasing the run-off from 20 c.f.s per square miles to 40 c.f.s. per square mile. This would mean an increase of about 3 per cent in the overturning moment at the 150-foot plane. (It is assumed that the additional run-off is discharged by spilling over the total length of 1,000 feet.)

Compare this with the effect upon a dam 50 feet high and 700 feet long with a 3,500-mile basin of making the same increase in the run-off. Here the overturning moment at the 50-foot plane is increased some 60 per cent.

Thus in the high dam, (which will in the nature of things generally be longer than a low one), on a small stream, the effect of even a great variation in the run-off is negligible, while in the low dam cited the effect is tremendous, and variation of flow and consequently of head is one of the principal factors which can be imagined as operating to cause the assumed overturning forces to be exceeded.

An examination of figures of run-off for floods of rare occurrence and of formulæ deduced from them, and a comparison of the flows thus obtained with those actually recorded in the few years of available observations on our Canadian rivers, will make it evident that the possibility of

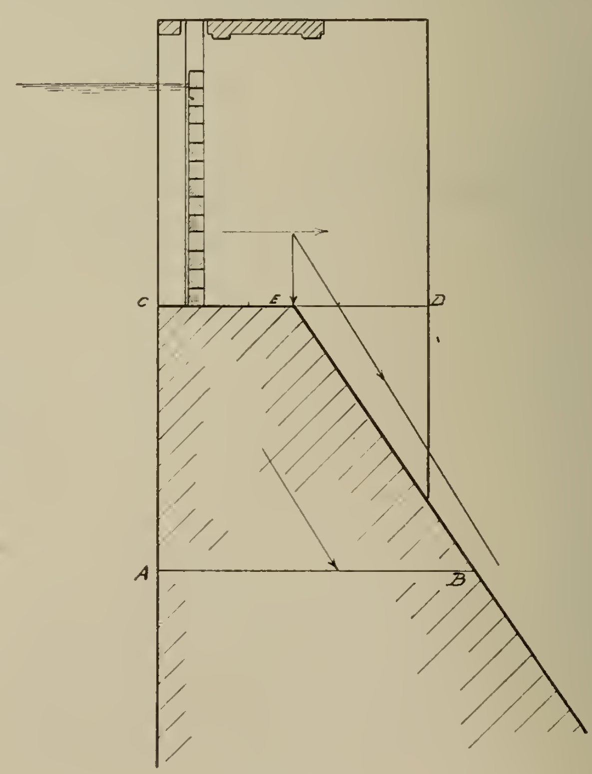

Figure No. 7

a maximum flow assumed for design being exceeded is not remote.*

To design the dam so that with the greatest even remotely possible flow the resultant still remains within the middle-third, is to provide a factor of safety under method two.

Need of Further Investigations

Any careful study of the theory of dam design as it stands to-day must lead to the conclusion that it is incomplete, if not actually erroneous, in some of its phases, and this is all the more significant as research in this direction appears to be at a standstill. We are left, for further information on this important subject, to the teachings of experience.

It is often said that experience is the best teacher, but it is always an expensive teacher, and, in the case of dams, the fee has often run into hundreds of lives and millions of dollars per lesson; and, in spite of the cost, or perhaps partly because of it, the results from an educational standpoint are very disappointing.

The Bouzey dam failed in 1895, and Prof. Unwin, speaking before the Institution of Civil Engineers on the report of the investigating engineers, said that there were, according to the report, so many reasons why the Bouzey dam should have failed that the world was left to wonder why it had ever stood up for a single day.

The case of the Gleno dam, which failed in December, 1923, is no better. This dam was a reinforced concrete multiple arch structure resting in the central portion on a solid masonry substructure. Judging from the articles which appeared in the American technical press, (which included a summary of the official investigation), one is led to believe that the materials and workmanship in the superstructure were bad, but the laboratory report shows the concrete to have had ample strength for the stresses it had to withstand, and although the failure occurred in the superstructure, the investigators are forced to the conclusion that the failure was due to the settlement of the masonry substructure under the central portions.

This block of masonry seems to have remained intact, however, and, in view of the fact that it is designated as the immediate cause of failure and of the criticisms made as to its stability and the quality of the work, it seems remarkable that no data is given supporting the supposition that settlement occurred in it, and that no tests were made on the strength of the masonry of this portion of the work.

Apparently tension existed at the upstream face of the superstructure, but we are told that the piers were reinforced, and, as no plans of the reinforcement have been published, either in the official government report or in the engineering papers, it is impossible to judge of the ability of the structure to withstand this tension.

So that, the lesson which cost humanity the lives of over 500 Italians and enormous property loss, is not of great value from a technical standpoint as it stands to-day. About the only conclusion we can draw is that people should not be allowed to build dams without adequate inspection of design, material and workmanship.

What we learn in this matter of the stresses in dams from experience must be learned from failures, because the fact that a dam designed according to certain assumptions

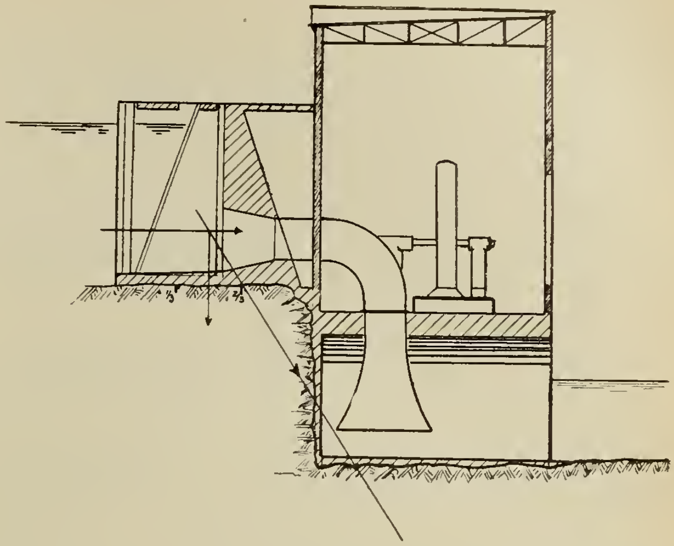

Figure No. 8

has not failed cannot logically be taken as proof that the assumptions used in design were correct.

It is not the intention of this paper to indicate that present ideas of design are all wrong, and that some day we shall see things entirely differently, nor is it the intention to picture the majority of existing dams as unsafe; but if it is admitted that our knowledge of the stresses acting in dams is incomplete, then it is evidently our duty to try to complete our theories so that we may get the maximum effect out of every yard of masonry placed and every dollar spent.

Much has been learned from dams that have failed, but a great deal remains to be learned. It might be said that we have a choice as to whether we shall wait for further lessons from experience or whether we shall attempt to get new information in some other way.

There is material before the profession which has not been digested. The data and theories resulting from experiments on elastic model dams in England referred to in the early part of this paper should be carefully considered, and there should be an authoritative expression of opinion as to whether the shear stresses deduced should or should not be accepted, and, if accepted, their effect upon design.

The fundamental basis of the whole system of dam design, the assumption that a masonry dam acts as a perfectly elastic homogeneous body, has not itself been verified. The English experiments indicated quite clearly that if a dam acts as an elastic body, then the trapezoidal law of uniformly varying perpendicular stress on a horizontal plane is true, but there was never any real doubt as to that. There is, however, a doubt as to the truth of the elastic assumption itself, which it would seem can only be verified by experiment.

If it were a question of building a test section 150 feet high, the case would no doubt be hopeless, but if it be accepted that our dams are generally from 40 to 60 feet high, and that information as to the action of a structure of that height would go a long way towards filling our needs, the matter is not so difficult. Concrete retains a characteristic stress-strain relationship over a considerable range of proportions of aggregate, and if concrete of lower strength than that used in dams, but of otherwise similar characteristics, were used, the same results might be expected from a proportionately smaller section. Cinder concrete is not very reliable in its performance, but this is in large part due to lack of uniformity in the cinders themselves, and if a uniform quality of cinders or some similar material were used, the

*Shortly after this paper was written floods have occurred along the north shore of the St. Lawrence river, and great surprise was expressed at the discharge recorded in some of the rivers in the area. These discharges, however, will be found to be lower than those indicated by the various formulæ for flood flow.

strength would be further reduced. It is possible that a model 20 feet high could be made in this way to indicate the action of a 40- or 50-foot dam. The weight of the section might also be controlled to such an extent that in loading with water the effect of doubling the overturning moment could be established.

A study of such a model should go far towards clearing up definitely the question as to whether or not, in an actual structure, vertical pressures on horizontal planes vary uniformly from face to face, i.e., whether the universal acceptance of the trapezoidal law is justified.

It should teach us many other things, and, if successfully carried out, should leave the profession in a much more comfortable frame of mind as to the soundness of assumptions used in design.

The question of uplift on sections above the base is one which presents no great difficulty for experimental investigation, and on which information is badly needed. It is sometimes said that as the foundation is where uplift principally occurs it might as well be included all the way up the section, but this is not altogether true. If, for instance, uplift were reduced in the upper section where the effect of ice pressure is most felt, it would have a distinct effect on the design.

Of a similar character and similarly comparatively simple would be experiments on the overturning effect of water entering minute tension cracks. The occurrence of such cracks is also a matter of great interest.

The action of reinforcement against ice pressure may also need to be more fully established. It is usual to design this reinforcement by the method used for "flexure and direct stress." It is perhaps not certain that with the extremely low percentage of steel usually used in dams the action is the same as with higher percentages.

There is also the question of provision for shear. Shear distribution is not referred to here, as that is something which could probably be demonstrated only with the large model previously suggested, but the total shear of any plane is something the amount of which is known, and there is a question as to how to treat it. The method usually used is to take the total shear, (or force acting to cause shear), and deduct from it the friction developed and term the remainder residual shear. It is perhaps not perfectly evident that this is a proper procedure. We might say that the friction and the shear are likely to act together or even that they probably do so, but before we can say that they certainly do we should have some experimental demonstration of the fact.

A similar, though perhaps not a parallel case, is that of rivetted lap joints in tension; here we recognize the presence of friction, but assume that it disappears before the shearing strength acts fully and the rivets are designed to carry the full load as shear. It is doubtful whether the cases can be considered as parallel, but in any event it should not be difficult to determine experimentally what actually does happen in a dam.

The form of the lower nappe has never been determined for any but very low heads. The form of spillway sections is determined by the shape of the nappe. In fact the nappe, rather than considerations of stability, will in some cases rule the whole design, yet our data on the nappe are based upon a set of experiments carried out in 1888, in which the maximum head used was about one foot. This certainly seems an inadequate foundation upon which to base deductions for the shape of a spillway to carry perhaps 10 or 12 feet of water. There are many dams where experiments at the higher heads could be conveniently and cheaply carried out, but such work is outside the province of the individual engineer.

Canada has been wonderfully fortunate in the matter of dam failures. That we have so far had no disasters should, unless our methods of design or construction are better than those followed in other countries, be a matter for thankfulness rather than for self-congratulation.

This Institute is as a whole more vitally interested in dams than any other similar body. That is to say, the proportion of our members who are more or less directly concerned with dams is greater than that of any other national engineering society. It is possible that the sum involved in the building of dams under construction in Canada today, (1924), or that have been completed within the past year, is in excess of the cost of all the existing dams in England. Yet the contribution of Canadian engineers to the knowledge of the subject is negligible compared with that of English engineers.

It would be a very desirable thing for the Canadian universities and other interests, who are in a position to do so, to carry on some of the much needed research in this connection, and there is an opportunity for The Institute to be of great assistance to the practising engineer by accumulating information and obtaining an authoritative opinion on the subject of the proper general assumptions for dam design. There are many matters in connection with each individual scheme which will always make the final choice of a section a matter of individual judgment, but the formulation of a generally-accepted basis of design would be helpful, and the Engineering Institute of Canada should be in a position to formulate that basis.

Partial Government Control Desirable

The author wishes to make a suggestion which has particular reference to the province of Quebec.

That a disaster may some day occur to a Canadian dam is quite conceivable. Such a disaster would probably result in hasty and perhaps unwise legislation regulating construction. Would it not be better to proceed in an orderly fashion to the framing of carefully thought-out regulations which might also make the possibility of disaster more remote?

There is in France an official standard specification for the investigation of dam sections. Would it not be to the advantage of the profession, and of the public generally, to have such a standard in the province of Quebec? Could not such a standard be drawn up by a committee of The Institute and approved by the government of the province, and could not the government be induced to establish an authority to which designs would be submitted as regards their safety before construction is started?

To carry the proposal to its logical conclusion, would it not be well for the government, in addition to passing upon the safety of the design, to appoint inspectors to examine the foundations upon which dams are to be built and inspect the materials and workmanship of the dam itself?

It is not the intention to go at length into the respective advantages to be derived by the public and the profession, but that the public could not lose seems evident. They would be provided with a double safeguard. The fact that the government authority would be intimately familiar with each stream and with *all* the dams and similar works built upon it, deserves notice. There would be, for instance, a very evident and important advantage in having the discharge capacity of all dams on a given river designed on the same basis.

Such an arrangement might be made to bring at least one advantage to the engineer or contractor. There is, as you are aware, a law peculiar to the province of Quebec, (and the French Republic), under which engineers and contractors are jointly and severally responsible for the safety of their work for a period of ten years after completion. Without going into the working of this article of the code, it will be admitted that there is a considerable feeling of dissatisfaction among engineers with regard to it.

With a practical scheme of government inspection of design and construction, any need or justification which now exists for this liability law would be removed and the article could well be amended to exempt dams and similar structures from its provisions.

This proposal is not made with the idea of exempting either the contractor or the engineer from his proper responsibility, but to the end that the contractor and engineer, having properly and skilfully carried out their several functions, they should be free of fear of future litigation due perhaps to no fault of their own. In other words, to put engineers and contractors on the same footing here as they are in other parts of the world.

Richibucto Cape Breakwater

A Description of One of a Number of Similar Necessary Public Works along the Coast of the Maritime Provinces

Geoffrey Stead, M.E.I.C.
District Engineer, Department of Public Works, Canada, St. John, N.B.

Paper read before the St. John Branch of the Engineering Institute of Canada, November 16th, 1922

Richibucto Cape is a fishing settlement on the northeastern coast of New Brunswick, in the county of Kent, and 5 to 7 miles south of Richibucto Harbour. Richibucto village lies 2 miles inland and the town of Richibucto about 12 miles north by road. The population of the cape, village and vicinity is about 1,000.

Richibucto Cape is one of the nearest points of the New Brunswick coast to Prince Edward Island, the distance across the Northumberland strait at this point being only 14½ miles, and was examined by Professor Kirkpatrick, when making his report on the car ferry service to the island, which has since been established between Cape Tormentine and Carleton Point, a shorter and more convenient crossing.

The preliminary survey for proposed works at the cape for the protection of the fishing boats was made in January and February, 1905. The first report is dated 17th February, 1905.

Probably since the first settlement of the locality fishing has been the chief means of livelihood, and in 1905 about 40 large boats were employed and the value of the fisheries was about $25,000 to $30,000 per year. However, there was no natural shelter, and in the previous five years 19 boats had been lost in storms.

In October and December of 1906, a survey was made extending over about 1½ mile of the shore with soundings out to a depth of about 15 feet at low water, and the site was chosen near the northern end of the cape, where deep water was closer to the shore than to the southward, the southern section being skirted with wide reefs and sand bars.

Construction Commenced

In 1908, an appropriation having become available, a right-of-way and site containing 1¼ acre was purchased for $175 and work was begun on September 8th by day labour. The site finally adopted was about 775 feet south of the one above mentioned, since the depths were practically the same and this position was more central for the lobster factories. The first work consisted of grading a roadway to the shore and opening stone quarries.

The shore section of the breakwater, which was begun in 1908, consisted of a stone embankment. This was extended in 1909 to a total length of 241 feet, where, reaching deeper water and the action of heavier waves, it suffered damage in several storms, and therefore at the outer end a timber crib 29 feet long by 20 feet wide was built as a core for the embankment.

Cribwork was adopted for the larger work of the pierhead and outer section of the approach, and, after tenders had been asked and only one, and that a very high offer, had been received, authority was given to proceed with the work by day labour at an estimated cost for those sections of $29,000.

During the construction of the approach from the shore a bank of sand had gathered on the site of the pierhead and southwards of the approach. The contract plans called for the removal by dredging of about 1,500 cubic yards of sand for the foundation of the pierhead, and, while the amount was not large, the danger to a dredging plant at this site and expense of towage made this part of the work difficult to tender on.

Successive surveys showed continued shoaling and advantage was taken of the facility for changes in the plan afforded by the day labour method and authority was obtained to build the pierhead first as a detached breakwater, further from the shore and thus in deeper water. This arrangement, by allowing the shore currents to pass between the approach and the breakwater, might naturally keep the harbour clear, and if not it was proposed to build a connection between breakwater and approach on the north side, from which the drift was coming, and a southern pier leaving a narrow entrance to the south through which the sand drift would necessarily be small, and afterwards to keep the harbour clear by a moderate amount of dredging, which plan has finally been carried out.

The change was of advantage in allowing additional room inside the pierhead, and the number of boats has so largely increased as a result of the construction of the breakwater that the extra harbour area now available, and which can be made so by further dredging, is valuable.

The pierhead cribs were built, and, taking advantage of the privileges of the day labour method, instead of dredging for the foundations, sank them in the sand and gave them a full year for settlement before completing the superstructure. They gradually settled practically to the rock, and the superstructure, except at one corner, has since remained exactly level.

Instead of passing behind the pierhead, the sand lodged in its shelter and therefore a connecting block was built between the end of the original approach and the north end of the pierhead. Thus the work was completed in the form shown on the contract plan, except that the pierhead was 73 feet further from the shore and there was a correspondingly greater length of approach. This change also increased the depth of the pierhead by about 4 feet when it had settled to the solid or rock bottom. The cost of this by day labour was about $33,800, but labourers' wages in 1912 went up 10 per cent, i.e., from $1.35 to $1.50 per day, and the cost of lumber was slightly higher towards the end of the work, increasing from about $15 per m.b.m. to $16 for square hemlock.

The changes in the work involved the construction of additional cribwork amounting to approximately 67,500 cubic feet, which at 11½ cents per cubic foot, the rate allowed in the estimate for the day labour work, would cost $7,762.50.

However, another change was made from the work as shown on the contract plan which saved probably $2,000 to $3,000. A reinforced concrete wave-break was called for, but from our experience with concrete at Cape Bauld, N.B., we considered that a timber wave-break would be equally serviceable and lasting, and the continued settlement of the blocks would most probably have caused serious cracks in the concrete wall. Therefore a timber wave-break was adopted. It was built of six tiers of 10- by 12-inch timbers laid close on the flat with long fenders outside and 10- by 10-inch posts inside, screw-bolted through from fenders to posts, and diagonal braces of 10- by 10-inch timber were placed inside, notched into the posts and into the stringers of the breakwater. The whole making a very strong wave-break.

Where the timber is almost continually wet with salt spray it lasts a long time, and after twelve years no signs of decay are apparent.

In 1911 two cribs each 64 feet long by 33 feet wide at the bottom were sunk in place for the pierhead and built to half-tide level. In 1912 two cribs of a total length of 100 feet for the remainder of the pierhead were built to half-tide level and additional timbers were placed on the last year's cribs. Cribs 86 and 85 feet long and 25 feet wide at bottom were built and sunk for the connection with the approach. The second of these cribs, when under construction, was carried away by a storm and grounded on a sand bar, but was raised with empty barrels and a scow, replaced and ballasted in position. In 1913 the corner crib, 55 by 30 feet, connecting the approach with the pierhead was sunk in place, the upper tiers, stringers, covering and cap were laid on the pierhead and approach, and the wave-break 330 feet long and about 5 feet high was built along the outer face.

In 1914 the remainder of the covering and cap timbers were laid. The corner crib, which was built last and which was not left as long as the other cribs, is the only one, as mentioned above, which after completion has not remained level, having settled about one foot on the northern side.

The greater part of the lumber was towed in rafts from Richibucto river and about five miles through the open straits, fortunately without loss though at times occasioning delay in the work.

As mentioned above, when constructing the cribs of the pierhead the sand lodged inside. The bank thus formed reached to about half-tide level, and therefore the connection with the shore approach was at once proceeded with. After the connection was made the bank levelled down somewhat, but the harbour was then practically filled to within one foot below low water level, except a narrow deeper strip close to the pierhead, and the outlook was apparently very blue for its future usefulness.

Southern Pier

The only course remaining was to proceed with the construction of the southern pier, leaving a narrow entrance, and maintain the harbour by dredging.

Work on the southern pier was commenced in 1914, building a 30- by 30-foot close-faced block of square timbers which was intended to be the end block or head of the pier and also a length of 60 feet of the approach from the shore, 10 feet wide on top, of round timber in open-faced work. The end block was left to settle and was not finally completed until 1920.

In the following year the approach was extended to a total length of 326 feet, and then there remained gaps of 160 feet between the approach and the 30-foot square block, and 100 feet between the latter and the end of the original pierhead of the breakwater.

The 30-foot square block was sunk somewhat further to the south than originally intended and it was noticed that waves striking the outer face of the block, instead of dissipating throughout the harbour, rebounded from the face and took a direction parallel to and slightly inside the pierhead, i.e., where all the boats lay. Though their force was diminished, it was still sufficient to seriously disturb the boats even when lying at the inner corner of the harbour. The fishermen naturally complained of this, and it was suggested that the outer gap be closed and the entrance established inside the 30-foot square block, which also had the advantage of giving a considerable area of perfect shelter inside the pierhead and proposed works.

As decided shoaling was occurring even beyond the pierhead by the withdrawal of the entrance within the outer line of the latter, the danger of a sand bank forming which would close the entrance was increased. However, the outer face of the proposed connecting block is parallel to the heaviest winds and seas, those from the northeast, and it was believed that these would tend to carry the sand along this face and sufficiently past the entrance.

Also, in the position that the smaller block was then placed there was a decided risk of the sand moving along the outer face of the pierhead being carried into the harbour through the first gap instead of beyond the block, and in general with works of this kind the windward pier, represented by the main breakwater, should overlap the leeward work which was in this case represented by the southern pier.

What appeared the lesser risk was taken, and so far has been justified, and again the harbour area was advantageously increased.

During 1916 a quantity of lumber and stone was purchased, and early in 1917 a block 100 feet long, connecting the 30-foot square block with the original pierhead, was built in place on the ice.

After the block was ballasted and the ice cut it settled as expected, and even after last year when covering was temporarily laid it settled about one foot in the centre and has since been finally levelled and covered.

The block was constructed of round timber in open cribwork and was sheathed with hardwood plank on the outside face and with spruce on the inside. It proved a great protection in the spring when the ice was driven heavily towards the shore, since it deflected the ice and none went into the harbour where all the boats were lying, whereas in the previous spring the ice returning filled the harbour.

About two months after this block was built it parted

Figure No. 1.—Richibucto Breakwater.

above the upper ballast floor during a storm, the superstructure being lifted about one-half foot on the inner face and floating up an additional 1½ foot at high tide. Heavy iron bars were then hooked under the lower face timbers, passing through the projections of the upper cross-ties and, the upper ends of the bars being threaded, they were secured to the upper timbers with nuts and washers. When, however, additional timbers were placed in 1919 to level the block and it was fully ballasted it went back into place and most of the hooked bolts were withdrawn as unnecessary.

At that time the number of boats in use was increasing and since most of the boats were aground when inside the harbour at low tide, and since the harbour was then fairly well inclosed, only one opening of 160 feet remaining where it was not likely to admit much sand, authority was obtained to have a section of the harbour dredged, which was done during July, August and September, 1917. A small clamshell gasoline power dredge was employed, at a rental of $21 per day, including wages of the operator and cost of gasoline, oil and repairs, and did the work by day labour.

About 5,171 cubic yards of sand were removed at a cost of 29 cents per cubic yard barge measurement and the depth given was 2½ to 4 feet at low water, where the previous depths varied from 1 foot above to 1 foot below low water, the range of spring tides being 5 feet.

The place measurement, quantity allowing for filling-in which occurred, the entrance channel being twice dredged, was 4,300 cubic yards, giving an expansion factor of 20 per cent.

In 1917 the first section, about 43 feet long, of an end block for the southern pier was also built.

In the fiscal year 1918-19 there was no appropriation, but in 1919 general work was done in levelling up the southern pier and the new blocks at the south end of the breakwater, and a number of piles were driven to strengthen the outer face of the pierhead where in one section the square-face timbers had been carried away.

In square timber work it was formerly the custom to carry the cross-ties through the face with well-made and close-fitting dovetails and to depend on the dovetails for holding the face timbers, and no bolts were driven through the dovetails for fear of splitting them. It has been found that the dovetails in time work loose, and the outer face timbers are then liable to be carried away. Therefore in late specifications bolting through the dovetails is allowed, holes being first carefully bored, and also, when the work is at all exposed, vertical posts inside the face screw-bolted through the face timbers to the fenders outside are called for, which makes a very strong construction, the inner posts being also bolted to the cross-ties.

On the Richibucto Cape pierhead, however, one of the blocks went about 2 feet out of line when placed, and the superstructure overhung somewhat to bring the top in line. Therefore the face timbers did not have a full bearing and the fenders did not overlap properly, and the damage was most probably due to these causes. Posts were used inside the face in at least part of the pierhead.

In 1920 the remaining crib was built to complete the pierhead of the southern pier, narrowing the entrance to 85 feet. The sides of the pier were sheathed with plank and filled and the approach was surfaced with brush, stone and gravel. Other work during the year included repairs, levelling and sheathing on the breakwater.

The last crib was built on a brush mattress, 3 feet thick, as a foundation, although doubts were expressed as to whether the sand under the mattress would not scour out and cause the same settlement as occurred when sinking the former cribs. This has not occurred so far, and apparently a considerable amount of cribwork has been saved by using the mattress. The block was completed in 1921 when no appreciable settlement was observed.

With the blocks of the pierhead, which are exposed to very heavy seas and where heavy scouring was liable to occur and has occurred, as shown in our latest survey, a mattress foundation would scarcely be safe and these blocks have now a solid foundation on hard or rock bottom, but, at the end of the southern pier, where there was a considerable depth of sand which was not likely to scour to any extent, the mattress was very suitable.

The accompanying illustration, figure No. 1, gives a general view of the harbour and works during 1920.

The Problem of the Action of the Sand

With reference to the action of the sand, which is the most difficult and interesting problem in connection with this work, it would be interesting to present some definite conclusions which would be of value as a guide to other works, but since the last block of the pierhead was built only during 1920 it is not possible to tell just what will be the final condition when a state of equilibrium has been reached, if such a state is ever reached on this shore.

It would appear from general observations that the heavy sand movements occur in cycles during perhaps a season of heavy storms when large bars form, remain perhaps for several years and again disappear or move along the coast. Undoubtedly there is a continual drift along the shore and continual changes in the outer bars, but it hardly seems possible that the great changes which have been seen during the construction of certain of our works are due wholly at least to the comparatively insignificant works themselves.

At Point Sapin a breakwater was built on a rock foundation over which there were only a few inches of sand or mud, and there was no evidence of heavy sand drift on the shore. It seems possible that a large submerged bar, lying out to sea about one-third of a mile to the northeast of the work, which had been there as far as is known for many years, moved bodily southwards and towards the shore, and thus caused the difficulty experienced in connection with that work. Certainly the boats formerly had some shelter between this bar and the shore, but since the change their shelter is gone.

At Richibucto Cape a series of surveys have been made covering the years from 1906 to the present, and these indicate the changes which have occurred and to a certain extent their causes and what appears to be the present trend. All along this coast the littoral drift is evidently from the north. The river entrances are deflected to the south in each case and the channels are continually moving south until they reach a stage in which they break through the bars to the north and again begin the southward progression.

There are several features, however, in the last survey which point to somewhat better conditions in the future.

These are, (1st)—The High Water line runs straight northwards from about the centre of the north side of the breakwater, and while it is now some 200 feet further from the shore than before, its straight course is an indication of its having reached a stable form, for if very heavy drift were still occurring the High Water line would curve outwards towards the northeast corner of the breakwater. Also, the extensive area of sand beach between the new High Water line and the original shore will give storage room for large quantities of sand carried shorewards by winds and waves.

(2nd),—The last survey, in comparison with the others, shows that the scour around the northeast corner of the breakwater has increased and that it is extending along the whole outer face of the breakwater. If this continues there may still be a bar outside the entrance, but there is likely to be a channel with sufficient water to either side of it.

(3rd),—The bar which formed in the spring of 1918 to such an extent as to prevent the boats from entering at low tide went away naturally, and the last survey showed better water across this bar than was found in the surveys of May and July, 1917. The water deepened somewhat in 1920 in the entrance after the construction of the last block and it was then deepening along the south side of the southern pier.

It is certainly to be hoped that the harbour can be maintained within reasonable expense, since the shelter it has provided, the encouragement given to the fisheries and the resulting extension of this industry have been very satisfactory.

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Secretary Visits Western Branches

On returning to Headquarters from his journey to the West, the Secretary wishes to thank the officers and members of the various branches for the uniform kindness and hospitality shown to him.

A journey of this kind affords an opportunity, not only for the formation of many pleasant acquaintanceships, but also for a survey of the activities and work of The Institute in the West.

The general impression gained is one of healthy life and activity, and it is interesting to note how the various branches follow lines of individual development, while at the same time working in unity with the other branches of The Institute, and showing loyalty to the objects which it has in view. It was especially pleasing to note the cordial relations existing between the various branches of The Institute and the several Provincial Associations of Professional Engineers. The Institute and the Professional Associations, while essentially different in their functions, are working along parallel lines, and the objects of each will be furthered by the spirit of co-operation which is manifested.

The results of the informal exchange of views which took place at so many of the branch meetings at which the Secretary was present will be presented to Council in due course, and Council will in this way be put in possession of the ideas of many individual members, as well as those of the Executive Committees, in a way which would not otherwise be possible.

Discussions of this kind are of even greater benefit to the functioning of The Institute as a whole than the discussions of Institute affairs which quite rightly take place at the Annual General Meeting, and cannot fail to be of assistance to the Council in its deliberations.

It was a pleasure to note the steady growth in numbers of nearly all the branches.

The Secretary was glad to have the privilege of attending the joint meeting at Estevan held under the auspices of the Saskatchewan Branch of The Engineering Institute of Canada, the Southern Saskatchewan Section of the Canadian Institute of Mining and Metallurgy, and the Saskatchewan Section of the American Institute of Electrical Engineers, for meetings of this kind do much to emphasize the friendly relations which exist between these important technical bodies.

Announcement Regarding Honour Roll

The final checking of the list of names to appear on the Honour Roll of The Institute is being undertaken at Headquarters. In accordance with the decision of the Committee under whose direction this work is being carried out, the list is to contain the names of those members of The Institute who served outside of Canada and the United States with the Allied land, air or naval forces.

With a view to assisting in the checking of this list, a letter is being addressed to all members of The Institute whose names are at present on The Institute's War Service list, with the request that certain information be supplied regarding their service overseas.

The letter referred to above is reproduced herewith, together with the headings under which information is desired, in order that any member who through one reason or another has not received a copy of the letter, may be made acquainted with the nature of the information required and forward the same to Headquarters without delay.

LETTER ADDRESSED TO MEMBERS

Dear Sir:—

The final list for the Honour Roll is now being prepared and checked, and in accordance with the directions of the Committee, is to contain the names of those members of the Institute who served, outside of Canada and the United States, with the Allied land, air or naval forces.

In order to ensure accuracy, I am sending this letter to all members of the Institute for whom we have a record of war service, and would ask you to fill in, tear off and return the enclosed slip at once.

Yours very truly,

R. J. DURLEY, Secretary.

Name in Full..................................

Date of Joining the Service..................................

Rank on Demobilization..................................

Unit with which you last served..................................

Were you overseas? If so, state Country or locality in which you served outside of Canada..................................

....

Decorations or Honours received..................................

Signature..................................

Date..................................

Maritime Professional Meeting

Not quite twelve months after the Maritime meeting of 1925, a very successful professional meeting has been held at Sydney, Nova Scotia, under the auspices of the Cape Breton, Halifax, Moncton and St. John branches. Few engineering societies have their membership more widely scattered than The Engineering Institute, and it is a matter for congratulation that so many of our members were able to attend, coming to the meeting by rail, or over the excellent main roads of Nova Scotia, or, in some cases, by sea. This meeting was the sixth professional meeting held by The Institute in the Maritime Provinces.

The Sydney members had been engaged for weeks on the preliminary work of organization, and on Tuesday morning, August 17th, after the usual formalities of registration, issue of badges, and so on, had been completed, the first technical session was called to order by Councillor W. C. Risley, M.E.I.C., at ten-thirty o'clock. The Mayor of Sydney, Mr. James MacConnell, gave the members a hearty welcome to the city. His Worship touched on the part played by the engineer in the development of the industries on which Sydney depended, and hoped that the city would again be selected, at no distant date, for a similar convention of The Institute.

Paper on the Humber Development in Newfoundland

The first business was the paper by H. C. Brown, A.M.E.I.C., on the Humber Development of the Newfoundland Pulp and Paper Company at Corner Brook. This has already been published in the August number of the Journal, and Mr. Brown read an abstract, in which he outlined the methods adopted in solving the various problems arising in the design and construction of the plant at Corner Brook, particularly with respect to the electrical equipment.

An active discussion followed, during which a number of details connected with transformers, cables, transmission line and pipe line were dealt with by Messrs. C. H. Wright, M.E.I.C., F. A. Bowman, M.E.I.C., E. L. Martheleur, M.E.I.C., D. W. Robb, M.E.I.C., F. W. W. Doane, M.E.I.C., W. M. Bristol, A.M.E.I.C., and others. After the author's reply, a hearty vote of thanks was unanimously accorded him, and the meeting adjourned for lunch at the St. Andrews Hall.

Luncheon, Visits to Local Plants, Dinner and Dance

The meal was enlivened by several bursts of community singing, and at its conclusion members and ladies were conveyed to the Waterford Lake power station of the Dominion Coal Company and to No. 1-B colliery at Glace Bay. The arrangements made for guidance and information at both places were greatly appreciated.

In the evening a dinner and dance at the Lingan Country Club terminated a very enjoyable day.

Characteristics and Utilization of Nova Scotia Coals

The sessions were resumed at 10 a.m. on Wednesday the 18th, Vice-President G. D. Macdougall, M.E.I.C., in the chair. The paper presented was by W. S. Wilson, A.M.E.I.C., and M. W. Booth, M.E.I.C., on the Characteristics and Utilization of Nova Scotia Coals, and was given in abstract by Mr. Booth, having already been published in the August Journal. It contains much valuable information not hitherto available on this important subject. Written discussions were presented from F. W. Gray, M.E.I.C., Lesslie R. Thomson,M.E.I.C., R. L. Weldon, A.M.E.I.C., F. Williams, A.M.E.I.C., W. Herd, M.E.I.C., Dr. W. A. Bell, Prof. D. W. Munn, A.M.E.I.C., and J. D. Garey, A.M.E.I.C. These discussions dealt with such points as the effect of storage on the quality of the coal, liability to heating in the storage pile, the effect of the low melting point of ash, comparative tests of Nova Scotia and other coals, the suitability of Nova Scotia coal for locomotive use, the importance of coking and briquetting, the geological occurrence of the various types of coal, the measures taken by consumers to modify their equipment so as to burn Nova Scotia coal efficiently, and the desirability of further experimental investigation in this connection. As a result of the discussion, the following resolution, moved by C. H. Wright, M.E.I.C., seconded by D. W. Robb, M.E.I.C., was carried unanimously,—

> "In view of the fundamental importance of the coal industry in the Province of Nova Scotia and the need of a more thorough knowledge of the properties and characteristics of our coals when selling in a highly competitive market, the present meeting of the Engineering Institute of Canada, convened at Sydney, formally commended to the provincial government of Nova Scotia the appointment of a continuing Board to carry on additional investigations of Nova Scotia coal.
>
> "It is further suggested that a definite regular annual grant of money be authorized to defray the expenses of such a Board."

The secretary was requested to send copies of the resolution to the Premier and to the Minister of Mines of Nova Scotia and to the Premier and Minister of Lands and Mines of New Brunswick.

The authors having replied to the discussion, a cordial vote of thanks was passed to them, the sense of the members present being that their paper was very timely and of importance to the industries of the province.

The secretary was requested to convey the thanks of the meeting to those whose efforts and kindness had contributed so greatly to the success of the meeting, particularly to:—

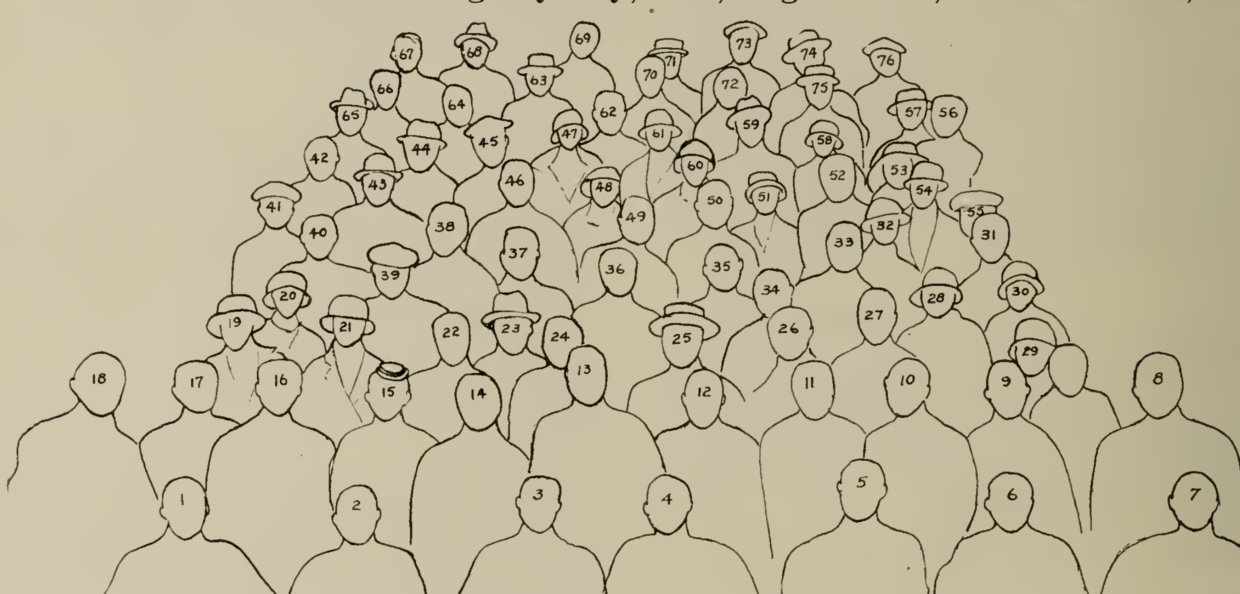
> His Worship the Mayor of Sydney, Mr. J. E. McLurg, Vice-President, British Empire Steel Corporation; the Commodore, Royal Cape Breton Yacht Club; the Manager, No. 1-B colliery, Dominion Coal Company; the Superintendent, Waterford Lake power station, and the ladies and gentlemen of the committees of the Cape Breton Branch who carried out the very successful arrangements for the meeting.

The afternoon of Wednesday was spent in an inspection of the steel plant and coke ovens of the Dominion Iron and Steel Company, and in the evening a very enjoyable dinner took place at the Lingan Country Club, Councillor W. C. Risley, M.E.I.C., chairman of the Cape Breton Branch, presiding.

The speaker of the evening was Mr. J. E. McLurg, who took for his subject The Engineer in Industry, and gave from his experience many instances showing the manner in which the engineering department of a great industrial enterprise is called upon to assist and advise the officers in charge of the operation of the plant. He referred also to the growing list of technically-trained men who are occupying executive positions, and drew attention to the openings for young engineers who desire to follow this line.

The toast of The Institute was proposed by Senator J. S. McLennan, and replied to by Vice-President G. D. Macdougall, M.E.I.C., and the Secretary. The Hon. G. S. Harrington, M.E.I.C., Minister of Mines in the Nova Scotia Government, in replying to the toast to Cape Breton, proposed in a happy speech by C. H. Wright, M.E.I.C., took the opportunity of referring to the resolution passed at the morning

Maritime Professional Meeting—Sydney, N.S., August 17th, 18th and 19th, 1926



1. D. W. J. Brown
2. F. A. Bowman
3. W. C. Risley
4. The Mayor of Sydney, Mr. Jas. McConnell
5. R. J. Durley
6. C. H. Wright
7. A. R. Crookshank
8. S. C. Mifflen
9. A. G. Tapley
10. J. R. Freeman
11. Major H. W. L. Doane
12. E. L. Ganter
13. J. P. Cotter
14. A. L. Hay
15. K. L. Dawson
16. E. L. Martheleur
17. J. D. Stewart
18. A. P. Theuerkauf
19. Mrs. W. C. Risley
21. Mrs. E. L. Ganter
22. W. J. Johnston
23. J. Kalbhenn
24. J. L. Clarke
25. G. W. H. Perley
26. J. G. H. Purves
27. D. H. McDonald
28. Mrs. J. R. Morrison
29. Mrs. G. S. Stairs
30. Mrs. C. M. Smythe
31. C. M. Smythe
32. Mrs. W. M. Bristol
33. G. S. Stairs
34. Col. F. W. W. Doane
35. J. R. Morrison
36. G. Stead
37. A. W. Fildes
38. P. Hiseler
39. J. A. Fraser
40. H. C. M. Gordon
41. A. Barlow
42. R. L. Nixon
43. A. T. Jewitt
44. Prof. F. L. West
45. W. A. Winfield
46. F. S. B. Heward
47. Mrs. K. L. Dawson
48. Mrs. McDonald
49. W. E. Hyndman
50. A. Gray
51. Mme. E. L. Martheleur
52. W. E. Clarke
53. Mrs. F. W. W. Doane
54. Mrs. W. E. Clarke
55. Y. C. Barrington
56. G. G. Murdoch
57. W. M. Bristol
58. Mrs. H. W. L. Doane
59. H. F. Bennett
60. Mrs. C. H. Wright
61. Mrs. H. F. Bennett
62. Prof. D. W. Munn
63. H. C. Brown
64. H. C. Hatfield
65. R. R. Moffatt
66. M. W. Booth
67. W. S. Wilson
68. H. Arthur
69. N. McLeod
70. B. Corlander
71. G. T. Medforth
72. A. D. Jost
73. J. J. McDougall
74. J. K. McKay
75. H. T. Doran
76. R. M. McKinnon

session, and was able to inform The Institute that measures had already been taken to give effect to their suggestions. A programme of experimental work on Nova Scotia coal had been drawn up and would be carried out at the Nova Scotia Technical College, Halifax, as soon as the necessary new equipment and changes in the existing boiler plant had been made. He was glad to say that the legislature had appropriated the necessary funds, and believed that great benefit would accrue to the Maritime Provinces from the action taken. Other speakers were W. Herd, M.E.I.C., A. P. Theuerkauf, M.E.I.C., and the visiting chairmen of the other branches of The Institute in the Maritime Provinces.

The dinner afforded a very pleasant opportunity for renewing and cementing acquaintanceships under the happiest conditions, and brought the official functions of the meeting to a close.

The Cape Breton branch was congratulated by all the visiting members on the very effective arrangements made and the entire success of the meeting, both from a professional and social viewpoint. The visiting ladies were particularly well looked after, a special programme of visits and social entertainments having been arranged.

The committee in charge of the general arrangements, Finance and Papers consisted of,—W. C. Risley, M.E.I.C., Chairman; W. S. Wilson, A.M.E.I.C., Vice-Chairman; D. W. J. Brown, Jr.E.I.C., Sec.-Treasurer; W. E. Clarke, M.E.I.C., J. R. Morrison, A.M.E.I.C., J. J. McDougall, M.E.I.C., S. C. Mifflen, A.M.E.I.C.

Other Committees in charge of arrangements were,—

Colliery Tour,—J. R. Morrison, A.M.E.I.C., A. L. Hay, M.E.I.C., H. C. M. Gordon, Jr.E.I.C.

Inspection Steel Plant and Coke Ovens,—A. P. Theuerkauf, M.E.I.C., W. Bown, G. Beaton, A.M.E.I.C.

Transportation,—W. E. Clarke, M.E.I.C., J. P. Cotter, A.M.E.I.C., N. McLeod.

Luncheon and Banquet,—W. S. Wilson, A.M.E.I.C., C. B. Ross, W. J. Ripley, A.M.E.I.C.

Publicity,—S. C. Mifflen, A.M.E.I.C., E. L. Ganter, A.M.E.I.C., M. Dwyer, A.M.E.I.C.

Reception and Housing,—D. W. J. Brown, Jr.E.I.C., R. M. McKinnon, A.M.E.I.C., C. M. Smyth, A.M.E.I.C.

Golf and Dinner Dance,—W. C. Risley, M.E.I.C., W. Herd, M.E.I.C., C. B. Ross.

Ladies' Entertainment,—Mrs. W. C. Risley, Mrs. W. E. Clarke, Mrs. E. L. Martheleur, Mrs. E. L. Ganter, Mrs. H. B. Gillis.

OBITUARY

John Seabury O'Dwyer, M.E.I.C.

The death of John Seabury O'Dwyer, B.A.SC., D.L.S., M.E.I.C., right-of-way engineer of the Canadian National Railways, Atlantic Region, occurred on July 9th at Shediac Cape, where he had gone to spend a few weeks, accompanied by Mrs. O'Dwyer. He was driving in an automobile with his wife and was stricken while returning to his cottage. Death was practically instantaneous.

The late Mr. O'Dwyer was in his sixty-ninth year and had resided in Moncton for the last twenty-five years. He was born at Abbotsford, Que., on September 28th, 1857, and received his early education at Bishop's College, Lennoxville, Que., later going to McGill University, where he graduated with honours as Bachelor of Applied Science in Civil Engineering in 1880, and was awarded the Lorne Medal. He was employed for a number of years by the Canadian Pacific Railway, later becoming a member of the Federal Department of Railways and Canals at Ottawa. He was construction engineer of the White Pass and Yukon Railways and, later, of the Midland line of the Dominion Atlantic Railway between Truro and Windsor. He also worked on the construction of the Intercolonial Railway from Campbellton to St. Leonards. In 1901 he came to Moncton as construction engineer of the Intercolonial Railway under W. B. MacKenzie, who at that time was chief engineer.

Mr. O'Dwyer was admitted to The Institute in the year of its incorporation as the Canadian Society of Civil Engineers when on June 25th, 1887, he was elected Associate Member. Eight years later, on May 23rd, 1895, he was transferred to Member.

During the past few years, his failing health occasioned anxiety to his friends, but, following two operations, improvement was so apparent that anxiety was allayed, and his sudden death was a great shock to his many friends and acquaintances.

By his death, the engineering profession, and the community in which he lived, suffer great loss; for, with a high ideal of duty and unflinching devotion to it, Mr. O'Dwyer always gave his best to his work, and his best was of a very high order. Fully equipped by knowledge, training and experience for the work in which he was engaged, he never failed to exercise diligence, conscientious care and sound judgment in every detail of it, allowing no personal consideration to interfere with his duty in full accordance with his own high standard of honour.

THE ANNUAL GENERAL

AND

GENERAL PROFESSIONAL MEETING

of THE INSTITUTE *for* 1927

WILL BE HELD AT

QUEBEC CITY

TUESDAY, WEDNESDAY AND THURSDAY
FEBRUARY 15th, 16th and 17th, 1927

Make a special note of the date.

Make your plans now, to attend.

PERSONALS

J. P. Freeman, A.M.E.I.C., formerly of Sydney, N.S., has joined the engineering staff of the Abitibi Power and Paper Company, Iroquois Falls, Ont.

J. H. Ings, S.E.I.C., of Toronto, Ont., is now with Messrs. Morrow and Beatty, Limited, at Kapuskasing in charge of residency No. 7 at Smoky Falls, Ont.

H. Aldous, Jr.E.I.C., is estimator and designer with W. H. Cooper, contractor, Hamilton, Ont. Some months prior to this Mr. Cooper was employed as temporary engineer on pulp and paper mill extension at Powell River, B.C.

J. B. Barnum, A.M.E.I.C., who for the past six months has been with the Riordon Pulp Corporation, Montreal, has joined the staff of the Foundation Company of Canada and is located at Maniwaki, Que.

Karl E. Buchmann, Jr.E.I.C., who graduated from the University of Toronto in 1925, is now located at Deloro, Ont., as assistant to the chief engineer of the Deloro Smelting and Refining Company.

E. R. Complin, S.E.I.C., who graduated from the University of Toronto with the degree of B.A.Sc. this year, has accepted a position in the safety department of the Ford Motor Company of Canada, Limited, Ford, Ont.

Angus D. M. Curry, M.E.I.C., of the Department of National Defence, Ottawa, has been promoted from the rank of Engineer Lieutenant-Commander to Engineer Commander, Royal Canadian Navy.

G. Vibert Douglas, A.M.E.I.C., is at present in Spain engaged in making a geological examination of property for the Rio-Tinto Company, Limited, and will be located at 23 Bella Vista, Minas de Rio-Tinto, Province of Huelva, Spain.

E. B. Hubbard, S.E.I.C., who has been for some time on the engineering staff of the Hydro-Electric Power Commission of Ontario, has severed his connection with the Commission and is leaving for California, where he expects to be engaged in hydro-electric work.

H. J. Edwards, S.E.I.C., formerly with the Employees' Relations Department of the Hydro-Electric Power Commission of Ontario, Toronto, Ont., is now superintendent, Simcoe R.P.D. of the Hydro-Electric Power Commission at Simcoe, Ont. Mr. Edwards graduated from Queen's University with the degree of B.Sc. in 1924.

J. B. Gough, A.M.E.I.C., who has been with the Newfoundland Power and Paper Company at Corner Brook, Nfld., is now with the engineering department of Price Brothers and Company, Limited, Quebec, P.Q. Mr. Gough was for several years chief draughtsman with the Laurentide Company, Ltd., at Grand'Mere, Que.

R. B. Young, M.E.I.C., senior assistant laboratory engineer of the engineering materials laboratory of the Hydro-Electric Power Commission of Ontario, and A. C. Tagge, M.E.I.C., vice-president of the Canada Cement Company, Montreal, were elected vice-chairmen of Committee C-1 on Cement at a meeting of the American Society for Testing Materials.

J. William Bain, A.M.E.I.C., has resigned from the position of assistant professor of electrical engineering at Queen's University, Kingston, Ont., and has been appointed electrical engineer in the Radio Branch of the Department of Marine and Fisheries, with headquarters at Ottawa. Mr. Bain, who is a graduate of McGill, went to Queen's as a lecturer in 1922 and was appointed assistant professor in 1924.

Gordon Kribs, M.E.I.C., who was for some time with the New Brunswick Power Commission at St. John, N.B., is now located at Niagara Falls, Ont., with Messrs. H. G. Acres and Company. Mr. Kribs graduated from the University of Toronto in 1905, and, prior to going with the New Brunswick Electric Power Commission in 1923, he had been with the Hydro-Electric Power Commission of Ontario since 1915 as assistant engineer in charge of the eastern district.

Hubert G. Welsford, A.M.E.I.C., Receives Promotion

Hubert G. Welsford, A.M.E.I.C., has been appointed to the position of general manager of the Dominion Engineering Works, Limited, to fill the vacancy caused by the death of Mr. John Overn, Jr. Mr. Welsford has been for some time assistant general manager of the company and has been closely identified with its development and expansion. Prior to the war he was connected with the Winnipeg office of the Dominion Bridge Company, having become connected with that company's staff in 1911. From August, 1916, and until the end of the war he was engineer officer in the Royal Air Force.

HUBERT G. WELSFORD, A.M.E.I.C.

Canadian Good Roads Convention

The thirteenth annual convention of the Canadian Good Roads Association will be held at Edmonton, Alta., on September 28th, 29th and 30th, 1926, with headquarters at the Macdonald hotel.

The past conventions of the association have proved of great interest, and the programme for the forthcoming meeting promises sessions of even greater interest than on past occasions. Important basic factors dealing with road building in all its phases will be discussed during the convention.

Included in the programme will be the subjects of earth roads, gravel roads, sand-clay roads, and the so-called permanent types of sidewalks, dust layers, equitable taxation, traffic regulations, federal aid, etc.

A general exchange of knowledge and experience in connection with road building will be afforded delegates attending the meeting, and there will be ample opportunity to bring up for discussion matters or problems of an educational or technical nature.

EMPLOYMENT BUREAU

Situations Wanted

Electrical Engineer

Canadian university graduate, twenty-nine years of age and single, with four years' experience in the design and construction of hydro-electric power stations, desires work in Canada. Last three years with the largest and most up-to-date engineering firm in the United States. Position with a progressive engineering firm, operating company or public utility acceptable. At present employed. Address replies to Box No. 211-W, Engineering Journal.

Experienced Mechanical Engineer

Experienced mechanical engineer, fifty-four years of age, at present located in England, desires to form a connection in Canada. Experience includes charge of construction and installation of equipment in a number of large industrial plants, and also general maintenance, ability to investigate and report on the engineering requirements of industrial plants. Can speak Spanish and Portuguese fluently. Address replies to Box No. 212-W, Engineering Journal.

Situations Vacant

A number of requests for recent graduates for temporary employment on surveys, draughting and construction work have been received. Members available for such positions should forward a statement of experience on file at Headquarters for consideration.

Draughtsmen

One or two draughtsmen for general paper mill work. Good opportunity to learn paper mill engineering. Unmarried men only. College graduates with one to three years' general draughting experience preferred. Address replies to Box No. 155-V, Engineering Journal.

Electrical Superintendent

Engineering electrical superintendent with four or five years' practical experience. Personal qualities will be considered to a great extent, especially ability to handle men under his direction. A thorough knowledge of alternating current motors and control is essential, also D.C. experience in sectionalized paper machine drives. Age about thirty or thirty-five years. Salary, $3,000 a year. Address replies to Box 156-V, Engineering Journal.

Chemical Engineer

Chemist familiar especially with newsprint manufacture who can set up and maintain a technical control system on groundwood, sulphite and newsprint, and be responsible for the quality of the individual constituents as well as the qualities of the final product. Personality equally important. Address replies to Box No. 157-V, Engineering Journal.

Civil Service Positions

List No. 320

The Civil Service Commission announces an open competitive examination for the following position:

Senior Assistant Engineer

A Senior Assistant Engineer, for the Department of Railways and Canals, Ottawa, at an initial salary of $2,700 per annum, which will be increased upon recommendation for efficient service at the rate of $120 per annum until a maximum of $3,180 is reached.

Duties.—To assist the Engineer in Charge in carrying out hydraulic or other engineering work.

Qualifications Required.—Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with three years of experience in engineering (preferably hydraulic) design, estimate, and construction work, two years of which shall have been in a position of professional responsibility, or five years of practical experience in engineering (preferably hydraulic) design, estimate, and construction work, two years of which shall have been in a position of professional responsibility; ability to complete and make ready for publication the results of investigations and surveys, or other pertinent data; tact and good judgment. Preference will be given to applicants who have had experience in the operation and maintenance of navigation canals and have specialized in hydraulic work. While a definite age limit has not been fixed, age may be a determining factor when a selection is being made.

Nature of Examination.—A rating on Education and Experience will be given from the sworn statements, supporting documents and other evidence submitted by applicants with their application forms. An oral examination may be given if considered necessary in the opinion of the Commission.

An eligible list, valid for one year, may be established.

General Directions.—Application forms properly filled in must be filed with the Civil Service Commission, Ottawa, **not later than September 9, 1926.** Application forms may be obtained from the offices of the Employment Service of Canada, from the Postmasters at Prince Rupert, Vancouver, Victoria, Edmonton, Calgary, Regina, Saskatoon, Winnipeg, Quebec, Fredericton, St. John, Charlottetown, and Halifax, or from the Secretary of the Civil Service Commission.

WM. FORAN,
Secretary.

Ottawa, August 16, 1926.

Canadian Engineering Standards Association Progress of Work

(*First half year 1926*)

Branch of Industry and Subject	Specification No.	Stage of Progress
A—Civil Engineering and Construction		
Steel Railway Bridges	A1–1922	6R
Portland Cement	A5–1922	6
Steel Highway Bridges	A6–1922	6R
Reinforcing Materials for Concrete	A9–1923	6R
Movable Bridges		4
Steel Structures for Buildings	A16–1924	6R
Concrete and Reinforced Concrete		2
Bituminous Roads		2
Block Pavements		4
Broken Stone Roads		3
Concrete Roads		3
Earth Roads		2
Foundation and Sub-grade Preparation		2
Sand Clay Roads		3
Gravel Roads		2
Road Structures		3
Classification of Items of Highway Expenditure	A19–1926	6
Definitions of Road or Highway Terms		3
B—Mechanical Engineering		
Wire Rope for Mining, Dredging and Steam Shovel Purposes	B4–1921	6
Galvanized Steel Wire Strand	B12–1924	6
Gearing		1
Cast Iron Pipe		2
Machine Screw Threads		1
Stove Bolts	B18–1925	6
Sheet Metal Gauges		1
C—Electrical Engineering		
Galvanized Telegraph and Telephone Wire	C3–1924	6
Distribution Type Transformers	C2–1920	6R
Regular Tungsten Incandescent Lamps	C10–1923	6
Power Transformers		2
Watt-hour Meters	C17–1925	6
Eastern Cedar Poles for Transmission Lines	C15–1924	6R
Western Cedar Poles for Transmission Lines		3
Reinforced Concrete Poles	C14–1924	6
Canadian Electrical Code		3
Electrical Overhead Crossings		1
Rating and Testing of Electrical Machinery		1
Control Cable		1
D—Automotive Engineering		
Flexible Steel Wire Rope and Strand for Aircraft	D7–1922	6
Report on Gasoline for Automotive Work	D11–1924	6
Traffic Signals for Highways		4
E—Railway Work		
Fences and Gates for Railways	E13–1924	6
G—Ferrous Metallurgy		
Commercial Bar Steels	G8–1923	6
Tests for Heavy Steel Castings		2
Methods of Sampling for Check Analysis for Rolled and Forged Steel Products		1
Forging Quality Bar Steel		1

Stages of progress

1. Decision made to undertake standardization
2. Draft proposal under consideration
3. Sent out for criticism
4. Submitted for approval
5. Approved for publication
6. Published

The letter R following the number of stage of progress indicates that the respective specification is under revision.

BRANCH NEWS

Calgary Branch

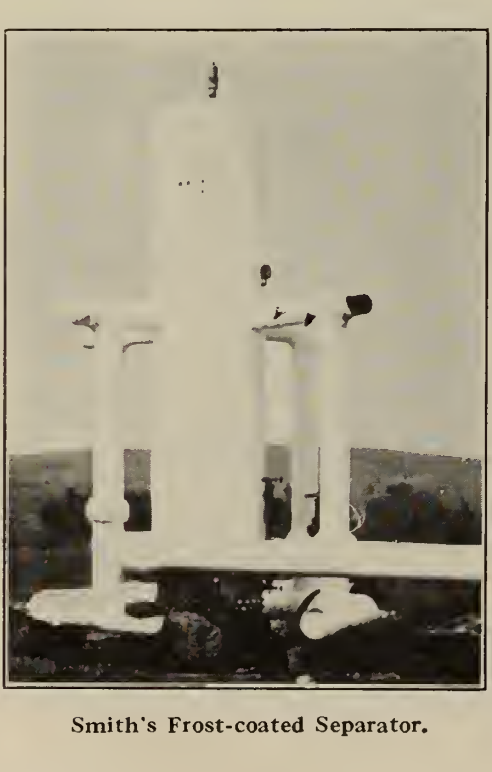
H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

Visit to Turner Valley Oil Field

On Saturday afternoon, July 24th, the branch members, together with a number of ladies and other visitors, made a trip by automobile to the Turner Valley oil field. As is well known considerable activity is in evidence in this area, and consequently over eighty persons availed themselves of the opportunity to join the party.

G. S. Coultis, A.M.E.I.C., local superintendent of the Royalite Oil Company, was on hand and took particular pains, and apparently pleasure also, in showing all around the plant of his company. This was the principal feature of the visit, which was primarily undertaken at the instigation of the Royalite Company. It was a big party to handle, but Mr. Coultis proved himself both painstaking and interesting, and the weather was extremely warm at that. The process of gasoline extraction at this plant whilst apparently simple to the uninitiated, is somewhat complex and any detailed description would require an expert in this line.

The first thing of interest to the visitor is the frost-coated Smith's separators, together with the frosted inlet and outlet pipes. These are coated with some four or five inches of solid frost which glistens in the hottest weather. It is here that the gas from the Royalite No. 4 well drips its gasoline content at 73 degrees Baume. This is conveyed to the treating plant nearby which consists of absorption, scrubbing, and compression departments. Gas is delivered from the Royalite No. 4 well at the rate of eighteen million cubic feet per day and at some twenty degrees below zero, and has to be raised to a suitable temperature for treating, in a special department. Then there are the necessary storage tanks and the pumping apparatus to enable the gasoline to reach Calgary some forty-five miles distant, through a four-inch main. Gas is conveyed for domestic use in Calgary through a ten-inch main. The huge roaring mass of flame projected over the river bank was a source of wonder to all. It is by this means that the excess gas is disposed of; a very wasteful method, but unavoidable. The disposal of this natural gas which is additional to the requirements of the district is a problem that will have to be faced and solved before very long. At present there is no alternative other than blowing it off and igniting it. The reflection in the sky of the flame from this one well is visible for fifty miles around.



Smith's Frost-coated Separator.

A visit to the Macleod No. 2 well, which has recently become a producer with some seventeen million cubic feet of gas, and the Royalite No. 4 and other wells in the vicinity, brought a most enjoyable trip to an end all too soon. The return trip was made through delightful scenery, luncheon being enjoyed on the banks of the Sheep river.

Edmonton Branch

A. Ritchie, A.M.E.I.C., Secretary-Treasurer.

The Edmonton Branch recently held its annual meeting which resulted in the election of the following officers for the branch year 1926-27:—

Chairman	T. W. White, A.M.E.I.C.
Vice-Chairman	A. I. Payne, M.E.I.C.
Secretary-Treasurer	A. Ritchie, A.M.E.I.C.
Committeemen	W. R. Mount, A.M.E.I.C.
	R. W. Boyle, M.E.I.C.
	W. J. Cunningham, A.M.E.I.C.
	S. R. Lamb, A.M.E.I.C.
(Ex-Officio)	A. G. Stewart, A.M.E.I.C.
(Councillor)	A. W. Haddow, A.M.E.I.C.

Lethbridge Branch

N. H. Bradley, A.M.E.I.C., Secretary-Treasurer.

Meeting in Honour of Mr. Durley

The general secretary, R. J. Durley, M.E.I.C., met the Lethbridge Branch on July 7th, in the course of his tour of the western branches. Summer is not an ideal season to bring members together for a meeting, but a fairly large number turned out to the dinner given in Mr. Durley's honour in the evening.

A feature of Mr. Durley's visit was a trip over the Lethbridge Northern Irrigation Project. The headgates at the intake were inspected and a stop was made at various other points of engineering interest, including the big metal flume 3,300 feet long and 15 feet wide; the two great wood stave siphons, one of which is 3,000 feet long with a diameter of 10½ feet, and the other 950 feet long.

Although the trip was taken by car, it might have been negotiated in a canoe for a distance of 80 miles through main ditches and canals. At any rate, the trip afforded an excellent illustration of a phase of engineering that is closely interwoven with agriculture. This is a particular instance where the engineer and the farmer meet on common ground.

Discussion of Institute Affairs

After dinner, Mr. Durley talked of Institute affairs and gave the members a general idea of the work of Council and the many angles of the year's activities. Among the topics taken up was that of The Journal and, in a humorous vein, Mr. Durley described his work as editor and called for suggestions as to methods by which The Journal could be improved. The Journal comes closer home to the average engineer than possibly any other detail of the organization and among the suggestions offered was a *Question Box* where questions of general interest could be answered. Another suggestion was for an editorial page, but this was turned into a general laugh when Mr. Durley stated very gravely that there was already a page devoted to editorials.

Another suggestion that aroused some discussion was one relating to propaganda designed to establish a better knowledge of the engineer and his work among the lay public, the idea being that popular mediums be utilized for articles on engineering to be written by writers of reputation who make a profession of feature stories. It was felt that while articles of a technical nature in the Journal were interesting and intelligible to engineers, few if any of them could be considered interesting to the public at large. Many of these, however, contained information that could be used for popular consumption if it were redrafted.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

On August 13th, the branch was favoured with a visit from R. J. Durley, M.E.I.C., general secretary of The Institute, who stopped off at Moncton on his way to the Maritime Professional Meeting at Sydney.

In the evening, Mr. Durley was entertained at a smoker held at the Riverdale Golf Club. Quite a goodly number of members journeyed over by car from the city, and listened with interest to the secretary's remarks on Institute affairs and progress made by the various branches. Following a general discussion, light refreshments were served. G. C. Torrens, A.M.E.I.C., vice-chairman of the branch, presided.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

Visit of General Secretary R. J. Durley

A special meeting was held at the Y.W.C.A., Queen Street, E., on July 15th, 1926, following a dinner at which we had as guests, R. J Durley, M.E.I.C., general secretary of the Institute, and R. O. Wynne-Roberts, M.E.I.C., past-president of the Toronto Branch.

C. H. Speer, M.E.I.C., called the meeting to order and introduced some of the local talent, who gave a fine programme of music and entertainment which was much appreciated by all. The programme was,—

Miss Doris Knight, piano selection.
Mr. A. McColl, vocal selection.
Mr. J. H. Jenkinson, A.M.E.I.C., a sketch from the Originals.
Miss Treva Richardson, piano selection.

Mr. Speer gave an outline of the activities of L. R. Brown, A.M.E.I.C., during the past twelve years that he had been in the Sault. Every position, and in fact everything, even to fishing, that Mr. Brown had taken on, had been carried through and he had made good. Mr. Brown is taking a position with the Newfoundland Power and Paper Company at Corner Brook and carries with him the best wishes of the Sault Branch.

Mr. Durley read the following letter and presented Mr. Brown with a fly book on behalf of the members of this branch.

July 5th, 1926.

L. R. Brown, Esq., A.M.E.I.C.,
City Engineer,
Sault Ste. Marie, Canada.

Dear Sir:—

The members of the Sault Ste. Marie Branch of the Engineering Institute express their regret at your leaving this city. Your great activity in matters pertaining to the general welfare of this community while it has met with that amount of opposition which goes with all endeavour, has made you dear to all. Your particular work in connection with the formation of the branch and during its early life has been, and will always be, appreciated by the members. Now that you are leaving they most sincerely hope that you will be greatly successful in your new field and wish you to make many new friends while not forgetting those you leave behind. As a token of this appreciation, will you accept this slight memento of your sojourn here.

On behalf of the Sault Ste. Marie Branch of the Engineering Institute, we beg to remain.

Yours sincerely,
(Sgd) J. W. LeB. Ross, M.E.I.C.
(Sgd) C. H. E. Rounthwaite, A.M.E.I.C.

Mr. Brown expressed his thanks and said that he felt sure that the Sault Branch would prosper and that he was proud to have been associated with it during his residence in the city.

Mr. Speer then called upon Mr. Durley who had just returned from visiting the western branches. He said that all the western branches showed good prosperity and were very active and congratulated the Sault Branch on its activity during the past year. He outlined the efforts being made to unite all the different engineering associations into a stronger body, and in referring to the general conditions of engineering in the west, he commended the work of the engineers on the Caribou highway construction through the mountains.

Speaking of the advantage of being a member of the Institute, he said it broadened our knowledge of other sections besides the one in which each member was particularly interested. Members should take an active part in the general discussion and interchange of views and should also make a determined effort to get to the meetings. In speaking of the work at headquarters, Mr. Durley complimented the staff on their efficiency, willingness and loyalty. A good many people think that headquarters is the Institute, but the headquarters staff existed solely for the purpose of carrying on the routine work and the Institute was the twenty-five branches from Halifax to Vancouver.

Mr. Durley touched upon the several duties of a general secretary, and the members fully appreciated what he and his efficient staff are doing to help The Institute carry on. It is a pleasure to have Mr. Durley make his annual visit to the Sault and the members are all looking forward to his next visit.

R. O. Wynne-Roberts, M.E.I.C., said that engineers should have more publicity than they get and that the public did not appreciate the work an engineer did and the benefit his work is to mankind. "We, in Canada," said Mr. Wynne-Roberts, "possess more engineering achievements than any country in the world, but there is nothing said about it. It is taken for granted."

Mr. Speer expressed his appreciation to the speakers and he felt sure that the Sault Branch had received many helpful suggestions from Mr. Durley. He pointed out that the attendance in this branch for 1926 was slightly over 50 per cent of the resident members.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

"We must make this an annual affair." This statement made by members present, describes the feeling of satisfaction of the members of the Saint John Branch who attended the *Branch Outing.* The affair was held at Belyea's Point, on the Saint John river, some sixteen miles from the city of Saint John. The party, twenty-nine in number, made the trip by automobiles, leaving the city from 5.30 to 6.00 p.m. on August 12th, 1926. On arriving at Belyea's Inn, the members found supper awaiting them on tables set outdoors in the orchard.

After supper the members went to the beach, where a branch meeting was held. It was truly a wonderful setting for a meeting. Forming a half-circle, the members sat on logs or stretched out on the beach; a perfectly calm night, people loafed along the shore in canoes, while farther off shore motor boats passed up and down the river. A. R. Crookshank, M.E.I.C., chairman of the branch, called the members to order and introduced R. J. Durley, M.E.I.C., general secretary of The Institute. Mr. Durley gave an impromptu address, and dealt with several features of his recent trip to the Pacific coast on his visit to the western branches of The Institute. Other phases of Institute work, including its financial condition, were dealt with. In particular, Mr. Durley laid stress on the important part taken by the branches in the work of The Institute, and of the satisfactory co-operation between headquarters and the branches. After Mr. Durley's address, the members asked many questions about The Institute, and it was evident all wanted to obtain information. In the variety of questions asked, a genuine interest in The Institute was evident amongst the members. Mr. Crookshank tendered a vote of thanks to Mr. Durley at the conclusion of his address.

After the meeting, soft-ball and volley ball was played until darkness stopped the game. Some of the members took advantage of the opportunity and had a swim. About 11.00 p.m. the members arrived back in the city, after a very pleasant evening.

Thanks to Cape Breton Branch, E.I.C.

Those members of Saint John Branch who were fortunate enough to attend the Maritime Professional Meeting held at Sydney, N.S., August 17th to 19th, 1926, are delighted with the trip, with the Cape Breton scenery and with the meeting itself. The meeting was in every way up to the high standard of previous Maritime Professional Meetings, and had the added attraction that Sydney and vicinity, with its coal and steel industries, has much to offer of interest to the engineer. The committees in charge of the various arrangements for the meeting are deserving of much praise. Good work, Cape Breton Branch!

Recent Additions to the Library

Transactions, Proceedings, Etc.

Presented by the Societies:

- Transactions of the Liverpool Engineering Society, Volume 46, 1925.
- Transactions of the Canadian Institute of Mining and Metallurgy and of the Mining Society of Nova Scotia, Volume 28, 1925.
- Transactions of the American Society of Mechanical Engineers, Volume 47, 1925.
- List of Members of the Institution of Mechanical Engineers, 1926.
- Constitution of the National Electric Light Association, 1926.
- Handbook of the Institution of Municipal and County Engineers, 1926-27.
- Year Book of the American Engineering Standards Committee, 1926.
- Constitution, By-Laws and List of Members of the Boston Society of Civil Engineers, 1926-27.
- Bulletin of the Société Scientifique Industrielle de Marseille, 1923-24.

Transactions of the Society of Naval Architects and Marine Engineers, 1925, Volume 33.

Proceedings of the Royal Society of Glasgow, Volume 53, 1924-25.

Proceedings of the American Concrete Institute, Vol. 22, 1926.

Year Book of the Philadelphia Section of the American Society of Civil Engineers, 1926.

Reports, Etc.

Presented by the Scientific and Industrial Research Council of Alberta:
Annual Report, 1925.

Presented by the Public Library of the City of Boston:
Annual Report, 1925.

Presented by the John Crerar Library:
Annual Report, 1925.

Presented by the University of Alberta:
Calendar, 1926-27.

Presented by the National University of Ireland:
Calendar, 1926.

Presented by The Minister of the Interior:
Annual Report of the Trade of Canada, 1925.

Presented by the Nova Scotia Power Commission:
Annual Report, 1924-25.

Presented by the Harbour Commissioners of Montreal:
Annual Report, 1925.

Presented by the Public Works Department of the City of Boston:
Annual Report, 1924.

Presented by the International Electrotechnical Commission:
Report of the New York Plenary Meeting, April, 1926.

Presented by the Department of Mines, Canada:
Final Report of the Peat Committee, 1925.

Presented by the United States National Research Council:
Proceedings of the Fifth Annual Meeting of the Highway Research Board.

Technical Books

Presented by McGraw-Hill Book Company, Inc.:
Corrosion—Causes and Prevention, by F. N. Speller.

Presented by E. and F. N. Spon:
Metal-Plate Work, by C. T. Millis.

Presented by Chapman and Hall:
Coal and Ash Handling Plant, by J. D. Troup.

Addresses Wanted

A revised list of members is being prepared for publication in the form of the Year Book, and it is desired to have this list as complete as possible. The following is a list of members for whom there is no address on file at headquarters. The Secretary would appreciate any information as to the present address of any of these members.

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Wind Measurement and the Protection of Coal and Ore Bridges

A Discussion of Existing Wind Recording Instruments and Special Designs for use as a Protective Measure on Coal and Ore Bridges and a Study of Wind Action on such Bridges

C. Stenbol, M.E.I.C.

Mechanical Superintendent, Algoma Steel Corporation, Limited, Sault Ste. Marie, Ont.

Paper read before the Sault Ste. Marie Branch of the Engineering Institute of Canada, March 26th, 1926

When a structure is designed, certain allowances are made for wind load, and, generally speaking, ample allowance is made. Occasionally, a house, a bridge, or a smoke stack blows down, particularly a bridge of the type known as a coal or ore bridge, which are structures on wheels, and can be moved along a track. This bridge travel is the weakest point, and forms the basis of the discussion in this paper.

Records Show Great Variation

To approach a subject a common and as well known as the *wind*, for the purpose of analyzing its behaviour, may seem to many, in our time of advanced science, as treading on rather beaten ground, and may, in fact, seem out of place. Every known force and phenomenon is safely bound by laws, expressed in formulas, the truth of which would be a serious matter to question. The wind is no exception. It is measured and expressed in recognized terms. The only trouble is that these terms vary. By comparing data compiled from various sources, we may come within 25 per cent of the truth, but should we be in the least careless a variation of 100 per cent is possible. The effects of such variations, when referring to specific measurements, are, to say the least, ridiculous, and convey ideas more erratic than the old nautical terms of *fresh wind, high wind, gale, storm, hurricane,* etc.

Students of travel and exploration, particularly in the Arctic and the Antarctic, will find that explorers are much concerned about the winds. By comparing their records, cases of variation of measurement seem very apparent. Using for comparison Captain Scott's South Pole expedition, 1910-1912, and Sir Douglas Mawson's Antarctic expedition, 1911-1914, and referring to the book written by Mr. H. G. Ponting, entitled "The Great White South," (Ponting was on Captain Scott's scientific staff), on page 126, he describes fully the Dines anemometer, which instrument they christened *the blizzometer.* On page 147, in describing one of the worst storms they had, he concludes by saying, "And the blizzard which followed on Atkinson's adventure attained a wind velocity of 60 miles per hour with a temperature of —35 degrees Fahr. On venturing outside, I was blown off my feet and completely lost in the smothering drift and pitch darkness. . . ."

Dr. Simpson, (of Scott's staff), reports of the same storm and describes it as the worst blizzard ever experienced. On July 8th, 1911, he records it as —31 degrees Fahr. and 63 miles per hour, and on July 12th, 1911, 66 miles per hour, with gusts as high as 80 miles per hour. Captain Scott wrote on July 10th, 1911, "We have had the worst gales I have ever known in these regions, and have not yet done with it. The wind reached an average of 60 miles per hour for one hour on Saturday. The gusts at this time exceeding 70 miles per hour."

Now, turning to Sir Douglas Mawson's records in his book, *The Home of the Blizzard*, vol. 1 and 2, he makes frequent and very interesting references to the wind and its behaviour, only a few of which will be mentioned. He writes, on page 114, vol. 1, "The classification of the winds here stated is that known as the 'Beaufort Scale.' The corresponding velocities in each case are those measured by the Robinson patent anemometer, our instrument being of a similar pattern." (Here follows the Beaufort scale in which hurricane is quoted as 77 miles per hour, equals 14.4 pounds per square foot.) "Beyond the limits of this scale, the pressure exerted rises very rapidly. A wind recorded as blowing at a rate of 100 miles per hour exerts a pressure of about 23 pounds per square foot of surface exposed to it. The mileage registered by our anemometer were the mean for a whole hour, neglecting individual gusts, whose velocity much exceeded the average, and which were always the potent factor in destructive work."

On page 119, he describes the art of walking against high winds, by using spiked boots and leaning forward on the wind. He illustrates this by several photographs, one of which shows a man, posing for the camera, with his feet together leaning forward at an angle of 31 degrees.

On page 121, he says, "Hodgeman was lost while visiting the anemometer. After two hours, search parties were sent out. The wind was blowing 80 miles per hour." On page 133, he says, "On May 15th, 1912, the wind blew at an average of 90 miles per hour for twenty-four hours. On the evening of May 24th, 1912, the hurricane came with a series of herculean gusts. As we afterwards learned, the momentary velocity of these doubtless approached 200 miles per hour." Again, on page 134, he says, "Frost bites that day were excusable enough, for the wind was blowing between 95 and 100 miles per hour. There was dense drifting snow and a temperature of —28 degrees Fahr."

There are numerous incidents in Mawson's records that his staff went about their usual work in winds above 90 miles per hour, whereas Scott's men had equal or more difficulty with winds of 60 miles per hour. It is rather difficult to account for this difference, but it becomes more apparent if the velocities are converted into actual force of pounds per square foot, using Eiffel's formula P equals $.0032V^2$, a wind of 60 miles per hour equals 11.52 pounds per square foot, and 90 miles per hour equals 25.92 pounds per square foot. The general condition of the two parties were somewhat similar or equal. They both had their bases on the South Polar continent, with the sea to the north and high glacial land to the south. They both had drifting snow with high winds. Captain Scott had 7 degrees lower temperature than Sir Douglas Mawson at incidents referred to, yet Mawson's men went about with greater ease than Scott's men, in winds of more than double the force.

Characteristics of Existing Anemometers

It is obvious that we cannot entertain any thought of the inequalities of the men, or that the records were incorrectly kept, consequently there is only one item open to question, namely, the correctness of their instruments. As before stated, Captain Scott used the Dines instrument. It is known as a *recording pressure tube anemometer*. Quoting the makers' further description, they say, "This instrument is constructed on the principle invented by Mr. W. H. Dines, F.R.S., in which the pressure and suction effects of the wind, acting upon a float, gives a perfectly true record of the action of the wind. The two tubes necessary to eliminate casual alterations of pressure in the room where the recorder is placed." Mr. Ponting makes many references to the Dines anemometer. Thus, on page 132, he says, "Another, and often less pleasant obligation of the watchman was to keep a heedful eye upon the blizzometer. When blizzards raged, the nozzle of this instrument sometimes becomes clogged with snow, thereby shutting off all pressure on the floating drum, and causing the pen to fall lifeless to the bottom of the chart."

Sir Douglas Mawson states that their instrument was of a similar pattern to the Robinson anemometer, and this instrument is described by the makers as follows: "In the well-known Standard Robinson cup anemometer, now in universal use throughout the world, for the determination of wind velocity, four hollow hemispherical cups are mounted upon crossarms at right angles to each other, with the open sections vertical, and facing the same way around the circumference. The centre of the cups moves with a velocity about one-third that of the wind which sets them in motion." The revolutions of these cups are recorded in several ways, which constitute various styles of instruments, but unlike the Dines instrument, it does not record sharp peaks or puffs of wind. Mawson writes on page 121, "The anemometer gave the greatest trouble, and before Correll had finished with it, most of the working parts had been replaced in stronger metal."

This will give an idea of the instruments, and shows that they were by no means reliable, yet there is nothing to show that the records were incorrect, except, assuming that Mawson tried to secure photographs showing men leaning against the wind, and it is natural to expect that the photographs giving the greatest angle were selected, making a rough calculation of the wind force required to support a man leaning 31 degrees forward, we get 14 pounds per square foot or 66 miles per hour, which is quite reasonable, as they would not be able to take pictures in the worst wind experienced, with dense drifting snow. But applying the same reasoning to Scott's men, they would not have been able to secure photographs in anything approaching even a 50-mile wind, which is hardly so, as we all have experienced greater winds; therefore, the only answer is that Captain Scott's instrument was reading low and Sir Douglas Mawson's instrument was reading high.

The reason for making this deduction is based on Mawson's quotation, "A wind recorded as blowing at a rate of 100 miles per hour exerts a pressure of about 23 pounds per square foot," which corresponds to the formula P equals $.0023V^2$, therefore 90 miles per hour equals 18.63 pounds per square foot, and if by chance Scott's instrument was calibrated to, say, old Smeaton's formula of P equals $.005V^2$, Scott's 60 miles per hour would equal 18 pounds per square foot, making the conditions and difficulties experienced by the two parties equal, instead of a difference of more than 100 per cent, as recorded. When we turn to our common engineering reference books, the various formulæ run from P equals $.005V^2$ to P equals $.0029V^2$.

The most recent information obtainable is from prominent instrument makers. Those of the United States appear to use P equals $.004V^2$ and those of Great Britain use P equals $.003V^2$, a difference of 25 per cent.

Turning back to our discussion of safeguarding moving structures from wind damage, we may differ 100 per cent,

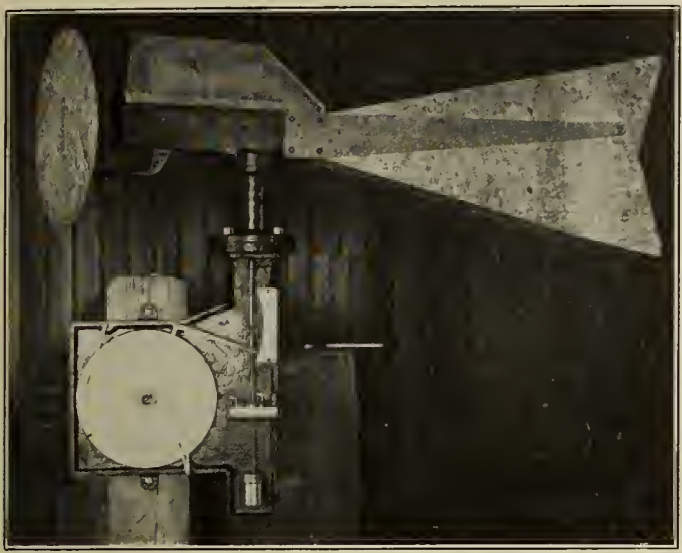

Figure No. 1.—Recording Gauge.

which, from an engineering point of view, is not permissible, and it is this difference which lead to the work described below.

Several years ago, the company with which the writer is associated was unfortunate enough to have two bridges blown down. This led to a vigorous campaign of safeguarding against similar accidents. Much was learned, and much had been done by the companies that carry tornado insurance. In their regulations as to bridge operators they stipulated that bridges must be fastened to track, at all times, except when moving, and must not travel in a *wind greater than 35 miles per hour.* This was accepted by the company and many others as a good safe rule, but it was not long afterwards that this rule was put to a test.

The blast furnaces needed ore, and the bridges were tied up on account of wind blowing at an estimated velocity greater than 35 miles per hour. The furnace superintendent naturally considered the superintendent in charge of bridges over-cautious, with the result that the mechanical superintendent was ordered by the manager to take the necessary precautions and move one bridge. To the writer, therefore, fell this unpleasant task.

Although, on the ground, the wind did not seem bad, on the top of bridge gusts of a force to indicate a 50-mile wind were experienced. The bridge was to move against the wind. The rails were wet and icy. The bridge had 100 per cent drive and good brakes. Men with wooden wedges were stationed behind each wheel, with instructions to follow up the wheel with the wedge as the bridge moved along. By watching the wheels it was noticed on two occasions that the wheels slipped on the rails when heavy gusts struck the bridge, showing that it would have been anything but safe to travel with the wind.

This incident led to the procuring of a wind gauge. Various instruments were considered, but none could quite meet the requirements. All that was required was to know accurately when the wind recorded 35 miles per hour; that is, 35 miles per hour here had to be 35 miles per hour anywhere else. The gauge had to be durable; it had to work in dust and snow; and, if out of working order, it must be easily repaired and calibrated again. As none of the instruments procurable seemed to meet such specifications, it was necessary to make one.

Two Types of Gauges Specially Designed for Bridge Use

Without describing the various models made, it will be sufficient to consider only two distinct types, as these are the final results of experiments carried out over a period of several years. The pendulum type, which is being mounted on all bridges, is simply an oblong plate hanging by a hinge from a yoke and faced square with the wind by a tail-plate. The whole instrument swings horizontally on a pivot, and as the wind increases the plate swings out, and when, say, 35 miles per hour is reached its lower end makes an electric contact on a stop fastened to the tail-plate. This is in turn wired in the usual way to the operator's cab, where a light, a bell, or both, call the operator's attention to the fact that the wind has reached the allowable limit. There is nothing about this gauge to go out of order, and when once calibrated it is fixed for all time. It does not need any other attention than that given by the regular men about the bridges. This wind-limit gauge is being manufactured, and, up to the present time, it has been installed on some 30 or 40 bridges.

The other type is also a pressure plate model, in which the plate is squared to the wind by a suitable tail-plate. The whole apparatus swings horizontally on a pivot, but, unlike the pendulum type, the pressure plate remains vertical and

Figure No. 2.—Recording Gauge Mounted and in Operation.

travels horizontally away from the wind. This motion is transferred through suitable levers, all mounted on ball bearings, to a vertical rod passing through centre of pivot.

The whole instrument is properly weatherproofed and mounted on a pipe, which in turn is supported by a mast. The rod passes down through the pipe to the recording instrument, which is located, in this case, in the dock office.

The recording instrument is a clock with a standard 12-inch chart. As the wind acts on pressure plate, it raises the rod, which is connected to a pen, which in turn marks the chart. It also records the wind direction on the same chart through the rod which turns with the gauge. The lower end of rod rotates a disc which through a cam-motion operates the wind-direction recording pen. It makes a complete 24-hour chart, giving at a glance the exact behaviour of the wind.

These, briefly, are the results of the experiments. The recording gauge described above is the fourth and final model. The second of these has been in operation for three years, and is still recording the characteristics of the wind.

The greatest difficulty to be overcome in the work was the calibration, or rather the determination of the ratio between pressure and velocity. The conflicting data, already referred to in this paper, left no definite base from which to start the work. By writing firms dealing in wind instruments their catalogues were secured, but in reply to inquiries as to upkeep and calibration, they politely replied that their guarantee went with the instrument, etc. From a British maker, however, a reply was received, part of which is as follows: "The indications are translated from pressure in pounds per square inch (should be pounds per square foot) to miles per hour by the formula P equals $.003V^2$. The actual calibration of the instrument is done by comparison with water tube gauge, using the formula W equals $.000731V^2$, where W has the pressure difference measured in inches of water, and V is the speed in miles per hour. The Robinson anemometers are constructed from calculations and corrected by comparison with standard instruments in a wind channel."

This indicates that the formula P equals $.003V^2$ is used in Great Britain, against an equally reputable one by United States, giving P equal to $.004V^2$, a difference of 25 per cent.

Our recording gauge is easily enough calibrated by dead weight, in the same manner as any weighing scale is tested. A pressure plate of one square foot and one pound acting horizontally against its centre, must be equal to a wind of the same force. It is, however, stated by various authorities that the unit pressure of the wind varies with the size of obstruction, and also with the shape of the object. This latter is clearly shown in the cups of the Robinson anemometers. Therefore, as a basis, one square foot flat surface and pound weights were used, and a series of tests were run to check the relation between pressure and velocity.

The wind is air passing a stationary object, and must be equal to an object passing stationary air. An automobile driving along a smooth level road on a calm day is about the handiest and most satisfactory means of carrying on such tests, as the speed can be varied and read directly on the speedometer. Several pressure plate models suitable for this work were made and mounted on a plank projecting four feet outside of the car. The top and wind shield of the cars were taken off. The speedometer was calibrated prior to the tests by timing between mile posts. Incidentally on this test it was found that mile posts varied from 1.2 to 0.8 mile. Tests were run from 20 to 40 miles per hour. The driver keeping constant speed by watching the speedometer, and the other man observing the pressure plate. Each test was run both ways several times, and on different days. Tests were run on July 24th, 1925, with pressure plate 6 by 6 inches or ¼ square foot, giving the following results as the average of several tests:

(1)	Speed of car	20	m.p.h. reading of gauge	0.4 × 4	equals	1.6	lbs.
(2)	" " "	25	" " " "	0.55 × 4	"	2.2	"
(3)	" " "	30	" " " "	0.75 × 4	"	3.0	"
(4)	" " "	35	" " " "	1.05 × 4	"	4.2	"
(5)	" " "	40	" " " "	1.2 × 4	"	4.8	"

P equals XV^2, V equals $\frac{P}{X}$ and X equals $\frac{P}{V^2}$, therefore, X from above tests worked out to:

$$\text{Test (1) } X \ldots\ldots = \frac{1.6}{20^2} = 0.0040$$

$$\text{Test (2) } X \ldots\ldots = \frac{2.2}{25^2} = 0.0035$$

$$\text{Test (3) } X \ldots\ldots = \frac{3}{30^2} = 0.0033$$

$$\text{Test (4) } X \ldots\ldots = \frac{4.2}{35^2} = 0.0034$$

$$\text{Test (5) } X \ldots\ldots = \frac{4.8}{40^2} = 0.0030$$

$$\text{The average of the five tests..} = \frac{0.0172}{5} = 0.0034$$

Similar tests were run with the pendulum type pressure plate, which gave an ascending scale with increases in the speed, the greater the coefficient X, apparently increasing with the angle of the plate.

(1)	Speed	20	m.p.h. angle with vertical	23°	coefficient,	X=0.003
(2)	"	25	" " " "	41°	"	X=0.0048
(3)	"	30	" " " "	46°	"	X=0.0045
(4)	"	35	" " " "	56°	"	X=0.0056
(5)	"	40	" " " "	60°	"	X=0.0058

The pressure plate in this case was 6 by 24 inches suspended lengthwise, the same as used for the wind limit gauges. This same plate has been checked with our recording gauge, by being mounted on same mast, with the contact stop at various angles, and the alarm compared with recording gauge in actual wind.

In conclusion, it may be said, although the experiments were not carried out over a sufficiently wide range, they indicate that there should not be any doubt as to a given wind. It should be measured and expressed in like terms everywhere. The research laboratories no doubt will in time take this question up, and, in doing so, it may be found that the wind pressure will be the logical unit to use. The velocity is then easily determined by a constant formula for a given temperature, barometric pressure, and rain, snow or dust carried with wind. Knowing this, a storm in any part of the globe can be compared with any other storm. For convenience, a pressure- and direction-recording gauge should be erected 50 feet from ground, or 20 feet above high buildings, with pressure plate one square foot, as such an instrument is large enough to be sensitive when heavily constructed.

Our experience showed that nothing of a flimsy or delicate nature will stand up to the continuous racking of the wind, the action of moisture, dust and snow. Sir Douglas Mawson emphasizes the destructive work of gusts or wind peaks. The writer has made many observations, and will mention an example watching the behaviour of the wind from the cab of one of the bridges. It was plainly noticeable (the wind peaks were just touching the 35-mile mark), that the gusts at times were coming with equal regularity, just as if they were trying to time the sway of the bridge. Once or twice it was done to such a nicety that it appeared that the sway of the bridge was sounding the alarm rather than the wind.

In guarding structures against wind damage, the maximum peaks must be considered, as they are really more destructive than a steady wind of equal velocity. Thus in the case cited above, the gusts added to the momentum, and each time put greater stress on the swaying structure until, fortunately, the timing of peaks changed and normal loading was again established. The action is probably best seen if watching exposed tall trees in a storm. They sway back and forth, and sometimes they sway back apparently beyond their normal position, and if the wind catches them again at that moment, it seems that it forces them with doubled power towards destruction. Another action of the wind is, *momentary peaks* at long intervals. It has been noticed, particularly in an abating wind, that the velocity of the wind sometimes increases after 20 to 30 minutes, with one or two peaks equal to its original force; therefore, it has been found advisable not to travel bridges until 30 minutes after last alarm.

This brings us up to very recent ideas in safeguarding travelling bridges against wind damage. The *Iron Age* of January 28th, 1926, in an article describing a modern manufacturing plant in which bridges were part of the equipment, says, referring to a coal bridge: " In addition to the usual safety appliances, is provided an anemometer which automatically cuts off the power and sets the clamps when the wind reaches a certain predetermined velocity." Again in a letter to the writer, the manager of one of the Tornado Insurance Companies, dated February 20th, 1926, says among other things: " The insurance companies and some superintendents think it adds to the safety of the bridge to have the travelling power cut off when the wind reaches a predetermined velocity." Referring to a certain manufacturer of bridge safety appliances, he goes on to say: " and he is now working out a plan whereby such cut-off would be effective only on a side wind, allowing the bridge to be moved with an end wind at a higher velocity."

In dealing with the idea of the wind cutting off the power and setting the clamps, the extreme conditions under which this will happen must be borne in mind. The bridge is travelling away from wind at its maximum speed. The wind reaches the danger peak and cuts off the power, and automatic clamps, together with the brakes, are applied. The nature of the automatic clamps is such that they jam tight to rail. In other words, the bridge is clamped to track suddenly, with the result that you have the momentum of the huge structure plus the force of the wind. The impact, when stopped suddenly, will be tremendous.* Would it not be safer, when the operator receives the wind alarm, to stop his motors, apply the brakes and, if necessary, plug the motors until the bridge is stopped, and then put on clamps? The above question was considered last December, and the suggestion it contained seemed to have some merit. All parties interested in the operation of our bridges were called in to discuss it. The operators considered themselves absolutely helpless and in great danger to their personal safety if the power was cut off the bridge while travelling. The question also arose as to whether bridge can travel with safety in greater end wind than side wind.

If the behaviour of the wind direction is studied it will be found that, like the velocity, it is by no means steady. One of the two bridges lost some years ago was from a *momentary gust, and from the opposite direction to the original wind, and it came after everybody thought the storm was over.* This was probably an exception, but it is really these exceptions which have to be guarded against. It is, therefore, hard to determine just when an end wind is safe. Also, considering that the side wind is probably not exerting its greatest force when it blows at right angles to the bridge. Compare it with a two-masted ship or sail boat. Wind dead astern does not drive it as fast as abeam, because when dead astern, only one sail is driving, whereas, when abeam, both sails are in the wind. The same is true in the case of the bridge. Any other wind, except a right angle wind, will blow through and *catch both sides of bridge,* and the vertical members offer greater surface when placed converse than when square with the wind.

Another factor to be considered is, when the wind strikes a surface other than at right angles, the co-efficient X in formula $P=XV_2$ increases as the angle increases; so that when the wind swings around to the end of the bridge, the side surface decreases, but the force of the wind per projected area of surface increases. This behaviour of the wind is plainly demonstrated when sailing *close hauled.* A good boat will lay four points off the wind, equalling 45°. Assuming half of this is the angle of wind to sail, and knowing that the same velocity wind will drive the boat faster at this angle than when squared to sail, it is almost reasonable to assume that the wind action on bridge members would be similar, so therefore a safe end wind would be only some of what lays inside of 45°, half of which comes on each side of bridge. If you examine a wind direction record, you will find that ordinarily it varies that much, and if of a gusty nature, fluctuates a great deal more.

The safeguarding of bridges from wind damage is, and probably will have to be, taken care of by the human element, and in this the operator plays an important part. When he is given the proper appliances and instructions, there is no excuse for bridge being subjected to undue hazards, but in order to establish standard appliances and coordinate the operator's duties with these and conditions under which he works, legislation similar to that governing steam boiler operation might be found useful. It will guard against unsafe structures, inadequate equipment, and radical methods, as well as assure the owners that only competent men, carrying the necessary qualifications, and having proven themselves reliable and efficient, are in charge of such structures.

*This statement has been discussed since this article was written, and advocates of letting the wind cut off the travelling current and set the automatic clamps say that " The clamp sets slow." That is, it requires several seconds for the clamps to set, which is generally true, but it will be found that this time is used up while clamp is travelling through its clearance space. Accordingly, the actual gripping of clamp allows for little or no braking power.

Electrical Development of Southern Saskatchewan

A Review of Existing Conditions and the Advantages of a Comprehensive Scheme for the Development of the Power Resources of the Province

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Paper read before the Joint Meeting of the Saskatchewan Branch of the Engineering Institute of Canada, the Saskatchewan Section of the American Institute of Electrical Engineers and the Southern Saskatchewan Section of the Canadian Institute of Mining and Metallurgy, at Estevan, Sask., July 8th—10th, 1926

The electrical development of Southern Saskatchewan is rather a comprehensive subject, and it is proposed to deal with only two or three of the salient features in this connection.

In order to obtain a thorough grasp of the subject, it is almost necessary to delve into ancient history. While steam and its attributes were more or less thoroughly understood at an early date, it remained for George Watts, in 1769, to harness this potential power for the benefit of mankind, and from this period on to the end of the nineteenth century may very suitably be designated as the *Steam Age,* which was the main factor that rendered possible the very rapid industrial development of the old world nations.

While it relieved the drudgery and hardship of human toil, and thus increased production, it was not a serious contributing factor to the elevation of the living conditions of the worker. Approximately one hundred years after George Watts' epoch-making discoveries, Siemens and Gramme, in the years 1866 to 1868, invented and perfected the electric generator which rendered possible the harnessing of electricity for industrial purposes. The initial research work of Faraday, the proof of this research work by mathematical calculation by Maxwell, the development of the necessary measuring instruments by Lord Kelvin and the pioneer training in the electrical field by Thompson have rendered possible the inauguration of the *Electrical Era* in the twentieth century, which has enabled the very vast developments of the new world under ideal conditions without having to go through the transition stages from the manual to the steam to the electrical development, which transition states have to a certain extent handicapped the industrial growth of the old world.

In a recent paper read before the Saskatchewan Branch of the Engineering Institute of Canada on "Industrial Development in Saskatchewan," the following table was used to show that the importance of cheap power is often exaggerated in the minds of the public:—

	Wages, Taxes, etc., per cent	Raw Material per cent	Fuel and Power per cent
The average of all manufacturing industries	20.4	77.5	2.1
Iron and steam industries	19.6	86.2	1.4
Food products	12.4	63.1	1.4
Textiles	35.5	62.6	5.4
Paper	32.0	77.5	2.1

If the above figures are allowed to stand at their face value, there is very little object in wasting any further time discussing the subject matter of this paper. While it is conceded that the actual cost of the power used in manufacturing processes is only a bagatelle of the production value of the article, it is very easy to prove, from an engineering and economic standpoint, that without the savings which have been effected in large and small industrial plants due to the labour-saving made available and the increased production rendered possible, which, it will very readily be seen, affects both the value of the raw material to the manufacturer and the wage item, which are the two major factors in all industrial production, the present very intensive development of industries in the twentieth century would not have been possible. This is conclusively proved by the following table showing the percentage of industries electrified in the industrial communities of the north central states of the United States:—

Industry	Total Horse Power Used	Percentage Electrified
Iron and steel	2,898,036	53.0
Food	1,562,360	62.0
Machinery	1,024,273	88.5
Transportation	968,311	85.9
Paper and printing	850,586	56.0
Steam, clay and glass	762,081	51.6
Chemical	724,930	77.6

The reason that a greater percentage of these industries are not electrified can be attributed to the lack of available power at a cheap rate, due to the phenomenal demand for electricity exceeding the available output. The present investment in the electrical industry exceeds seven billion dollars and new capital at a rate of over one billion dollars per year is being invested in this industry without any appreciable prospect of meeting the demand, and an extraordinary thing about all power development schemes is that even where developments have been started presumably well ahead of any prospective demand, immediately the power developed has become available it has been absorbed by the industrial development of the country.

Without further stressing the engineering and economic importance of electrical development, there is one other factor that is worthy of very great consideration in this connection, and, as far as the author is aware, has never received due recognition from engineers and executives in considering electrical industrial development schemes. This factor, which has a vital bearing, is the viewpoint of the worker, which cannot be shown better than by quoting the remarks of Mr. Wm. Green, president of the American Federation of Labour, the mouthpiece of undoubtedly the world's largest organization of labour. " The workers have learned from experience that electrically-driven machinery has lightened the burden of employment and relieved them of the drudgery and hardship of human toil. They now do with the machine what at one time required the strength and vigour of their bodies. Work has been made easier, life has been made more tolerable, living conditions have improved and the workers have been permitted to enjoy the blessings and benefits of modern life. The marvellous development of electrical power has resulted in increasing the efficiency and productivity of the individual worker. In proportion, as he has been supplied with additional horse power, the worker has made strides forward in increasing in capability and enlarging his usefulness. The United States Government statistics show that within the last two decades the productivity of the individual worker has been increased from twenty-five to fifty per cent; this showing could not have been made except for the broad and general use to which electricity has been adapted."

Further, Secretary of Labour Davis, of the United States, in a recent speech before the National Electric Light Association, gave as his considered opinion that the same degree of electrical development applied to industries in Great Britain as exists at the present time in the United States would very possibly have obviated the recent general strike, which has without doubt retarded the industrial development of the Old Country, and is still continuing in the mining industries. That this viewpoint is known and thoroughly shared by the British Government is, in the author's opinion, amply borne out by the Electricity Bill which is at present before the British Parliament and is the tangible result of the creation of the electricity commission some years ago.

The benefit of living in a new country is that we need not go through the throes of the evolutionary and development stages that were necessary in the older settlements, but can take advantage of the lessons learned by them and apply them to our own conditions. For this reason, the salient features of this Electricity Bill are of considerable interest to us who are on the threshold of the possible electrical development of this province. The fundamental features of this bill, and what it involves, were very concisely stated by the Right Hon. Neville Chamberlain, member of the British Cabinet, who was the speaker of the evening at the recent annual dinner of the Institution of Electrical Engineers, which is the largest and most influential technical society in Europe. The following is quoted from his address:—

> " I do not know what you think of it, but the first sketch of the proposals has been welcomed by the public with an unanimity which has rather alarmed me. The only thing that concerns me is that the bill is praised quite as much for what it does not do as for what it does do. To begin with, there is no subsidy and there is to be no nationalization, there is to be in fact as little state interference as is compatible with the purposes we have in view. I think I may, from a layman's point of view, express our purpose as being threefold, to provide for a concentration of production, for the pooling of power reserves and for the standardization of equipment. I believe that if we can achieve these three things, we may hope to see throughout the country a considerable cheapening of electricity and certainly a very much more available supply. I hope it will be agreed that aims of that kind are worth a serious effort. We cannot, of course, make such changes without interfering with local and personal interests; certain stations will have to be closed, thereby causing a certain amount of dislocation and change and possibly the abolition of existing offices. What we desire, however, are changes which we believe to be in the national interest and of benefit to the community as a whole, and what is of benefit to the community as a whole must sooner or later percolate right through to every individual part of it."

The last portion of these remarks are of very vital interest in considering any development scheme in a new country, as it will readily be seen that by initiating the development before instead of after the local demand forces the building of small isolated plants will be cheaper in the long run for the community, even although the scheme does not initially produce dividends, as it will obviate the necessity, at some later date, of having to buy and close the plants that will not dovetail into a comprehensive scheme. From information available, it would appear as if the five hundred and eighty odd local plants throughout the British Isles will be reduced, under this Electricity Bill, to less than sixty, situated at logical distributing centres selected on account of their facilities for the production and transmission of power at the cheapest possible rate.

The Situation in Southern Saskatchewan

Coming now to the local situation as it affects Southern Saskatchewan, a survey of industrial history will show that all great industrial developments have taken place on the coal fields if and where they are within easy access of a constant supply of good water. A survey of Southern Saskatchewan, in the vicinity of the coal fields, shows heavy alkali ground waters in the western portion of the field, with the Souris river as the only logical body of water draining an area where the alkali deposits are not so prominent as in the western section, and with its course so situated as to render the creation of a very large reservoir of water economically feasible without serious damage to arable land in the vicinity, storing sufficient water for both a very large electrical generating station and for all industrial undertakings which might be established in the vicinity of such a station due to its ideal location.

On a cursory survey of the situation, this location must be within a very limited radius of the town of Estevan.

The question of the possibilities of economical distribution from a plant so located has often been raised, a study of the Shannon river development scheme in Ireland, with an initial development of 75,000 horse power, will, to a certain extent, adequately answer this question. As this scheme is proposed to be a state-wide scheme, and if we consider that they propose to leave out the industrial area of Northern Ireland from this scheme, it will be seen that the conditions are very similar to those governing in Southern Saskatchewan, and by placing a map of Ireland over Southern Saskatchewan, with the development site near Limerick on Estevan, it will be seen that the territory to be covered is very similar. If further proof is required of the feasibility of such a scheme, a study of the Australian scheme for the supplying of power to South Eastern Australia from the lignite fields in the vicinity of Victoria, N.S.W., boundary, and the development scheme in the area of the Golpa open pit mines in Germany, are a further indication of the possibility of generating at pit heads. Mining in both areas is very similar to the conditions which would govern in Southern Saskatchewan.

Two very interesting features of this 160,000-horse power German plant which have a bearing on the possibility of development at Estevan are that, due to the high ash and sand content of the raw lignite, the steaming capacity of the boilers was very unsatisfactory, and this difficulty has been obviated by blowing dry pulverized fuel into the furnace, increasing the boiler ratings from 30 to 50 per cent. A further factor is that a well-designed lignite power plant taking advantage of all data available at the present time can be superior from the point of view of utilization of space, compared with the best bituminous coal plant possible, thus rendering the first cost of construction of the plant considerably cheaper, and this saving can be utilized toward a reduction of rate or an increase in the distances of economical transmission, thus increasing the scope of pit head generation on the lignite fields, as against local generating systems.

From the above, it will be readily agreed that the establishment of a large generating plant for Southern Saskatchewan at the pit heads is, from the engineering and economical standpoint, possible. The next point to be considered is, is it justifiable under present conditions? A reference to Mr. Chamberlain's speech referred to above will bring out one phase of this situation, namely, the necessity for the elimination of the uneconomical small plants which are bound to spring up if a general development scheme is not undertaken in the near future.

The second factor of considerable importance to a farming, as differentiated from an industrial, community is the prospect, becoming more possible every year, of serious inroads being made into the foreign markets for our farm produce by countries who previous to the World War held those markets, and who will within a very short time possibly be again serious contenders on these markets, with everything in their favour. Even if they fail to make serious inroads into our present export market, the competition introduced is bound to seriously affect the price obtainable for our produce, making possibly production, under present agricultural methods, unprofitable. Considering the above possibility, until new markets can be found for our surplus products or until our methods of agricultural production can be adjusted to conform to the new conditions which are bound to arise, serious depression is almost bound to result unless an industrial development of our natural resources can be started to tide us over this adjustment period. Such industrial developments are unquestionably bound to be hastened by any comprehensive electrical development scheme which may be inaugurated.

On account of the sparse population and the lack of present large industrial centres, an electrical development scheme is bound to incur serious losses during the first few years of operation unless the resources available in the vicinity of the proposed plants are utilized at their maximum efficiency. This can never be done economically by the individual development of small companies, and the only scheme that is apparently at present feasible is the creation of a large holding company for the establishment of the necessary water reserves for power and industrial purposes and the adequate conservation and use of all products of such a development scheme to the maximum extent. This is only possible under unified control with subsidiary companies, thus reducing the engineering and sales organizations and expenses to an absolute minimum.

It is generally recognized that coal cannot be considered as just a fuel, but is a valuable and complex mineral resource to be conserved to the best of our ability. The report of the British Coal Commission, considered to be a masterpiece and the most comprehensive report yet drawn up on this industry, contains the following significant paragraph:—" The question of the most profitable use of coal is not the co-ordination, as is often supposed, of two industries, coal and electricity, but of several, coal, electricity, gas, oil, chemical products, etc."

A comprehensive scheme for the utilization of all by-products of Saskatchewan lignite has been very thoroughly outlined as an economic issue in the eastern financial press, and some of the salient engineering features have been touched upon recently in the technical press. Any discussion of electrical development under existing conditions in Southern Saskatchewan must of necessity touch on the economic and engineering details of industrial development as well as rural electrification, which subjects it is not intended to touch upon in this paper, except to state that the Southern Saskatchewan scheme can be elaborated and reproduced at other centres into a provincial-wide scheme, and the logical centres that suggest themselves for further initial industrial electrical development points are Regina, Saskatoon, Prince Albert and the coal fields of the north, eventually linking up with the hydro-electric developments possible on the Churchill and Nelson rivers.

The two largest steam-boiler plants within reasonable freight haulage of the lignite fields are at Regina and Winnipeg, and both of these have found it more economical to use the Alberta semi-bituminous coals in preference to lignite, partly due to the inherent defects of lignite, such as inability to store high moisture and ash content, low calorific value and low fusing point of the ash. These, however, as pointed out, can and have been overcome in the German plant mentioned, and there is no inherent difficulty in utilizing the Saskatchewan lignites in properly-designed plants, but from the results conducted so far it would appear that it is up to the people of Southern Saskatchewan, and particularly Estevan, to work out their own salvation in the matter of the utilization of the natural resources so prolifically situated at their thresholds. If this is done, quoting from Mr. Chamberlain again, " The community is bound to benefit as a whole, and what is a benefit to the community as a whole must sooner or later percolate right through to every individual part of it." Such development, however, is not possible unless local and personal interests are waived and comprehensive plans are involved for the future, and continually brought up to date as more engineering information on developments becomes available. In a survey of the industrial and scientific development of the last hundred and fifty years, it will be found that the visionary dreams of the individual electrical community or state, oftentimes considered absurd and impossible when first suggested, have by perseverence become established facts and have resulted in some of the greatest benefits to mankind, and it seems safe to state that the above applies most forcibly to the growth and development of the technical industry in its broadest aspect.

Rural Electrification in Western Canada

A Compendium of Some of the Problems Encountered in Venturing into a New Market for Power, with Particular Reference to Rural Distribution

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General

It is difficult to define rural distribution or to describe a rural line. In most localities a *rural line* is taken to mean one that serves farmers only. This limits the field too closely, for there are many lines serving hamlets and even villages, as well as farmers, that might comprehensively be described as rural lines; so, for the purposes of this paper, rural distribution will mean service to hamlets and villages as well as to farmers.

It is only within the present decade that any nation-wide attempt has been made to study and meet the rural demand on this continent. Perhaps the Great War may be given the credit or cited as the cause which gave an impetus to this movement. Previous to the war there were, of course, many transmission and distribution systems all over the continent, linking up great and small cities and serving en route towns and even villages where there was sufficient manufacturing load to bear the cost of a substation and local distribution system. But the feasibility of serving the hamlet and the farmer had not been determined. It is true that there were many distributing companies, composed largely of consumers, who purchased energy en bloc from an operating company for distribution to themselves. They assumed all the risks.

The scarcity of labour and its high cost; the movement of great bodies of rural population and consequent widening of knowledge of and demand for modern conveniences; the release of capital diverted temporarily into war channels; the prosperity of sections of the farming community; an increasing diffusion of knowledge of the utility to rural people; and the increasing density of population have all been causes contributing to the movement. To these should be added the perception by the management of the utilities that the great mass of the rural population must be served electrically, otherwise they would serve themselves. Whatever the cause, there is at the present time a very widespread endeavour on the part of operating companies to study and develop the rural field. In 1923, the National Electric Light Association, collaborating with the United States Department of Agriculture, the American Society of Agricultural Engineers and the National Farm Bureau Federation, appointed a committee of experienced engineers to study the problem, and, under their guidance, in seventeen of the United States, experimental lines have been constructed and the results of the operation are being closely analyzed.

In Canada we have the outstanding development of the Ontario Hydro-Electric Power Commission, who, since 1911, have been working on this problem, and at present are serving over 20,000 rural consumers. In one year alone, 1920, this commission caused personal visits to be made to 22,000 farmers, to determine the feasibility of giving them electrical service. In the Prairie Provinces, a beginning has been made along these lines in Manitoba by the Manitoba Power Commission, but this system is in its early development state, and no conclusive data may be expected from it for a year or two. The Commission is now actively engaged in the study of the farm problem. During the past year approximately forty miles of rural lines have been built. Many petitions for service have been received and are now under investigation.

The Market

All will agree that there must be a nucleus of demand or potential market before a development of this nature may take place. One illustration of this will suffice. In the northern parts of Manitoba and Saskatchewan are the Nelson and Churchill rivers, with five or six million potential horse power. Why are they not developed? Because there is apparently no convenient market. There are no large consumers of power, no large centres of population close enough to the power sites to carry the tremendous annual charges on the cost of development of the sites and the building of transmission lines. There must, therefore, be a ready market for the sale of power or a market capable of development.

The potential rural market has long been overlooked or neglected. There are isolated examples to the contrary, as in Ontario, in California among the irrigated farms, and in some of the states where small cities and towns, all containing manufacturing plants, and thickly scattered over the countryside, form centres of distribution from which rural communities are served, but, generally speaking, it has not been considered sufficiently profitable to merit development.

The urban demand in many localities has made it unnecessary to sell electricity; it has sold itself; but rural districts are now demanding service, and the industry is busy trying to satisfy this demand. In most cases, however, great difficulties are encountered; returns on capital are small, and, compared with urban distribution, the capital invested per consumer is large, load factor is low and demand irregular. Low density of population and small consumption of energy per capita contribute largely to the difficulties of the problem.

There are many points of difference between rural and urban distribution; in the design of the lines, in the load demand, in the consumption, in the methods of service and in the general aspect of the subject.

To-day we hear engineers speaking of customer miles, of kilowatt miles, instead of kilowatts per thousand feet of line or per hundred square feet. We hear such things as yearly service charge per farm instead of minimum monthly charge; kilowatt-hour per pound of butter instead of per ton of steel, and so on; power costs per bushel of grain threshed, per ton of ensilage cut, etc. A new nomenclature has come into the engineer's language, and those who are dealing with such matters have had to revise their tables, alter their constants and make new curves and graphs to depict the condition and results.

It is evident that new methods of obtaining revenue, of increasing consumption, must be developed if rural lines are to show a profit or even be self-supporting. The market, therefore, must be developed along the lines of showing the consumer value for his money, and once this point is demonstrated the saturation point will be easier to approach.

In the Ontario Hydro-Electric Power Commission, three farmers or hamlet consumers, or 15 kilowatts per mile, is set as the minimum requirement at the published rates for the extension of a rural line from a village or town. In Manitoba, if two farm services per mile between villages cannot be obtained, the service charge becomes so large as to prohibit, in many cases, the extension. In some of the states the requirement is that the farmer shall make a definite investment in wiring and current-consuming devices to the value of over $500. In other states the farmers are required to finance the building of the line from the centre of distribution.

In western Canada, our problem differs from that in eastern Canada or from that in the eastern or middle states. Here we have a lower density of population. In Saskatchewan, for instance, of a total area of 161 million acres, with 44 million acres occupied as farm land, the total population, 1921 census, is 757,510, including a rural population of 538,552. Taking the area of assessed land as a basis, the rural population per square mile is approximately eight.

On the same basis, the rural population of Manitoba is approximately fifteen. In Ontario, on the same basis, the rural population is thirty-five per square mile. These figures should not be taken as a measure of the prospective market for power, but only as a comparison of the relative densities of rural population. In western Canada towns are infrequent, and there is little or no manufacturing. The farmers have heretofore been largely grain growers, and except in the cultivating of the fields are not large consumers of power. In eastern localities, every small town has a manufacturing plant of some kind which uses power. The farmer raises more stock, more dairy products, and has a greater use for power in a confined area, which is a great essential to low unit cost. There is, therefore, more consumption per dollar of capital invested in construction. Rates can be lower and greater encouragement given to the market, resulting in profit. As the soil becomes impoverished in western Canada, and no longer responds to mining methods but requires diversity of product, and, as the population becomes denser, then the problem of cost will become simpler. It will be seen that conditions here are even more difficult than in the east.

Here in our own country we have reached the point at which the future of the Dominion is in our own hands. It is in our power to develop into a great nation,—the biggest link in the British Empire. The prime essential would seem to be an increase in population, not necessarily in the present urban centres, but most certainly in the rural areas, because for a long time agriculture must remain our basic industry. We require the best class of immigrant it is possible to obtain, preferably the experienced and intelligent farmer. We must strive to attract and welcome the best settlers only, and, when we get them, keep them on the land. Many of the present-day farmers do not consider the farm their permanent abode. They think of it as a means whereby they may accumulate sufficient capital to enable them to retire to some comfortable urban centre to enjoy life according to their tastes. Agriculture is the most essential industry in any nation. In the older communities, families occupy the same land generation after generation. In this newer land, the majority of childhood scorn the farm and at the first opportunity desert the land and swarm to the bright lights.

Farming in this country must not only be profitable, but also the farmer and his family must be comfortable and contented. They must enjoy being agriculturists. Chief amongst present-day comforts and conveniences is electricity. If we can serve the farmer with electricity and teach him its proper uses, then it will indeed become a factor, and a great factor, towards settling the land problem.

Now, are we to sit back and wait and hope for a dense population to serve at an assured profit? Or will we place this incomparable servant and convenience at the farm door now, to the limit of our ability and resources, and thus assist in attracting the population so necessary to our future prosperity?

The Source of Power

Power may be developed by any of the methods in common use,—steam, fuel-oil, natural gas, producer gas, water falls, wind power.

In Manitoba there is the Winnipeg river, which can serve practically all of the settled portion of the province. In Saskatchewan there are the Souris coal fields but no large water power within easy transmission distance of the farming communities. In Alberta there are many water powers and coal fields and wells of natural gas.

Power may be developed in one large central station or in a number of stations of greater or smaller size, either connected or isolated, as the case may be. This paper does not deal with the central station problem, but the power may be generated, and its cost at the bus-bar is a very important factor.

In small systems, where the farthest point of transmission does not lie beyond, say, 25 miles from the point of generation, the cost may go beyond 3 cents per kilowatt hour at the bus-bar. But beyond this distance it should be below 3 cents, and as the distance goes beyond 100 miles it should drop below one cent. The reason these limits are chosen is that power losses in transmission and distribution of from 20 to 70 per cent are experienced, and even 70 per cent may be exceeded. If, then, the cost at the consumer's meter is beyond 5 or 6 cents, and in addition there are the fixed and operating charges service on the line, the total cost of the kilowatt hour becomes so high as to make its use prohibitive.

The voltage of generation is not a very weighty factor in the general case. It is assumed that only a.c. is being considered, and it is readily increased in pressure. At present, 3-phase, 60-cycle current is the most common; 60-cycle current creates higher transmission losses than 25-cycle, but there are compensating advantages, such as lower cost of apparatus per unit of capacity, which make it desirable.

The Method of Distribution

The first step in rural electrification is to obtain a supply of energy at a centre of distribution. The centre of distribution may be the generating station or a point in a link of a transmission system. Let us assume that energy is available at this point at a suitable voltage and a market is waiting for service. The load may be purely farm load, village load or combination of both.

The size of the load and the distance transmitted determine the voltage and type of line to be built. Experience gained formerly in transmitting large blocks of power long distances at stated voltages is not necessarily a true standard by which to design rural lines, because on the latter the load demands are much smaller and consequently the distance of transmission may be greater. Voltage regulation determines the distance of transmission on rural lines. The present market may not be the ultimate market, and in the future the line may require to be extended far beyond the original terminus. Consequently, before deciding on the voltage and type of line, the whole area capable of being served from that centre of distribution should be investigated.

It would appear that 11,000-volt star connection is the limiting voltage from which farm and village loads may be economically tapped off the same line, and 30 miles might be taken arbitrarily as the limit of transmitting distance at that voltage. From this line farmers may be served single-phase with 6,600-volt transformers at a cost not greatly in excess of the usual 2,200-volt type. For distances up to 15 miles, 4,000-volt star connection is a very useful voltage to use, as all equipment is standard, easy to obtain from stock, and protective equipment is low in price. With the same size of pole and conductor, there is little difference between the cost of an 11,000-volt line and a 4,000-volt line.

In the majority of systems at present operating, transmission between generating stations and large cities and towns is affected by 66-kv. or 110-kv. lines. From these towns 40-kv. or 22-kv. lines link up other small towns and villages, and from the latter 4,000-volt, 6,600-volt, 11-kv. or 13-kv., 3-phase lines radiate. From these mains single-phase lines are taken off to serve consumers located in the surrounding territory.

In one of the northwestern states there is a 40-kv. loop 250 miles in perimeter, fed at two points, the longest leg being 150 miles. This seems to be a considerable distance to transmit energy effectively at 40-kv. In Manitoba, there is a 2,200-volt line serving two small villages and some farmers which is 15 miles long and is giving good service. These distances are cited to show the nature of the load demand and the danger of using the usual standards in designing or estimating rural lines.

A 3-phase, 22-kv. line can be built for under $1,500 per mile, using 35-foot butt-treated poles, triangular spacing steel pole tops, No. 3 copper or equivalent, normal pole spacing 250 feet, guyed at road crossings and at the half-mile.

A 4,000-volt or 2,200-volt, 3-phase line, using the same type of construction, will cost about $1,400 per mile. Using No. 6 copper, 30-foot poles, 200-foot spacing, it can be built for about $1,120 per mile. Single-phase, 2,200-volt or 6,600-volt lines with 30-foot poles, 150-foot to 200-foot spacing and No. 6 copper cost from $650 to $800 per mile, depending on local conditions and the amount of *sand papering* which the line receives.

These are lines of substantial construction for their purpose, and, with reasonable maintenance, will last from 15 to 25 or 30 years. None of them include ground wires or right-of-way.

Cost of farm services vary; a 3-kw. service directly off the line to the buildings costs approximately $85; the half-mile-long service of 15-kw. or 20-kw. costs $1,000 to $1,500.

It seems reasonable to assume that there will not be required, for a long time, in the Prairie Provinces any greater voltage than 4,000-volt to serve the farm load. The choice of voltage at the beginning of this development of farm service is important. Complications will arise and costs increase if more than one voltage is chosen, since apparatus of the various voltages will have to be carried in stock. Unfortunately, sufficient test data have not been collected on the Manitoba Power Commission's system to furnish tables of demand and consumption. However, curves can be obtained from other operating utilities.

The Rate Structure

The fixing of rates for village or farm service is a very contentious matter. It may be stated that in villages and small towns, 20 cents per kilowatt hour for lighting and 5 cents per kilowatt hour for power are the maximum rates that can be set and still obtain a fair consumption. This is a point for argument, but experience has shown that consumers are very careful of the use of power at these rates and will not use it freely.

At these rates, in villages and towns where there no street lights, consumptions lower than 50 kilowatt hours per capita per annum occur. With street lighting it goes as high as 170 kilowatt hours. With rates of 15 cents and 4 cents, respectively, it ranges from 150 to 200 kilowatt hours per capita per annum.

These consumptions are obtained without any intensive selling of appliances. With careful education and energetic sale of appliances, there is no reason to doubt that these consumptions will go as high as 350 kilowatt hours per capita per annum, even at 15 cents and 4 cents, without greatly increasing the peak demand.

When farm rates are considered, a new factor is encountered, but perhaps it would be well to revert at this point to a short study of any rate structure, considering only transmission and distribution costs. There is first the cost of power. In the transmission end of the rate this may be a rate per horse power or per kilowatt year or a kilowatt hour rate. In rural distribution it is usually a kilowatt hour rate, for the reason that the load factor at present is not definitely determined, and diversity factor on a kilowatt year rate might approach 100. Whatever unit is used, the rate should cover interest, sinking fund, replacement reserve or insurance on the capital cost of construction, taxes, maintenance and operation, and in addition the cost of power at the receiving end. It will be readily seen how the cost of the kilowatt at the receiving end decreases with the increase in the load factor up to the point where the capacity of the line is reached. These are bare costs, to which may be added profits or dividends. Then in a village there are the same charges on the distribution system, and, when all these items are added, the cost of the kilowatt hour to the consumer is obtained.

These are the items of cost, but they are treated in various ways. The treatment varies, whether the utility is financed by private or public capital. In Ontario, the Hydro-Electric Power Commission may suspend for five years certain of the fixed charges. In some private companies this section of the utility is operated at a loss for a time until increasing consumption and revenue overtakes the accumulated losses.

The rate to the village is applied in many ways. Some companies put the same rates into effect in all small towns and villages over a large area. In other localities each section of the transmission system is self-supporting, that is, each new town taken on carries the yearly cost of the extension of line necessary to reach it. The Ontario Commission arrive at the wholesale rate by a system of mileage and demand. These comments apply to a transmission system; where there is an isolated plant, the town or village carries all of the yearly costs unless the operating company is absorbing a loss in one town by spreading it over other towns operating at a profit.

Coming back to the farmer's rate, it is becoming a recognized principle that the farmer must carry the fixed charges on the line from the centre of distribution and pay an energy charge in addition. The fixed charges and maintenance on a farm line may be taken as 12 to 15 per cent per annum. Operation costs vary with the mileage patrolled by one man, for this is practically the only operating cost.

One mile of line costs, say $1,120, this being the main trunk through the district.

The fixed and maintenance charges, at 15 per cent per annum are	$168.00
Cost of patrolling	15.00
Total annual costs	$183.00
With 3 farmers per mile, each share will be	$61.00
Taking the capital cost of a 5-kw. farm service at $200, with an annual charge of	30.00
Service charge per farm per annum will be	$91.00

In addition, there will be the cost of energy, which should not exceed 8 cents per kilowatt at the meter. It is quite evident that the costs of construction must be kept to the absolute minimum, otherwise the cost of service becomes prohibitive.

The Ontario Hydro-Electric Power Commission base their rates on the cost of the kilowatt mile. All consumers within a certain zone are charged the same rate for the same class of service. The zones have no geographical or political boundaries.

Other utilities use different systems. The Adirondack Power Company establish a rate for the first consumer outside the village. If another farmer farther out desires service, estimates are made of the cost of extension. If the average rate for these two farmers does not exceed the first farmer's rate, both have the same rate. If it exceeds the first rate, the latter remains the same, number two farmer paying the excess, and so on as new extensions are made.

In some localities the utility finances and constructs the line and services, recovering its costs in the yearly service charge. In others the farmers finance and the utility constructs the line, or the farmers also do the construction and the utility sells energy at the centre of distribution. There seems to be a trend towards the utility both financing and constructing the line, thereby controlling more effectively the design and operation and making it easier for the farmers to finance.

The rate must be reduced to its simplest terms before quoting to the farmer. He cannot be expected to understand the complicated process by which it is constructed. He is first of all interested in the cost in dollars and cents of the classes of service offered. The value received for expenditure made must be demonstrated.

Experience gained in localities where farm service has been given a trial, where a demonstration of the great variety of uses has been made, shows that he becomes a satisfied and even enthusiastic consumer. Even though his rates are higher, he would not be without the service at much higher cost. Much of the time formerly expended in tedious chores is released for more profitable work. The quantity and quality of produce is increased, and he finds that electrical power is not only a convenience but a money-maker as well.

Whatever the rate, or however it may be apportioned, there must be an intelligent and continued effort on the part of the utility or some directing body to develop the greater use of electrical energy. Its use for lighting is the first, but should not be the last to which it is put. By lighting the buildings efficiently and cheerfully, and by taking the drudgery out of the chores, farm life can be made comfortable and attractive, and these improvements will go a long way in retaining for agriculture its position as the basic industry of our country.

Here is a problem that challenges the best thought and skill of the engineer.

Conclusion

1. Much experimental and constructive work has been done in rural electrification and valuable data on the result are available.
2. At the first glance, the market in the Prairie Provinces does not appear capable of development, owing to low density of population and long distances between consumers.
3. A closer study reveals certain localities that are capable of immediate development.
4. Development of a market attracts and makes feasible adjoining markets.
5. Standards set and results obtained in other localities should be used with caution when applied to conditions in the Prairie Provinces.
6. The electrification of the rural field must be accompanied by an intelligent direction and demonstration of the varied uses to which electricity may be put.
7. Costs must be kept low and construction simplified.
8. Rates must be simple.
9. In the initial stages of development, large returns cannot be expected on the capital invested.
10. The benefits derived from rural electrification cannot be fully estimated; its dividends are cumulative.

The writer is indebted, for a great part of the information from which this paper has been written, to the officials of the Ontario Hydro-Electric Power Commission, the Northern States Power Company, the Otter Tail Power Company, and to articles that have appeared from time to time in technical periodicals.

Mining North of The Pas, Manitoba

Notes on Mining Claims and Mineral Prospects in the Mineral Belt North of The Pas, Manitoba

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Paper read before the Joint Meeting of the Saskatchewan Branch of The Engineering Institute of Canada, The Saskatchewan Section of The American Institute of Electrical Engineers and The Southern Saskatchewan Section of The Canadian Institute of Mining and Metallurgy, at Estevan, Sask., July 8th-10th, 1926

The recent discovery of valuable copper-zinc-gold deposits in granite gneiss in connection with pegmatite dykes at Kiss-iss-ing or Cold lake, and other points to the east and west, indicates that the mineralized region is much more extensive than had been supposed, and, from present information, includes the area within the hatched line on the accompanying map.

Toronto interests having taken an option on the Sherritt-Madole claims, indicated at "A," a diamond drill was brought in last fall, and drilling was completed for the present a few weeks ago, and although no definite information is yet available, information brought down by reliable parties is to the effect that the ore is of the same type as that of Flin-Flon, but of much higher grade. Its development will be dependent upon that of Flin-Flon, and if the value and extent of the ore body are as represented, it is probable that the projected railway to Flin-Flon will be extended to Cold lake, and that a transmission line for electric power may be constructed to the Bloodstone falls, on the Churchill river, about 35 miles further north, (see map), where 35,000 continuous 24-hour horse power are available, and it is probable that with small additional expenditure the possible power output could be increased to 60,000 horse power. (See page 22 of Dr. E. L. Bruce's Report on the Amisk-Athapapuskow Lake District, 1918, Memoir 105, Department of Mines, Ottawa.)

Referring now to the great Flin-Flon copper sulphide ore deposit, which is situated at Flin-Flon lake on the boundary between Manitoba and Saskatchewan, but lies mostly in the former province, and is now in process of development by New York interests and the Mining Corporation of Canada, a railway charter from mile 7 on the Hudson Bay Railway to Flin-Flon, via Cranberry Portage, has recently been granted by the Manitoba government, and bonds for construction guaranteed to the extent of $3,500,000. Surveys for this line were made several years ago, and the approximate location is shown on the accompanying map. The distance from mile 7 to Cranberry Portage over the flat lying dolomite is about 48 miles, and reported easy of construction, and when that point is reached water transportation will be available through lake Athapapuskow to the head of Schist lake, thus giving access to the Mandy mine, and, by a 4-mile wagon road, to Flin-Flon during the summer season. This route could be utilized pending the construction of the remaining 37 miles through the rugged Pre-Cambrian to the terminus, and in the rock cuts on the latter portion it is highly probable that, in the same way as at Cobalt and other points in the construction of the National Transcontinental Railway, valuable mineral discoveries will be made, for the region is well mineralized, there being numerous surface indications of copper, zinc, gold and silver.

The gross value of the 16,000,000 tons of ore at the mine is stated by Mr. Watson, president of the Mining Corporation of Canada, to be approximately $242,000,000, viz.:—

Zinc.....	$79,000,000	Copper.....	$76,000,000
Silver....	62,000,000	Gold.......	25,000,000

Mr. Phelan, chief engineer of the corporation, states, in connection with the application for the railway charter referred to, in which the corporation is interested, "*The Flin-Flon is the largest known ore deposit on the North American continent.* The ore deposit is commonly called complex, which is generally considered to mean an ore containing not only gold, silver and copper, but also zinc. Due to the scarcity of new mines and the high price of zinc in the last five years, an intensive study has been made of such ores in an attempt to treat them successfully. One of the successful methods, which is in extensive use, is the so-called 'preferential oil flotation' process. Harry Whitney's mineral department, in 1919, secured patents covering another process designed to treat such ores. This method is called the 'sulphating process,' and a large amount of money has been spent in its perfection and its adaption to complex ores in general, and the ore from the Flin-Flon mines in particular." Mr. Phelan said that it would be some time before the tests now being made at Denver would be completed, but that reports from that city express extreme satisfaction in the progress being made thus far. Eighty tons of ore and one hundred gallons of Flin-Flon Lake water were shipped to Denver a few days ago, the object being to determine the chemical action of the water. In connection with these tests, Messrs. Watson and Clark, officers of the Mining Corporation, in an interview at Winnipeg in April, stated that the present option on the property would positively be taken up and that there was no question about the discovery of a satisfactory process for handling the ore whereby values in zinc would be realized, thereby increasing the total value of the ore by about $6.00 per ton. Present value of this ore being from $7.00 to $10.00 per ton, it would thus be worth from $13.00 to $16.00 per ton.

When the tests are completed, it is then intended to erect a pilot smelter costing from $600,000 to $700,000 for the purpose of working out further details of the process on the ground, and after this has been operated so as to determine any modification that may be necessary, the regular smelter to handle the full output will be installed, and Mr. Watson stated that the Mining Corporation would expend approximately $12,000,000 in initial expense within eighteen months of the time the railway reaches the mine.

The construction of a smelter and mining operations at Flin-Flon will afford employment for a large number of men, so that on the border between Manitoba and Saskatchewan there is now reasonable assurance that a large mining town will soon be established.

The Mandy mine of high-grade chalcopyrite, from which over two million dollars worth of ore has been shipped to the Trail smelter, is situated about six miles south of Flin-Flon, and there is still a large amount of valuable ore to be taken out. A detailed description of this remarkably rich ore body will be found on pages 72 to 77 of Dr. Bruce's report previously referred to, also in the report of Dr. Alcock, pages 1 to 36, in Summary Report, 1922, part G, of the Department of Mines, Ottawa.

The Mandy was prospected, drilled and developed under the direction of Mr. J. E. Spurr, geologist to the Tonopah Mining Company and now editor of The Engineering and Mining Journal. In his book on the ore magmas published in 1923 he describes the ore as follows:—"The ore deposit is a sulphide lens in green schistose rocks, which are probably of tufaceous origin. The only difference between the foot wall and the hanging wall is that the latter is slightly more schistose. The ore occurs in a narrow especially schistose zone lying in more massive greenstone schist. Three-quarters of a mile from the mine is a large granite intrusion. . . . The length of the lens is about 200 feet, with a well sustained width of about 40 feet, it wedges out with depth, and in about 200 feet, more or less, practically comes to a point or becomes inconspicuous. Inasmuch, however, as the construction indicates that a large part of the vertical extent of the lens has been removed by erosion, it is evident that originally the ore body had much greater vertical dimensions; it must have been a body at least 400 feet high by about 200 feet long, and 30 to 40 feet wide at the centre, tapering above and below.

"The lens consists of practically solid sulphides, with

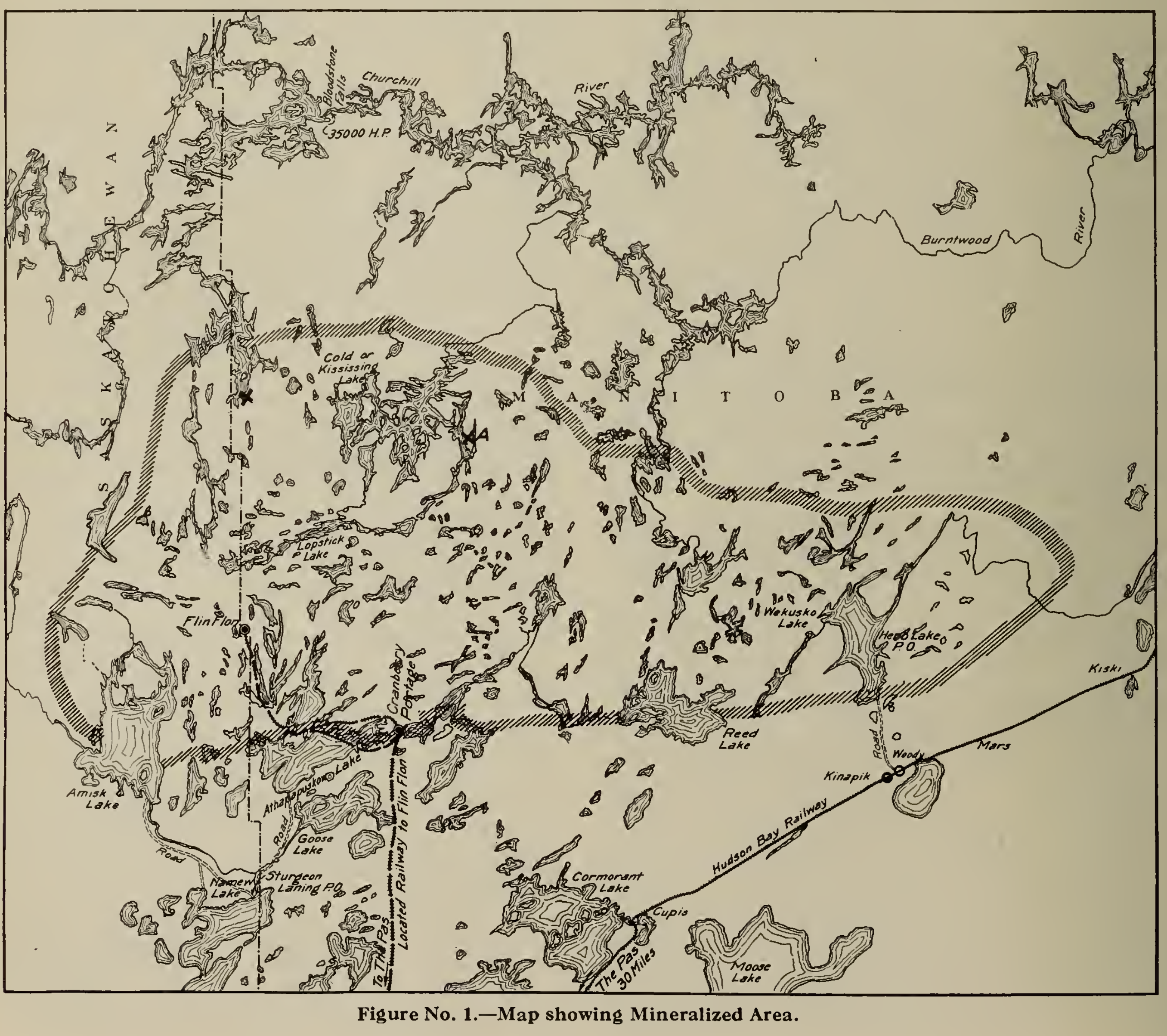

Figure No. 1.—Map showing Mineralized Area.

very little visible quartz. Massive chalcopyrite and zinc blende are the most conspicuous elements, and, though often occurring mixed and interlaminated, occur mainly in separate portions of the lens, so that it has been possible to mine the high-grade chalcopyrite separately and ship it to the smelter.

"(1) The earliest vein or vein-like formation consisted of a very unimportant amount of white quartz veinlets, and veinlets of coarse pyrite.

"(2) Massive fine-grained blende, dark red, dense and homogeneous throughout as to grain and colour, was introduced. It formed a lens, with a vertical cross-section double that of the horizontal. This lens locally contains many streaks and bands of cupriferous pyrite intimately drawn out and interstreaked with blende in such a way as could only have been done by flow. This shows that the blende and cupriferous pyrite was in a plastic form or stiff paste. This zinc ore carries up to around 30 per cent zinc when sampled in five-foot cuts.

"(3) The blende ore was split open, and high-grade chalcopyrite introduced a little diagonal to that of the cupriferous blende lens. This chalcopyrite is massive and homogeneous throughout as to texture and colour, except for streaks and bands of blende, like No. 2. This ore assays up to around 25 per cent copper when sampled in five-foot cuts. Thousands of tons mined and shipped averaged around 18 per cent copper. . . . The fine lines and bands of blende are so intimately interstreaked with the chalcopyrite, and the streaks are drawn out in such perfect parallelism, that the conclusion is that the structure is the result of flow, and that the ore could have been introduced in no other way than in a plastic form as an intrusive mass. Therefore both main periods of one deposition, first of blende and later of chalcopyrite, were intrusions of plastic sulphides. Certainly the intrusions were stiffer than is usually the case in most igneous rocks, which are introduced as solutions and crystallize after intrusion. . . ."

In a footnote, page 120 of *The Ore Magmas*, Mr. Spurr differs from the view expressed by Dr. Bruce in an article on Economic Geology, viz.:—That the banding of the chalcopyrite-blende ores was due to an original schistose structure which the sulphides have replaced. "I cannot accept this theory for which no evidence is offered. The form of the ore body is believed to be possibly due to the replacement of a drag fold in the schist. The distribution of the chalcopyrite, whose later diagonal intrusion furnishes the extensions of the ore body, which led Dr. Bruce to this conclusion, quite negatives it. Dr. Bruce agrees with my conclusions that the ore is genetically connected with the granite intrusion."

As far as is known, the Mandy lens has no duplicate elsewhere, and the views of such able geologists as Dr. Bruce and Mr. Spurr regarding the formation of this unique and remarkably rich ore body may be of interest.

It is also interesting to note the great change in the view of geologists regarding the granitic rocks of the Laurentian plateau or Pre-Cambrian shield, nearly all of which were supposed to be our most ancient rocks, and that the greenstone lavas had been poured out over them, whereas further investigation has shown that most of the greenstones or Keewatin lavas and sediments are more ancient, and that in many areas both these rocks, as well as the older granites, have been intruded by younger granites and granite gneiss, and it is in connection with these later intrusions, and especially where pegmatite dykes occur, that ore deposits may be looked for with some hope of success. When it is considered that in the vast area of the Pre-Cambrian shield, covering as it does about 2,000,000 square miles, little more than the margin of this area has yet been prospected, and yet valuable mines have been discovered, we may reasonably expect further exploration to greatly add to the number, and it is probable that the mineral resources of the Northland will be found in time to greatly exceed in value the agricultural resources of the West.

THE ENGINEERING JOURNAL

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Secretary's Eastern Visit

The Secretary has just returned from a journey to the Maritime Provinces and Newfoundland, during which he attended the Maritime Professional Meeting held in Sydney on August 17th and the following days, the report of which has already appeared in the Journal.

At St. John, N.B., Moncton, Sydney and Halifax the members' hospitality was much enjoyed, and the round table discussions which took place on matters of Institute affairs were most helpful. It is evident that the Sydney meeting, like the five other Professional meetings which have been held in the Maritime Provinces, has been of benefit to The Institute at large, for such meetings have greatly enhanced the prestige of The Institute in the Maritime Provinces, particularly by drawing public attention to technical questions of the greatest importance to the community. As an example of this may be taken the important programme of experimental work on Nova Scotia coals which was announced at the Sydney meeting by the Minister of Mines, and is now being put in hand by the Provincial Government. This investigation results directly from the discussions on methods of coal utilization which took place at the Halifax Professional Meeting last year and the Sydney meeting this year.

After the Sydney meeting, a number of our members took the opportunity of paying a visit to Corner Brook, Newfoundland, where we were most kindly received and entertained by the officers of the Newfoundland Power and Paper Company and the local members of The Institute. The party was able to form a very clear impression of the construction and operation of all parts of the important enterprise which is being carried out at Corner Brook and Deer Lake.

The Secretary afterwards proceeded to St. John's, where a considerable number of our members are located, many of them being engaged on the public works, highways or mining activities of the Colony. Discussion turned upon the desirability of forming some representative organization for the engineers of Newfoundland, whether as a branch of The Institute, or possibly a separate affiliated Association, and a committee was formed to consider and study this question. There is at present no corporate body of engineers in Newfoundland available for consultation or co-operation in regard to matters affecting the engineering profession, or engineering work on which public money is expended.

The last few years have seen most interesting developments in Newfoundland, not only in connection with the utilization of the natural resources of the country, but also as regards improvement in the means of communication both by land and sea.

Members of all grades of The Institute in Canada will join in wishing success to the engineers in Newfoundland in the work which they are carrying out in Britain's oldest colony.

Institute Transactions being Published

Early this year consideration was given to the question of publishing a volume of Transactions by The Institute, and in March a circular was addressed to all members of The Institute calling attention to the matter and requesting members to advise the secretary on a printed form as to their willingness to subscribe to a copy of these Transactions if issued. The subscription price per copy was set at a sum not to exceed three dollars ($3.00). The response to this circular was such as to justify the publication of a limited edition, and accordingly Council issued instructions that the work be proceeded with. Preliminary work in connection with the manuscripts is already completed and the volume will shortly be going to press.

In view of the importance of this volume, containing as it will the most valuable papers published in the Journal during the years 1923, 1924 and 1925, it is considered that a further opportunity should be given to members who desire to subscribe but who failed to so notify the secretary when the original circular was sent out. Accordingly, subscriptions will be received, and copies reserved for the subscribers, if these are in the hands of the secretary not later than November 15th, 1926.

Discussions of Papers Published in Journal

With the resumption of the publication of Transactions of The Institute, as outlined in the above announcement, the attention of the members is drawn to the opportunity afforded to submit written discussions on papers which have appeared or will in future appear in the Engineering Journal. The papers published in the Journal are read at either professional meetings or branch meetings of the Institute and these may be discussed by any member. Such written discussions should be forwarded to Headquarters as soon as prepared in order that they may be available for consideration when future volumes of Transactions are being prepared.

Annual General and General Professional Meeting

On page 386 of the August issue of the Journal there appears an announcement regarding the Annual General and General Professional Meeting of The Institute which is to be convened, in accordance with the By-laws, at Headquarters, 176 Mansfield Street, Montreal, on Tuesday, January 28th, 1927, at 8 p.m., where, after the transaction of formal business, the meeting will be adjourned to reconvene at Quebec City on Tuesday, February 15th, and will be continued during the two succeeding days. This announcement points out that the technical sessions and discussions will centre around the subjects of conservation and utilization of Canada's forest resources and the recent development of hydro-electric power in Canada. Other subjects will be discussed, and it is expected that in the November issue of the Journal there will appear a tentative programme of the meeting. This meeting promises to be one of the most interesting gatherings held under the auspices of The Institute, and members are urged to make a special note of the dates and to plan to attend this meeting.

Meeting of Council

MEETING OF SEPTEMBER 21st, 1926

A meeting of Council was held at Headquarters at 8 p.m. on Tuesday, September 21st, 1926, Past-President A. Surveyer in the chair, six members of Council being present.

The financial statement and monthly report of the Finance Committee were presented and approved, and the Committee's recommendation in regard to twenty-eight special cases were adopted. Five applications for reinstatement were considered.

Attention was drawn to the cases of a number of students who are over age for Student membership, but who have not applied for transfer, and the Secretary was directed to communicate with the various branches to which they belong, asking them to look into these cases.

Discussion took place regarding the expenditure of Institute funds available for Students' and other prizes, and a small committee was appointed in order to study the situation with a view of making recommendations as to the policy to be adopted and the best method of expending the funds available for this purpose.

With regard to the approval of Branch By-laws, the Chairman of the Legislation and By-laws Committee stated that his committee would shortly be prepared to submit a report on the divergencies which at present exist between the various Branch By-laws and those of The Institute.

The cases of two members eligible for Life Membership under Section 38 of the By-laws were considered, and Life Membership granted.

Lists of officers of the Winnipeg and Edmonton Branches were submitted and approved.

The Secretary's reports on his journeys to the Western and Maritime Branches were submitted and received.

Council noted with pleasure that the President will be able to visit Headquarters during October, at which time he also expects to visit a number of branches in the east.

A draft programme for the Annual General and General Professional Meeting to be held in Montreal and Quebec in January and February, 1927, was submitted and discussed, and approved by Council, subject to any further minor changes which may be found desirable.

Elections and Transfers were effected as follows:—

Elections	
Members	6
Associate Members	3
Juniors	2
Affiliate	1
Students	12
Transfers	
Associate Member to Member	4
Junior to Associate Member	2
Junior to Affiliate	1
Student to Junior	5

Twenty-five applications for admission and transfer were considered and classified for the ballot returnable October 15th.

Consideration was given to nine special cases in connection with applications for admission.

Council rose at twelve-fifty a.m.

The Honour Roll

An announcement regarding the checking of the list of names to appear on the Honour Roll of The Institute was published on page 414 of the September issue of the Journal, and at the foot of this announcement was reproduced the circular letter addressed to members of The Institute whose names at present appear on this war service list, with the request that any members who have failed to receive the circular should notify the secretary at once giving, on the form printed in the Journal, the information asked for regarding their service. This letter, together with the headings under which the information is desired, is again reproduced below and members are urged to forward this information to the secretary immediately, as this is the last opportunity they will have of doing so.

LETTER ADDRESSED TO MEMBERS

Dear Sir:—

The final list for the Honour Roll is now being prepared and checked, and in accordance with the directions of the Committee, is to contain the names of those members of the Institute who served, outside of Canada and the United States, with the Allied land, air or naval forces.

In order to ensure accuracy, I am sending this letter to all members of the Institute for whom we have a record of war service, and would ask you to fill in, tear off and return the enclosed slip at once.

Yours very truly,

R. J. DURLEY, Secretary.

Name in Full...

Date of Joining the Service.................................

Rank on Demobilization.....................................

Unit with which you last served..............................

Were you overseas? If so, state Country or locality in which you served outside of Canada.............................

....

Decorations or Honours received.............................

Signature...

Date...

OBITUARIES

Colonel Georges Roy, M.E.I.C.

The death of Col. Georges Roy, M.E.I.C., occurred with tragic suddenness on July 6th, 1926. Born on August 5th, 1878, he commenced his military career at the early age of seventeen, being commissioned as 2nd Lieutenant in the 1st Field Battery at Quebec on June 15th, 1895. In 1902 he proceeded to South Africa with the 4th Canadian Mounted Rifles, returning within a few months owing to the declaration of peace. Resigning his appointment, with which he then held the rank of Captain, he entered the Permanent Force as a Lieutenant in the Royal Canadian Artillery on August 13th, 1903. He was promoted to Captain on November 19th, 1906; Major on May 28th, 1915; substantive Lieutenant-Colonel on April 1st, 1920; and Colonel on January 12th, 1922. Appointments which he held included

COLONEL GEORGES ROY, M.E.I.C.

those of Officer Commanding the Royal Canadian Artillery; Commandant, Royal School of Artillery; Chief Instructor of Artillery; Inspector of Artillery (Horse, Field and Heavy); Officer Administering Royal Canadian Artillery (later changed to Colonel Commanding, R.C.A.), and Staff Officer for Artillery, National Defence Headquarters. In addition, he was at the time of his death a member of the Mobilization Committee and Chairman of the Standing Arms Committee.

On May 23rd of this year Colonel Roy assumed the acting command of Military District No. 5, with Headquarters at Quebec, his old home and birthplace. On July 6th he was appointed to command the district in succession to the late Major-General J. P. Landry, and it is one of the ironies of fate that he should have died so soon after attaining one of his life's ambitions. There is no doubt but that had he lived he would have proved a very acceptable and able commander of this essentially French-Canadian district.

Colonel Roy possessed scientific and academic qualifications which are not usually found in an officer of a regular army, being a graduate of Laval University of the year 1901 and a qualified civil engineer, with the degree of Bachelor of Science. After graduation, he studied Law at the same institution and completed the full course, although owing to proceeding on active service to South Africa he did not take the examinations.

On the outbreak of war in August, 1914, fate, combined with his own efficiency and the necessity of retaining in Canada some senior qualified officers for instructional purposes, again stepped in, and for over two years he was prevented from seeing service at the front. He never, however, for a moment permitted his keen disappointment to overcome his high sense of duty, but threw himself wholeheartedly into the tasks that lay before him. As Inspector of Artillery; O.C. Royal Canadian Artillery; Commandant, Royal School of Artillery, and Chief Instructor of Artillery,—appointments, which under the exceptional circumstances, he held simultaneously,—he was the man chiefly responsible for the artillery training in Canada of the reinforcements for the Canadian Expeditionary Force. The gunnery courses at Petawawa during the early years of the War were planned and conducted almost entirely by Colonel Roy, and the character of his training was reflected in the efficiency of the units and drafts which reinforced the Canadian Artillery in England and France.

In April, 1917, Colonel Roy achieved his ambition when he was at last permitted to proceed overseas. There being at the moment no vacancy in the Canadian Artillery, he was offered and accepted the command of the 38th Siege Battery, 63rd (Mobile) Brigade, R.G.A. With this Battery he served in the field for fifteen months, was mentioned twice in Despatches and was reported on by the Imperial authorities in the highest terms. Early in April, 1918, he was acting in command of the Brigade during the severe fighting which followed the successful German attack on the Portuguese Division, which was holding a sector of the line on the Lys. At the time of the Armistice, arrangements were in hand to recall Lieutenant-Colonel Roy to the Canadian Corps, where he was to have been given command of the new Brigade of Heavy Artillery then forming.

For over twenty years Colonel Roy was a member of the Canadian Artillery Association and for some years previous to his death was also, as Staff Officer for Artillery, an ex-officio member of the Executive Committee. His work brought him into almost daily touch with the officers of the association, and it is a real tribute to his tact and administrative ability that he succeeded during the difficult period of the post-war years in evolving artillery programmes which it was possible for the department to carry out in spite of severe financial limitations, and which were at the same time satisfactory to the non-permanent members of the association.

Colonel Roy was an exceptonially efficient soldier, who made artillery tactics and training a life-long study. His greatest asset, perhaps, was an inexhaustible fund of sound common sense. His education as a civil engineer and a lawyer was of great service to him and enabled him to bring to the problems with which he was faced a logical and trained scientific mind. He was a good disciplinarian who knew how to win the confidence as well as the ready obedience of those serving under him. He always took the keenest interest in moulding the characters of young officers, encouraging them both by precept and example to realize their responsibilities. There are many officers in the Canadian Militia who gratefully admit that they are better for their training under Colonel Roy, a man who watched over them with a fatherly eye and sought always to instill the principles of honour and an abiding sense of duty.

Although the very antithesis of a militarist, Colonel Roy was an ardent advocate of preparedness for war. He wrote occasional articles for publication and was as much at home with the English language as he was with the French tongue. Two articles from his pen appeared in early numbers of the *Canadian Defence Quarterly*. Colonel Roy was elected Member of the Engineering Institute of Canada on June 24th, 1924, and was active in the promotion of closer co-operation between the Institute and the Canadian Military and Air Services.

Colonel Colin Worthington Pope Ramsey C.M.G., M.E.I.C.

News of the untimely death of Colonel Colin Worthington Pope Ramsey, C.M.G., M.E.I.C., which occurred as a result of an automobile accident on September 11th, 1926, has been received with great regret by his many friends in the engineering profession and in public life throughout Canada. Colonel Ramsey was returning to Montreal in his car after visiting an estate at Bedford, Que., which he purchased early this year, when he suffered the injuries which caused his death.

The late Colonel Ramsey was born at Bury, Que., on January 15th, 1883, and received his early education in his native town. In 1901 he joined the engineering staff of the Canadian Pacific Railway and during the next four years occupied successively the positions of rodman, draughtsman, transitman and resident engineer. In 1905 he was appointed assistant engineer in charge of the location of various lines and two years later occupied the same position in charge of the construction of various lines. In 1910 he became division engineer of construction and the following year engineer of construction and subsequently chief engineer of construction.

Colonel Ramsay entered the militia while a young man, becoming Adjutant of the 7th Hussars. Early in 1915 he joined the Canadian Expeditionary Forces as Lieutenant-Colonel, Canadian Engineers. He formed a battalion of engineers under the name of the Canadian Overseas Construction Corps, being promoted to Colonel in April 1917. As a result of his work in France, he had conferred upon him the distinction of Companion of St. Michael and St. George and the Distinguished Service Order. At the end of the war he returned to the Canadian Pacific Railway as superintendent. In March, 1920, he entered the firm of Dominion Construction Company and Ramsey, engineers and contractors, and the following year he became a director of the Grenville Crushed Rock Company, engaged at the same time in consulting engineering.

The late Colonel Ramsey was admitted to the Institute as Student on October 8th, 1903, and was transferred to Associate Member on October 8th, 1908, and to Member on April 11th, 1914.

Allan Gordon McLerie, A.M.E.I.C.

Through the death of Allan Gordon McLerie, A.M.E.I.C., general manager of the Fairfield Aerial Surveys Company (of Canada), Limited, which occurred while on duty at Kenora, Ont., on August 4th, 1926, commercial aviation in Canada has lost one of its early pioneers and staunch supporters, and to those who have had the pleasure of knowing him the news of his death has come as a great shock.

The late Mr. McLerie was born at Windsor, Ont., on December 7th, 1888, and following completion of his public and high school education he carried on his studies through an engineering course with the International Correspondence Schools. From 1907 until the beginning of 1911 he was engaged in junior engineering work on the National Transcontinental Railway, successively occupying the positions of rodman, draughtsman and instrumentman. In March, 1911, he was appointed resident engineer on this work at Winnipeg, Man. In April, 1913, he became resident engineer on the Banff-Windermere road, British Columbia, and in March of the following year was appointed in the same capacity in connection with the work of the Greater Winnipeg Water District, subsequently being appointed assistant division engineer on the same work.

In December, 1916, Mr. McLerie joined the staff of the Walbridge Aldinger Company, at Detroit, Mich., as superintendent of construction. In March, 1918, he joined the Royal Air Force as cadet and lieutenant and acted as field instructor at Camp Borden, Ont. Following the Armistice he carried out the trial of a mail route between Toronto and Camp Borden for six months and, flying through all weather conditions, he demonstrated the feasibility of commercial aviation in Canada. He then returned to the Canadian Air Force at Camp Borden and remained there until he joined the Fairchild Aerial Surveys Company at Grand'-Mere, Que., in 1923, as manager of the mapping division. In the spring of 1926 he was appointed general manager of the company and held this position until his death.

Mr. McLerie was admitted to The Institute as Student on October 14th, 1911, and was transferred to the class of Junior on June 22nd, 1912, and to that of Associate Member on July 22nd, 1919. He was also a member of the Detroit Engineering Society and the Automotive Engineering Society.

Addresses Wanted

A revised list of members is being prepared for publication in the form of the Year Book, and it is desired to have this list as complete as possible. The following is a list of members for whom there is no address on file at headquarters. The Secretary would appreciate any information as to the present address of any of these members.

Members

A. Angstron	J. F. Guay	H. Longley
J. R. Barlow	A. E. Johnson	A. H. Smith
T. B. Campbell		

Associate Members

W. A. G. Adams	W. E. Janney	G. M. Ponton
P. I. Baker	W. H. Jones	H. H. Robertson
W. L. Ball	L. W. Lester	P. Oakley Spicer
A. R. Black	H. Lindsay	M. S. Sutherland
W. H. Blanchet	H. Macneil	C. F. Szammers
D. M. Bright	J. C. Meade	W. E. Tidy
J. Erskine	W. M. Miller	T. W. Webb
R. J. Fisher	C. N. Mitchell	J. L. Wilson
J. L. Franzen	F. W. Pearson	W. G. Wilson
J. Hole		

Juniors

G. N. Allen	G. A. Emslie	J. A. M. Penrose
F. D. Austin	J. H. Hewson	L. A. Perry
E. Bryant	R. G. MacKenzie	J. H. Ryan
T. Clarke	C. A. McConville	

Students

W. W. Abernethy	W. J. Evans	T. W. Kennedy
J. M. Allen	J. W. Fagan	W. J. Lewis
A. G. Anderson	R. W. Farmer	R. E. Lindsay
M. Balfour	R. H. Foss	R. St. C. Low
P. E. Bauman	J. M. Fraser	E. M. O'Brien
A. Benjamin	C. H. Frid	J. H. Oliver
C. M. Bowyer	L. Gareau	R. J. Rainnie
G. F. Bryant	A. J. Grant	L. L. Roquet
E. W. R. Butler	J. H. Halliday	L. J. Scott
H. Carignan	S. B. Hansuld	R. C. Shanly
J. A. Circe	R. A. H. Hayes	T. G. Sillers
F. L. Code	D. A. Henderson	W. L. Simpson
H. Crutchfield	R. M. Hueston	S. W. Williams
W. V. Delaney	C. B. Jandrew	F. E. Wilson
C. D. Evans		

PERSONALS

J. Grant MacGregor, M.E.I.C., formerly of Red Deer, Alta., is at present municipal engineer with the Manitoba Department of Provincial Highways and is located at Killarney, Man.

J. E. Letson, A.M.E.I.C., is at present with the Imperial Pipe Line Company, Limited, at Wayne, Mich. Mr. Letson was for a number of years resident engineer, Imperial Oil Refineries, Limited, Montreal East.

G. L. Bockus, A.M.E.I.C., who for some time has been with the Shawinigan Engineering Company, Limited, Montreal, is now with the Canadian Celanese Limited, Drummondville, Que. Mr. Bockus was for a time superintendent of power, city of Sherbrooke, Que.

Norman D. Wilson, M.E.I.C., of Wilson, Bunnell and Borgstrom, consulting engineers and town planning engineers, of Toronto, is shortly leaving for Mexico on business in connection with the tramways in Mexico City. Mr. Wilson has recently returned from Brazil.

J. B. Barnum, A.M.E.I.C., who was reported in last month's Journal as being with the Foundation Company of Canada, Limited, is on the staff of the Canadian International Paper Company, representing them on the construction of the Gatineau storage dams.

Frederick H. Palmer, A.M.E.I.C., has been appointed to the post of Canadian Trade Commissioner in Milan, Italy, his present address being via Manzoni 5, Milano 2, Italy. Mr. Palmer is a graduate of Nova Scotia Technical College of the year 1913.

E. M. Van Koughnet, S.E.I.C., has accepted an appointment to the staff of the Shawinigan Engineering Company, Limited, and is at present engaged on power line work for the company. Mr. Van Koughnet received his diploma of graduation from the Royal Military College in 1922, and subsequently attended McGill University.

W. B. Crombie, A.M.E.I.C., formerly construction engineer with the Abitibi Power and Paper Company, is now resident engineer for the Spruce Falls Company, Limited, in charge of the construction of the company's new mill at Kapuskasing, Ont., and the hydro-electric power development at Smoky Falls.

Major C. A. Doherty, A.M.E.I.C., formerly superintending engineer, North Eastern District, Department of Works and Buildings, Air Ministry, Bedfordshire, England, has been transferred to the Air Ministry Headquarters to take charge of the Designs Branch (Works). His present address is Alexander House, London, W.C. 16, England.

J. M. Duncan, A.M.E.I.C., has severed his connection with the Hydro-Electric Power Commission of Ontario to accept an important position with the Atmospheric Nitrogen Corporation, Syracuse, N.Y. Mr. Duncan was previously engaged as consulting engineer specializing in steam power plants, central and district heating plants and fuel economy, with headquarters in Toronto, Ont.

Horace L. Seymour, M.E.I.C., consulting engineer, of Toronto, and vice-president of the Town Planning Institute of Canada, will spend the greater part of the next three years in the city of Vancouver, where he is being retained as resident engineer on the city plan, with consultant privileges. A. G. Dalzell, M.E.I.C., consulting engineer of Toronto, who is associated with Mr. Seymour in some phases of his town planning work, has just left for St. John's, Newfoundland, and a preliminary report, in collaboration with Mr. Seymour, is being prepared along town planning lines. For the convenience of clients, a consulting office will be maintained in Toronto under the name of Horace L. Seymour and Associates.

E. G. Richards, A.M.E.I.C., who has been on leave of absence in England, is returning to the Gold Coast, British West Africa, towards the end of October. In a recent letter to Headquarters, Mr. Richards outlines the work in which he was engaged with Major L. E. Silcox, D.S.O., M.E.I.C., when last in Africa. At that time they completed 350 miles of a close preliminary survey for a new railway commencing at Kumasi and ending at Navorongo, following the Eastern frontier of the Gold Coast Northern territories. The work to which Mr. Richards is returning will be in connection with an alternative route from the same points but along the Western frontier. He estimates that it will take until the end of 1929 before the final location is completed. Their staff on this work consists of eight Europeans and about 250 natives, and they have been successful in training several young educated natives as instrumentmen and draughtsmen.

Paul A. Beique, A.M.E.I.C., Appointed Member of Montreal Tramways Commission

Paul A. Beique, A.M.E.I.C., according to a recent announcement, has been appointed a member of the Montreal Tramways Commission by the Quebec government, succeeding the late P. E. Mercier, who had been appointed to fill the vacancy following the death of the late Dr. L. A. Herdt, M.E.I.C.

Mr. Beique is a native of Montreal and received his early education at St. Mary's College and St. Charles College, Baltimore. He later undertook his engineering studies at the Ecole Polytechnique, Montreal, from which he received the degrees of Civil Engineer and Bachelor of Applied Science. His first work was with a firm of engineers and architects. Subsequently he accepted the position of draughtsman with the Quebec, Montreal and Southern Railway.

In 1907, Mr. Beique joined the staff of Messrs. O'Brien and Mullarkey, railway contractors, in the capacity of inspector, and in the following year was appointed superintendent for the same company on construction of the Quebec, Montreal and Southern Railway. In 1909, he became associated with a firm of civil engineers and land surveyors who were engaged in private practice. In 1913 he entered consulting work, and in addition to his general practice was acting town engineer for the town of Lasalle, Que., and was a member of the Consulting Board of the Metropolitan Commission of Montreal.

J. J. Macdonald, M.E.I.C., Appointed Chief Engineer.

J. J. Macdonald, M.E.I.C., has been appointed chief engineer of The Foundation Company of Canada, Limited, with headquarters in Montreal. He was formerly located in London, England, occupying the position of construction engineer for The Consolidated Construction Company, Limited, and J. G. White and Company, Limited, and returned to Canada early this year.

Mr. Macdonald is a graduate of McGill University of the year 1911, when he received his degree of B.Sc. Following graduation he took a post-graduate course at McGill in the advanced theory of structures. Prior to and during his engineering course he had several years' experience in railway location. After graduation he entered the employ of Messrs. Waddell and Harrington, consulting bridge engineers, Kansas City, Mo., and specialized in structural design and construction, covering the work in all departments of bridge engineering. During his work he was engaged on some of the largest installations of vertical lift and other moveable bridges and also on reinforced concrete arch bridges and other structures.

Mr. Macdonald was next appointed office engineer on the staff of The Halifax Ocean Terminals project. In this capacity he had charge of structural design in connection with the harbour works, bridges, transit sheds, sewer and water systems, etc., and acted on the valuation in respect of the expropriation of property, including exchequer court work. During this period he did notable work in connection with development of the mobile pneumatic caisson method of preparing deep water foundations for quay walls and in the design of long span reinforced concrete arch bridges. He next served as resident engineer on the construction of sections of above work and spent some time at the head offices of the Canadian Government Railways at Moncton, N.B., in charge of preparation of plans and specifications for work going to tender.

Early in 1919, Mr. Macdonald accepted an offer to join a firm of British engineers and contractors with a view to introducing Canadian or American methods of design and construction in connection with reconstruction work in Great Britain and France. He rapidly advanced to the position of chief engineer and had charge of the design and construction of important works, notably the extension of the Royal Edward Docks at Avonmouth, and large grain elevators for the same port, besides a great variety of factory, warehouse and general work.

In 1923, Mr. Macdonald accepted the position of construction engineer with J. G. White and Company, Limited, of London, England. He had charge of the construction of the super-steam-electric power station for the London Counties at Barking, under their subsidiary The Consolidated Construction Company, and was connected with important foundation, tunnel, and water works contracts. He also directed extensive sanitation and harbour work in South America for J. G. White and Company, Limited, and work in connection with a number of important hydro-electric projects.

In 1925 Mr. Macdonald prepared construction layouts and estimates for the difficult foundation work for the great new bridge across the Tyne river, at Newcastle, under Sir Douglas Fox and partners for Dorman Long and Company, Limited, who secured the contract for the work. He also had charge of important road and pavement contracts.

Catalogue of Publications

The Natural Resources Intelligence Service of the Department of the Interior, Ottawa, Canada, has issued a new catalogue of the Service's publications. The function of the Service is to supply authentic information on the natural resources of Canada to all who are interested in them and in the problems associated with their development. The recently issued catalogue of publications lists the numerous reports, maps and charts which have been issued to date, and will prove of considerable assistance to those interested in making applications and enabling them to state clearly their requirements. Copies of this booklet and also any maps or reports referred to in it will be gladly supplied to any members upon application to the Director, Natural Resources Intelligence Service, Department of the Interior, Ottawa, Canada.

ELECTIONS AND TRANSFERS

At the meeting of Council held on September 21st, 1926, the following elections and transfers were effected:—

Members

BAIRD, John Ainslie, B.A.Sc., (Univ. of Toronto), engaged on sub-divisions and municipal drainage, Sarnia, Ont.

COTHRAN, Frank Harrison, gen. supt. of constrn. for Aluminum Co. of Canada, Ltd., Isle Maligne, Que.

COX, Leonard Martin, consulting engineer, San Francisco, Cal.

DEBLOIS, William Howard, B.Sc., (McGill Univ.), mgr. chem. div. Mond Nickel Co., Ltd., Coniston, Ont.

SILLCOX, Lewis Ketcham, M.E. and E.E., (Univ. of Brussels), gen. supt. motive power, Chicago, Milwaukee & St. Paul Ry Co., Riverside, Ill.

SUTHERLAND, Luther Holton Dunbar, B.Sc., (McGill Univ.), engr. i/c various bldg. contracts, E. G. M. Cape & Co., Ltd., Montreal, Que.

Associate Members

COX, Archibald, town engr. and supt. of utilities, Estevan, Sask.

SWITZER, James Everett, dist. hydrometric and irrig. inspecting engineer, Dept. of Interior, Calgary, Alta.

WOODSIDE, James, B.A.I., (Dublin Univ.), on hydro-electric development with Can. International Paper Co., Montreal, Que.

Juniors

BUTCHART, Harold Tremayne, B.Sc., (Univ. of Alta.), fuel engr., Wilson Coal & Coke Co., Ltd., Calgary, Alta.

MURPHY, George Arnold, ch. clerk, office of the gen. supt., Montreal Tramways Co., Montreal, Que.

Affiliate

VERDON, Joseph Benjamin, boiler inspector, Prov. Gov. of Quebec, Dept. of Public Works and Labour, Montreal, Que.

Transferred from the class of Associate Member to that of Member

JENNINGS, Robert Bernard, div. engr. C.N.R., Montreal div., Montreal, Que.

KESTER, Fred. Henry, contracting engineer, Walkerville, Ont.

McCRORY, James Alexander, B.S., (Pennsylvania State College), off. engr., Power Engineering Co., Montreal, Que.

MIDGLEY, Frank Harold, C.E., (Associate, Royal Tech. Coll.), engr. Lake Erie & Northern & Grand River Rys., (subs. of C.P.R.), i/c mtce. and constrn., Galt, Ont.

Transferred from the class of Junior to that of Associate Member

MOONEY, Frank Melbourne, Jr., B.Sc., (McGill Univ.), asst. engr. timber mechs., Forest Products Research Labs., South Farnborough, England.

STAVERT, Reuben Ewart, B.Sc., (McGill Univ.), gen. mgr., Brit. Metal Corp., Ltd., Montreal, Que.

Transferred from class of Junior to that of Affiliate

IRVING, George Fleming, B.Sc., (Armour Inst.), Imperial Oil Limited, Winnipeg, Man.

Transferred from class of Student to that of Junior

BISSELL, Harold Rudolph, B.Sc. '22, M.Sc. '23, (McGill Univ.), divisional engr., Copper Queen Branch, Phelps Dodge Corporation, Bisbee, Arizona, U.S.A.

BUDDEN, Arthur Napier, B.Sc., (McGill Univ.), gen. engrg., Gen. Electric Co., Mexico.

HUMPHREY, Harold William, B.Sc., (N.S. Tech. Coll.), with Public Service Electric & Gas Co., Newark, N.J.

ROSS, Malcolm Vaughan, B.Sc., (McGill Univ.), asst. elect'l engr., Brown Corp. sulphite pulp mill, La Tuque, Que.

WOOLWARD, Charles Desmond, B.Sc., (McGill Univ.), engrg. dftsman., Foundation Co. of Canada, Montreal, Que.

Publications of Other Engineering Societies

An exchange arrangement exists between the Engineering Institute of Canada and the American Institute of Electrical Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Civil Engineers and the American Society of Mechanical Engineers.

Subscriptions may be sent either directly to New York or through Headquarters. The following list of rates gives in the first column the amounts payable by members of the Engineering Institute for the various publications:—

	Rate to Members	Rate to Non-Members
American Institute of Electrical Engineers		
Journal, single copies	$0.50	$ 1.00
" per year	5.50	10.50
Transactions, per year, paper	5.00	10.00
" " " cloth	5.00	10.00
Year Book	1.00	2.00
Pamphlets	.25	.50
American Institute of Mining and Metallurgical Engineers		
Magazine, single copies	0.50	1.00
" per year	5.00	10.00
Transactions, per volume, with pamphlets, paper	2.50	5.00
(Other publications, same rate E.I.C. members as to A.I.M.M.E. members.)		
American Society of Civil Engineers		
Proceedings, single copies	0.50	1.00
" per year	4.00	8.00*
Transactions, " "	6.00	12.00†
Year Book	1.00	2.00
(Other publications 50 per cent reduction on catalogue price to E.I.C. members.)		
**If subscription is received before January 1st, otherwise $10.00.*		
†If received before February 1st, otherwise price $16.00.		
American Society of Mechanical Engineers		
Journal, single copies	0.50	0.60
" per year	4.00	5.00
Transactions, per year	6.00	8.00
Year Book	1.00	2.00
(Other publications, same rate to E.I.C. members as to A.S.M.E. members.)		

Recent Additions to the Library

Proceedings, Transactions, Etc.

Presented by the Societies:

Transactions of the Institution of Civil Engineers of Ireland, vol. 51, 1926.

Reports, Etc.

Presented by the Sewerage and Water Board of New Orleans, Louisiana:

Semi-Annual Report, 1925.

Presented by the Department of Trade and Commerce, Canada:

Sixth Census of Canada, 1921, vol. 2.

Technical Books

Presented by Professor E. A. Allcut:

Materials and Their Application to Engineering Design, by E. A. Allcut and E. Miller.

Engineering Inspection, by E. A. Allcut and C. J. King.

Presented by D. Van Nostrand Company:

Elementary Steam Engineering, by E. V. Lallier.

Presented by the Harvard University Press:

Mathematical and Physical Papers, 1903-13, by B. O. Pierce.

EMPLOYMENT BUREAU

Situations Wanted

Civil Engineer

Canadian, civil engineer, university graduate with experience in road works, construction and maintenance, desires position with engineering firm where advancement may be won on recommendation of efficient service. Business experience, age 25, single, in excellent health, speaking both languages. Best of references. B.A.Sc. At present employed, but available on short notice. Personal interview sought. Address replies to Box 213-W, Engineering Journal.

Construction Engineer

Recent graduate of University of New Brunswick, with experience in field surveys and draughting, desires position, preferably with a structural or hydro-electric organization where there is possibility of advancement. Address replies to Box 214-W, Engineering Journal.

Electrical Engineer

McGill '23, age 27, single, three years' drafting experience on the construction of substations and power stations. Eight months' test with the Canadian General Electric Co. Four months' mining and electrical maintenance in Northern Ontario. Two and half years' general commercial experience. Position in or around Montreal preferred. At present employed in New York City. Address replies to Box 215-W, Engineering Journal.

Situations Vacant

Draughtsmen

Two draughtsmen for Welland Ship Canal. Salary $150 per month. Apply, stating qualifications, experience, etc., to Alex. J. Grant, engineer-in-charge, Welland Ship Canal, St. Catharines, Ont., not later than October 7, 1926.

BRANCH NEWS

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

On Friday, August 13th, the members of the Victoria Branch, and local members of the Association of Professional Engineers of British Columbia, through the courtesy of P. Philip, M.E.I.C., deputy minister of Public Works, were able to attend an exhibition of moving and other pictures that gave glimpses of the main highways of the province, of its scenery, and its industrial developments.

There was a large number of engineers and their friends present, a musical programme giving added enjoyment.

The location of the various views was well indicated by an arrow moving across a map of the province, and stopping at the point at which each picture was taken. Along the various routes from Victoria to the Mainland were gathered illustrations of the beautiful scenery among the islands passed. A splendid portrait was shown of the great explorer Simon Fraser, who gave to the public so much of the early information regarding this province. In the Fraser Valley, pictures of the New Westminster bridge across the Fraser river, and of Harrison lake and Hot Springs were included.

The progress in transportation was well indicated by photographs of mule teams hauling gold and supplies along the old Cariboo road in 1860, followed by views of the Canadian Pacific Railway and Canadian National Railways freight trains, and of motor stages and trucks. The old Alexandra bridge was shown in comparison with the new structure of the suspension type that has recently been completed. Actual construction work was shown in progress, the shovel on caterpillar treads attracting much comment on account of the ease with which it could be handled in awkward places. The timber cribbing along the road near Jackass mountain was an excellent example of this class of work.

Pictures taken along the various main roads of the interior, such as Kamloops to Vernon, and Vernon to Kelowna, were used to illustrate the development of these farming and orchard sections.

Photographs of the Southern Okanagan irrigation project at Oliver showed details of the well-constructed main canal, flumes, pipes, and other outstanding features of this work, which was inaugurated by the provincial government in the interests of returned men.

The magnificent Bonnington falls on the Kootenay river near Nelson came in for recognition, including the power developments of the city of Nelson and the West Kootenay Power and Light Company, which supply municipal and mining requirements to a very large area.

Transportation of logs by flume was strikingly illustrated by pictures from the works of a logging company near Cranbrook, the main flume being some thirteen miles long, served by several branch flumes from which the logs are received automatically. The excellent character of the British Columbia roads, the resulting advantage to industrial and farming development, and the variety of interest that awaits the tourist to this province were well emphasized by the pictures shown; and the thanks of the branch are due Mr. Philip for his invitation.

Vancouver Branch

E. A. Wheatley, A.M.E.I.C., Secretary-Treasurer.

Executive Meeting of August 17th

A meeting of the branch executive was held in the offices of the branch on August 17th. Further consideration was given to the subject of the relation of the Public Works Department of the Dominion to the Provincial Professional Engineering Acts. The secretary was instructed to forward to the Council of the Institute full information on this subject.

The following nominating committee for 1926-27 was appointed: Chairman, C. Brakenridge, M.E.I.C.,; members, J. Muirhead, M.E.I.C., W. O. Marble, M.E.I.C., F. P. V. Cowley, A.M.E.I.C., and Tom McElhanney, A.M.E.I.C.

Additional bookcases were ordered to be purchased for the development of the Branch Library at the University Club.

Executive Meeting of August 24th

A meeting of the branch executive was held on August 24th.

The president of the Institute, Major Geo. A. Walkem, M.E.I.C., was present, together with J. L. Rannie, M.E.I.C., past-chairman of the Ottawa Branch.

A blue print of the proposed tablet to be erected by the Institute and the Association of Professional Engineers of British Columbia, jointly, was submitted and considered. The wording adopted was:

"In commemoration of the Engineering Achievement of the two Companies of Her Majesty's Royal Engineers, who, in 1858, were responsible for the construction of the Cariboo Road.

"This Tablet is erected by the Engineering Institute of Canada and the Association of Professional Engineers of British Columbia."

The following committees were appointed, their duty being to obtain speakers for the forthcoming fall and winter sessions:

Committee No. 1—On Engineering Education

Prof. Duckering, L. F. Merrylees, A.M.E.I.C., and the Secretary.

Committee No. 2—Subjects of Mining Interest

Geo. A. Walkem, M.E.I.C., W. H. Powell, M.E.I.C., R. W. Brock, M.E.I.C.

Committee No. 3—On Electrical and Mechanical Subjects

J. Muirhead, M.E.I.C., and J. F. Frew, M.E.I.C.

Committee No. 4—On Civil Engineering Subjects

W. B. Greig, A.M.E.I.C., Chas. Brakenridge, M.E.I.C., A. S. Wootton, M.E.I.C.

A discussion was held, in which Mr. Rannie participated, on the problem of dealing with such contentious matters as the appointment of American engineers on Canadian works, and whether it was within the scope of the work of the Institute to deal with such contentious problems. It was agreed that the most satisfactory way of dealing with such problems was by very close co-operation beween the Institute and the provincial associations of professional engineers.

Branch Entertains United States Engineers

On August 28th a number of engineers and ladies from Bellingham, Wash., U.S.A., were entertained by the branch. The entertainment took the form of a trip around Vancouver harbour. This was made possible by the courtesy of the Vancouver Harbour Commissioners, who placed at the disposal of the branch the V.H.C. "Fispa."

The day being bright and warm, one of the most pleasant and interesting trips was enjoyed. Opportunity was provided to note the new work going on in the harbour, and the development of the summer resorts around the margin of the inlet. The head of the inlet, Indian river, was visited, and on the return trip an opportunity was given to see the work of the new terminal railroads being carried out by the Vancouver Harbour Commissioners.

The party landed at the new B.C. pier of the Canadian Pacific Railway, and were conducted around the pier by Sydney E. Junkins, M.E.I.C.

The day was concluded by a dinner given in honour of the engineers of Bellingham at the Hotel Vancouver, where votes of thanks were tendered, both to the Vancouver Harbour Commissioners and to Mr. Junkins.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.

The members of the Papers and Meetings Committee of the branch have been working hard to arrange an interesting programme for the fall. As a result of their endeavours, the following programme has been arranged, and it is felt that a record attendance and keen interest should result:—

Date	Subject	Author
Oct. 7	—Arvida Townsite	H. R. Wake, A.M.E.I.C.
" 14	—Engineering Features of Breaking the Alleghany Ice Gorge with Thermit	Dr. H. T. Barnes, M.E.I.C.
" 21	—Manufacture of Carbide	Mr. Witherspoon
" 28	—Bearing Metal Bronzes	Messrs. Roast and F. Newell, M.E.I.C.
Nov. 4	—The American Railway Engineering Association	J. E. Armstrong, A.M.E.I.C.
" 11	—Student Papers.	
" 18	—Vacuum Process for Drying Paper	Mr. Ogden Minton
" 25	—Bryson Development	H. E. Pawson, M.E.I.C.
Dec. 2	—Railway Supplies	L. C. Thompson
" 9	—Municipal Symposium	H. A. Terrault, M.E.I.C. P. E. Jarman, M.E.I.C.
" 16	—Annual meeting.	

The chairman of the Papers and Meetings Committee would like to remind the branch that the success of the meetings is not dependent only upon the securing of good speakers, but requires a good attendance of the branch members and a lively discussion. Special endeavours are being made to increase the discussion this year, and every member is asked to do his part.

If there are any suggestions which members have for speakers for the second term, please send them to the secretary.

Trade Publications

Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., have recently issued a publication entitled "Registers of Revenue" describing special features of the watt meter. The publication number is C-1753. The company has also issued revised leaflets Nos. L-3549-B, L-20135-A, and L-20011-A covering their types CA, CL, and CN circuit breakers and types F-11 and F-22 oil circuit breakers. These publications may be obtained from any of the district offices of the company.

The Dominion Insulator and Manufacturing Company, Niagara Falls, Ont., are now distributing a new general catalogue, No. 20 O-B. This book of 945 pages includes complete listing of all O-B porcelain insulators, trolley and line materials, rail bonds, car equipment and mining materials. It is logically divided and thumb-indexed for the well-defined classes of products of this company. In addition to descriptive and listing information, there are many helpful suggestions for the man concerned with the installation of these products. All of the material pertaining to porcelain insulators and hardware, and other pertinent data, 472 pages, is also being distributed in a separate binding, known as the Insulator Section. This special binding is for the convenience of those interested in the high tension materials only. The books are carefully indexed and convenient cross references are plentiful.

THE CHATEAU FRONTENAC, QUEBEC CITY

THE HEADQUARTERS *of the*

FORTY-FIRST ANNUAL GENERAL

AND

GENERAL PROFESSIONAL MEETING

of THE ENGINEERING INSTITUTE OF CANADA

The Annual Meeting will be convened in Montreal at the Institute Headquarters (in accordance with the By-Laws) on Thursday, January 27th, 1927, at 8.00 p.m., and will be adjourned to reconvene at

QUEBEC CITY

FEBRUARY 15th, 16th and 17th, 1927

Preliminary Notice

of Applications for Admission and for Transfer

September 19th, 1926.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in October, 1926.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

COLE—ARTHUR WM. WILLOUGHBY, of Ottawa. Ont., Born at Glasgow, Scotland, Aug. 30th, 1898; Educ., prel. D.L.S. 1915, final D.L.S. 1926; 1923 (June to Dec.), 1924 (Apr. to Sept.), instrumentman, Geodetic Survey of Can.; Oct. 1924 to Feb. 1925, instrumentman, Dept. of Rys. and Canals; Apr. to Sept. 1925, instrumentman. Geodetic Survey of Can.; Oct. 1925 to Jan. 1926, dftsman., Can. Int. Paper Co.; 1926 to date, instrumentman with same Co. 1916-19, overseas.

References: W. Blue, C. G. J. Luck, J. B. Barnum, D. H. Nelles, F. P. Steers.

COOIL—THOMAS REGINALD, of Saskatoon, Sask., Born at Maple Creek, Sask., Mar. 1st, 1903; Educ., B.Sc., Univ. of Sask., 1926; 1925 (summer), asst. on surveys br. of Sask. Dept. of Highways, surveying road diversions and land; May 1926 to present time, instrumentman with City of Saskatoon, giving line and grade for semi-macadam roads and sewers, also surveying and drawings and inspecting road work.

References: C. J. Mackenzie, H. M. Weir, W. W. Meadows, R. A. Spencer, G. M. Williams.

CULLWICK—ERNEST GEOFFREY, of Peterborough, Ont., Born at Wolverhampton, England, May 24th, 1903; Educ., B.A. in engineering, Cambridge, England, 1925; June 1925 to April 1926, student apptce. in Brit. Thomson Houston Co., Rugby, England; May 1926 to present, in mech. dept. of Can. Gen. Electric Co. Ltd., Peterborough, Ont.

References: J. A. G. Goulet, R. Dobie, P. Manning. J. Barnes, V. S. Foster, S. Goulet, G. Coutts.

PARMELEE—EDWARD HENRY, of Montreal, Born at Lansing, Mich., Nov. 14th, 1878; Educ., Univ. of Mich., 1900-02; home study, lectures, etc.; 1898-99, lineman and power house engr., Washtenaw Elect. Light Co., Ypsilanti, Mich.; 1899-1900, supt. overhead mtce., Detroit, Ypsilanti and Ann Arbor Elect. Ry. Co.; 1902-04, meter tester, Detroit Edison Co.; 1904-05, meter tester and asst. supt. of same Co. at Sault Ste. Marie, Ont.; 1905-17, conducted gen. elect'l engrg. and contracting business through the Cobalt country; 1917-18, i/c Minnedosa Hydro-Elect. Co., Minnedosa, Man.; 1918 to June 1926, salesman for Can. Wire & Cable Co. and West. representative of Ferranti Meter & Transformer Mfg. Co., Winnipeg; June 1926 to present, Eastern District mgr. for Ferranti Meter & Trans. Mfg. Co., Montreal.

References: A. B. Cooper, C. A. Clendening, E. V. Caton, R. N. Coke, E. J. Turley, J. W. Sanger.

PALMER—LEONARD CHARLES DUNLOP, of Montreal, Born at Ottawa, Ont., Nov. 13th, 1899; Educ., artillery commission, R.M.C. 1916; permanent commission received during war period in lieu of degree; 1917, i/c experimental Pround station night flying establishment, R.F.C.; 1919, Northern Electric Electric Co., Montreal, wire & cable dept., inspection dept., high-tension testing. telephone testing; 1922, Canadian Vickers Ltd., i/c aviation dept. in connection with first Can.-built amphibious for Can. Govt.; 1922-24, i/c aviation sales & service, Can. Vickers; 1924, asst. to M. V. Sauer, ch. hydraulic engr., appointed sales mgr., represented Vickers at Wembley Exhibition, and Vickers hydro-electric dept. at Geneva; reorganized Wm. Hamilton Co. Ltd., Peterborough, Ont.. at present, 1st vice-pres. Wm. Hamilton Ltd., Montreal mgr. i/c Eastern Canada.

References: P. P. Westbye, M. V. Sauer, W. H. Munro, F. B. Brown, J. B. Challies.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO MEMBER

DE CARTERET—SAMUEL LAURENCE, of Quebec, Que., Born at Auckland, New Zealand, Nov. 24th, 1885; Educ., Ph.B., Yale Univ., 1908; 1908-10, Riordon Paper Co., i/c party, topographic and forest surveys and i/c of office work of foregoing; 1910-23, with Brown Corp., 1910-12, i/c of dept. topographic and forest surveys; 1912-23, design and constrn. of dams, piers, etc., constrn. and operation loading plant and private sidings at St. Casimir, constrn. steel tug and scows, operation and mtce. 20 miles private ry. and electric plant Upper St. Maurice; 1923 to date, with Hammermill Paper Co., design and constrn. flume. wharf, piers, loading and shipping facilities at Matane, management company's properties and operations in the Prov. of Que., reports on various engineering projects.

References: A. R. Decary, R. deB. Corriveau, A. E. Doucet, L. C. Dupuis, A. Ferguson, A. B. Normandin, J. C. Smith.

FINLAYSON—ERNEST HERBERT, of Ottawa, Ont., Born at Toronto, Ont., March 28th, 1887; Educ., B.Sc., Univ. of Toronto, 1912; 1910, asst. chief, forest survey party; 1911, chief forest survey party, both of these required line and traverse surveys in addition to exploratory investigation; 1912-14, appointed inspector of fire ranging, Forest Service, also fire inspector, Board of Ry. Commissioners, Canada, i/c fire protection methods and administration on Dom. lands, Manitoba, Saskatchewan and Alberta; 1914-20, inspector of forest reserves, Alberta District, Forest Service, i/c administration of twelve million acres national forest lands; 1920-22, forest protection specialist, head office, Forest service, represented Gov't of Canada at first British Empire forestry conference in London, Eng.; 1922-25, acting director of forestry, organized and was vice-chairman, British Empire Forestry conference, Canada, 1923, and was secretary, Royal Commission on pulpwood; at present, director of forestry.

References: J. D. Craig, F. C. C. Lynch, O. Finnie, J. B. Challies, D. R. Cameron.

MACNABB—THOMAS CREIGHTON, of Revelstoke, B.C., Born at Toronto, Ont., Aug. 22nd, 1876; Educ., B.A., Univ. of Man., 1902; surveys, 1902, preliminary location; 1909, reconnaissance of rys.; 1909-14, constrn. of rys.; 1914, div. engr. mtce., Regina; 1916, dist. engr. for Sask; 1917 to date, supt. (mountain territory), Revelstoke div., all with C.P.R.

References: W. A. James, J. G. Sullivan, F. W. Alexander, F. Lee, J. C. Holden, J. G. MacLachlan, J. M. R. Fairbairn.

REAKES—GEORGE, of St. Lambert, Que., Born at Torquay, England, June 19th, 1860; Educ., Queen's College Univ., Birmingham, 1881-85, served articles with F. H. Phillips, C.E., county engr., Glamorganshire, Eng.; 1885-86, asst. county engr. i/c 140 miles roads and bridges; 1887-1900, Brit. Gov't. survey and engrg. work; 1900-07, asst. engr., Nat. Telephone Co. and Brit. Post Office (telegraph dept.) i/c designing and laying out underground conduits work; 1908-12, Dept. of Railways and Canals in Montreal, Westmount and Sydney, N.S., on roads, sewers, sidewalks and reinf. concrete work; 1913-17, town engr. and gen. mgr. town of Beaconsfield, designing and carrying out roads and electric light systems; 1918-23, with C.N.R., inspector i/c reinf. concrete piers, piling and foundation work; 1924, concrete work on South Shore bridge; 1925 to date, consulting engr. on roads, sewers and water work, town of Greenfield Park.

References: H. T. Hazen, F. B. Brown, C. N. Monsarratt, C. A. Mullen, H. Gibeau, T. C. Connell, R. B. Jennings.

SHERMAN—NORMAN CLARENCE, of Esquimalt, B.C., Born at Brighton, Ont., Sept. 4th, 1888; Educ., Public and High Schools, Ont., 3 yrs. faculty of appli. sci. and engrg., Ordnance Coll., Woolwich Arsenal; 1908, Fairbanks-Morse, erecting and testing gas engines, lathe and fitting work in small shop; erection and test. i/c small gang, Riverside Engine Co.; 1910-11, i/c Gov't. shops at Halifax, mfg. and repairing ordnance and ordnance stores; 1910-11 in England at ordnance coll.; 1912-15, i/c tech. work in West. Canada, field garrison and naval branches, also i/c explosives branch from 1912-13, work inc. mfrs. repairs, etc., and mounting of guns, examination work and instructional depot; 1915 to present time, ordnance mech. engr. mech'l engrg. branch, Dept. of Nat. Defence, in Inspection Dept. (contracts and in arsenal work [mfrg.]), personally responsible for mtce. inspection and serviceability of artillery equipment and other appliances for mechanical warfare in the four Western provinces and, indirectly, for the rest of Canada.

References: C. E. Webb, C. R. Young, H. M. White, J. A. Walker, T. A. McElhanny.

WILSON—ROBERT STARR LEIGH, of Edmonton, Alta., Born at Lunenburg, N.S., Aug. 13th, 1885; Educ., B.Sc., McGill Univ., 1911; 1905-06 with C.P.R., Sept. to Mar. instrumentman, Mar. to Oct. i/c constrn.; Oct. 1906 to Jan. 1907, instrumentman on survey, Middlemist & Wyse, Toronto; Mar. to Aug. 1907, on T. and N. O. Ry. constrn. with McRae, Chandler & McNeil, 1907-08, sub-contractor on same; 1909-10 (summers), topographer on ry. surveys for Man. & North Shore Ry. and G.T.P.; 1911-12, demonstrator and lecturer, McGill Univ.; Apr. and July 1912, asst. supt. on building constrn., Atlas Constrn Co.; 1912-15, i/c purchasing, costs, sub-contracts and estimating with R. J. Lecky & Co. Ltd., Regina, Sask.; 1915-19, lecturer and demonstrator in maths. and civil engrg. at McGill Univ.; 1919 to date, professor of civil and municipal engrg., Univ. of Alberta.

References: H. M. MacKay, R. W. Boyle, A. L. Ford, R. J. Gibb, E. Stansfield, C. A. Robb.

FOR TRANSFER FROM CLASS OF JUNIOR TO HIGHER GRADE

BOWMAN—CHARLES McCAWLEY, of Halifax, N.S., Born at New Glasgow, N.S., Sept. 3rd, 1893; Educ., 3 yrs. engrg. course at King Univ., Windsor, N.S., 1911 and 1912 (summers), with Mar. Tel. & Tel. Co. Ltd., drafting, instrument repair shop and cost accounting; 1913 (summer) and 1914 (summer), Dept. Public Highways, N.S. Gov't., chain and rodman, inspecting pipe & concrete culvert constrn.; 1914-18, with Can. Engineers, employed on electrical work during service; Dec. 1918, rejoined Mar. Tel. & Tel. Co. as engrg. asst. in Gen. Plant Dept. work, inc. making estimates and specifications for constrn.; 1919-25, making development studies and fundamental plans, etc.; 1925 to date, commercial engr. with same Co., responsible for commercial surveys, long-term forecasts, rate studies, development of special services, etc., Halifax, N.S.

References: J. E. Belliveau, G. S. Stairs, K. E. Whitman, W. A. Winfield, C. M. Crooks.

FOR TRANSFER FROM CLASS OF STUDENT TO HIGHER GRADE

BURCHILL—GEORGE HERBERT, of Peterborough, Ont., Born at Nelson, N.B., May 12th, 1889; Educ., B.Sc., N.S. Tech. Coll., 1923; 1917-19, overseas, Can. Artillery; 1923-24, testing dept., Can. Gen. Electric Co.; 1924 to date, asst. engr., alternating current engrg. dept. with same company.

References: B. L. Barns, W. F. McKnight, W. M. Cruthers, N. D. Seaton, A. B. Gates.

COULTER—STANLEY L., of Massena, N.Y., Born at Windsor, Ont., Nov. 20th, 1897; Educ., B.A.Sc., Univ. of Toronto, 1924; 1922, 8 mos. with R. H. Cunningham & Co. Ltd., Ont., as supt. design, constrn. & installation of electric furnaces and ovens under supervision; 1923, 8 mos. elect'l dfting dept., Detroit Edison Co.; 1924-26, 2 yrs. grad. student engr. on test course, Gen. Elect. Co., Schenectady, N.Y.; at present, asst. to elect'l engr., Aluminum Co. of Am., Massena, N.Y.

References: L. B. Tillson, R. W. Downie, J. E. Porter, R. W. Angus, T. R. Loudon, J. R. Cockburn, P. Gillespie.

HAYES—ST. CLAIR JOSEPH, of Peterborough, Ont., Born at Halifax, N.S., Dec. 24th, 1899; Educ., B.S. Mech. Eng. 1922, B.S. Elec. Engrg. 1923, N.S. Tech. Coll.; B.A. St. Mary's College, Halifax, 1919; 1921 (summer), asst. in power house inventory with Jackson & Moreland; 1924 to date, with Can. Gen. Elect. Co. as, 1923-24, test. dept., 1924 to date, with D.C. engrg. dept.

References: B. Ottewell, W. M. Cruthers, F. R. Faulkner, D. W. Munn, W. F. McKnight.

JENKINS—THOS. HARDING, of Windsor, Ont., Born at Toronto, Ont., May 1st, 1902; Educ., B.A.Sc., Univ. of Toronto, 1925; 1923 (summer), timekeeper and material clerk, C.N.R., Grant, Ont.; 1924 (summer), structural dftsman, Hamilton Bridge Works Co., Hamilton, Ont.; 1925 to present, structural dftsman, Can. Bridge Co., Walkerville, Ont.

References: T. R. Loudon, C. H. Young, W. J. Smithers, P. Gillespie, A. E. West.

JOHNSTON—OSWALD DANIEL, of Toronto, Ont., Born at St. Elmo, Ont., Sept. 29th, 1895; Educ., B.A.Sc., Univ. of Toronto, 1923; 1921 (summer), with Spanish River Pulp & Paper Co., Sault Ste. Marie, Ont.; May 1924 to present time, sales engr. with D. M. Fraser, Ltd., and, at present, asst. to general mgr. making recommendations, writing specifications and estimating on electrical and engrg. equipment.

References: D. M. Fraser, C. R. Young, A. B. Cooper, R. E. Cleaton, W. P. Dobson.

MILL—ARTHUR McTAVISH, of Cochrane, Ont., Born at Renfrew, Ont., May 31st, 1894; Educ., B.Sc., Queen's, 1919; 1913-17, asst. to Dom. Land Surveyors; part of 1918 on Pougan Fall water power survey; Sept. 1918 to July 1920, Frid Constrn. Co., Hamilton, on layout and reinforcing steel in constrn. of factory and store; 1920-23, with Ont. Highways Dept. on Ottawa-Port Fortune road; 1924-25, held contracts with dept. of public highways, Ont., and Counties of Prescott and Russell; at present, asst. to H. D. Duff, res. engr. for Dept. of North. Development, Ont., at Cochrane, Ont.

References: C. H. Fullerton, J. J. Richardson, G. H. Patterson. E. Neeland, O. Higman.

SILLS—HERBERT RYERSON, of Peterborough, Ont., Born at Kingston, Ont., Sept. 19th, 1900; Educ., B.Sc., Queen's, 1921; test course of Can. Gen'l Electric Co.; 1916-17, shopwork at Can. Locomotive Co., Kingston; 1918-19, fieldwork, Geological Survey of Canada; 1920 (summer), shopwork, Can. Gen'l Electric Co.; 1923-24, junior engr. in A.C. Generator and Synchronous Motor Engrg. dept., Can. Gen'l Elect. Co., collecting and co-ordinating test, design and operation data on synchronous machinery; 1924-26, asst. engr. of same dept., design, cost estimating, supervision of tests and passing of machinery, first asst. to B. L. Barns.

References: B. L. Barns, W. M. Cruthers, R. L. Dobbin, G. R. Langley, L. deW. Magie, E. R. Shirley, V. S. Foster, A. B. Gates.

SUTHERLAND—NORMAN CLAIR, of Kenogami, Que., Born at Amherst, N.S., June 16th, 1895; Educ., 3 yrs. civil engrg., Queen's Univ., 1920-22; 1912-13, clerk, district office., Nat. Transcontinental Ry., St. John, N.B.; 1914 (summer), asst. on mineral investigation, Mond Nickel Co.; 1915-19, overseas, Can. Engineers. gazetted lieutenant Aug. 1918; 1920 (summer), asst. on mineral investigation, Saguenay dist., for private interests; 1922 (summer), mineral investigation, Newfoundland, rodman, C.P.R., Toronto, 1923 (summer), constrn. foreman on power house near Southern Pines, N.C., Hester & McElvee, Raleigh, N.C.; 1924, electrical operator, Chicoutimi and Kenogami power plants, Price Bros.; 1925-26, chief operator, Price Bros., Kenogami, Que.

References: A. McPhail, W. P. Wilgar, D. S. Ellis, A. A. MacDiarmid, W. G. Mitchell.

VALIQUETTE—CHARLES, of Outremont, Que., Born at Montreal, Aug. 20th, 1901; Educ., C.E. and B.A.Sc., Univ. of Montreal, 1925; 1924 (summer), asst. road engr., road dept., Isle-aux-Noix, Que.; 1925 to date, asst. road engr., constrn. and mtce., Road Dept. of Prov. Que., Boucherville, Que.

References: A. Frigon, T. J. Lafreniere, P. L. P. LeCointe, C. C. Leluau, A. Fraser.

VAUGHAN—HAROLD WILFRED, of Montreal, Que., Born at Wolfville, N.S., May 3rd, 1896; Educ., B.Sc., McGill Univ., 1921; 2 yrs. B.Sc. course at Acadia Univ. then branched to engrg., graduating with Acadia Univ. certificate; 1920 (summer), rebuilding glass furnace, with repairs to 5-ft. producer gas pipe line, Dom. Glass Co.; 1921-23, asst. to ch. engr., Electrical Commission of City of Montreal; 1923 to present time, asst. supt., light dept., City Hall, work covers design, plans, specifications, estimates, tenders and superintendence of installation for underground lighting systems, also estimates, inventory and removal of expropriated materials (overhead pole lines, etc.).

References: G. E. Templeman, G. R. MacLeod, J. G. Caron, C. V. Christie, C. M. McKergow, G. P. Cole, L. H. Marotte, J. E. Blanchard.

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Engineering Features in Breaking the Allegheny Ice Gorge

Conditions Prior to the Commencement of the Work, Methods of Attack and the Results Obtained

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Paper read before the Montreal Branch of The Engineering Institute of Canada, October 14th, 1926

Description of the Gorge

Early in February 1926, the surface ice on the Allegheny river broke and moved down over a distance of some 50 miles above Oil City and Franklin, Pennsylvania. The restriction of the river at Brandon, 14 miles below Franklin, caused the ice to stop and jam in such a way that the entire mass above filled the gorge to that city, causing the river to rise, but not enough to cause apprehension. The character of the river is typical of these mid-state streams, and winds for miles between high cliffs with shallows, islands and deep hollows interspersed. The normal flow is in the neighborhood of 3,000 second-feet, but in the rainy season or with a sudden storm the level rises 20 feet or more in a few hours.

Towards the end of February a large quantity of ice came down from Kinzau, and quickly jammed into the pack which held below Franklin without dislodging or moving it. This caused the river to become packed from Franklin to Oil City, a distance of 8 miles, with a rapid rise of water level, higher than had ever been experienced by these communities. So serious was the situation with the flooding of Oil City and Franklin that the entire water works was put out of commission and Oil City was left without water or lights for several hours. The Pennsylvania Railroad put its locomotives to work supplying steam for the pumps, and the city fire apparatus was used to assist in the same work. The two cities were in very grave danger, apart from the uncomfortable condition in which the lower streets were from the high water and floating ice.

This second run of ice blocked the river up to Oil City, and left a solid ice gorge for 20 miles. In a few days more ice came down and blocked for 5 miles above Oil City, making a solid and almost dry ice jam 25 miles in extent.

Grave fear was evinced by the citizens over the situation, as it would have been impossible to cope with a heavy rain, and the normal run-off from such rain would have very materially increased the flood condition.

On the first of March a telegram was sent to the writer from the Mayor of Oil City asking for aid, and on the same day the writer left for New York, where he got in telephone communication with Oil City. In the meantime, the United States army engineer at Pittsburgh had been in communication with the Mayor of Oil City and had dissuaded him from seeking aid from the writer. From New York, the writer explained over the telephone that his methods were unknown to most engineers, and that he felt certain the flood level could be relieved, as had been done elsewhere. Later on in the day a message was received from the Oil City Chamber of Commerce by the secretary, Mr. L. H. Gavin, to come out to the Allegheny valley to look over the situation. Accordingly, the writer arrived in Oil City at noon on the third of March and at once met the combined Chambers of Commerce of Oil City and Franklin. After describing the principles of the method of ice control, which the writer had worked out during many years of study and experiment on the St. Lawrence, it was unanimously decided by the Chambers of Commerce to finance the work, and that same afternoon a special train was put on by the Pennsylvania Railroad, whose tracks followed the gorge for the entire length, and during the afternoon the writer inspected every part of the gorge. In the evening the writer again met the members of the Chambers of Commerce, when the method of attack was outlined and the various committees of co-operation were organized. A special Ice Gorge Committee was formed, and at the writer's request met every evening in the Chamber of Commerce at Oil City and at Franklin on alternate evenings. Reports of committees were received each evening, and the work laid out for the following day.

The writer realized that such a large jam could not be moved easily with no water to float the ice, and indeed, during the first week, the weather was so cold that it was useless to send large masses of ice down the river, as they merely jammed lower down. The river was free of ice below Brandon, and when the writer arrived the Pennsylvania

Figure No. 1.—Allegheny Ice Gorge from a Hill Overlooking Venango.

Railroad had been using dynamite in an effort to break out the foot of the jam.

The remaining story of the work will be given as the various steps are described. What has already been written brings the story up to the time the writer took charge of all operations, and received the loyal and hearty support of the citizens of Oil City and Franklin.

Methods of Attack

As explained to the Chambers of Commerce, every known method of attack known to the writer would be used in forcing a passage for the water through the gorge. In the writer's experience, thermit had proved the most powerful tool, and while other agencies were employed they were all of small value compared to that.

The various committees formed were:—

Thermit, under the personal direction of the writer.
Dynamite, under the direction of Mr. J. T. Ridgley, supervisor of the Pennsylvania Railroad, Allegheny Division.
Calcium Chloride, under Mr. T. C. Frame.
Ash, Sand and Gravel, under Mr. L. O. Bouquin.
Sulphuric Acid, under Mr. F. B. Hall.
Water Levels, under Mr. W. S. Wilson.
Weather Reports, under Mr. H. G. Johnson.
Field Inspection, by Boy Scouts, under Mr. L. S. Culbertson and Captain Ziegler.

Figure No. 2.—Street Scene in Oil City During the Early Flood when the Second Gorge Came Down.

Until March 5th, the writer was engaged in gathering material on the nature of the ice, plotting the findings on the government maps of the river, and planning the best method for the attack. The containers for the thermit were being constructed and filled with the first ton ordered from New York. Up to this time the dynamiting alone had been carried out, and a small channel had been opened through the lower end of the gorge with its use.

In a broad general way the use of the heat units at first was for the purpose of opening up the channels under the ice and weakening the surface before taking the ice out in order to bring down enough water to float the ice and afford relief to the high water at Franklin and Oil City. As soon as the weather moderated the various sections of the gorge were treated, and large patches opened, but when the warm weather set in the final removal of the sections was effected with large charges of thermit.

The use of dynamite was continued to free as much of the restricted area below Brandon as possible in preparation for the final removal of the pack. As a matter of fact, the dynamiting had to be discontinued shortly after the thermit was applied on account of the excessive bleeding of the ice running under the gorge and coming out at the lower end.

The calcium chloride was used to open channels in the surface ice near the bridges, and was found quite effective.

The mixture of sand and gravel was used for the same purpose, and was spread on the surface so as to gather the sun's heat to melt the ice faster. It was remarkable to see the rapidity with which the gravel sank into the ice, and at these treated points patches of water opened when the weather moderated.

Sulphuric acid was never used, although it was kept in reserve, there being a considerable supply of crude acid in the neighbourhood.

Water levels were carefully observed at Franklin and Oil City and at points higher up, and the writer was kept constantly informed of these. At the same time, weather reports were received during the day from various stations along the river as well as from the Weather Bureau at Washington.

The Boy Scouts were organized into groups for observation at the various bridges near Oil City and Franklin to report on the fluctuations of levels and the surges from hour to hour. The entire river during the first ten days was constantly surging and pulsating, due, no doubt, to the high head of water seeking channels through the ice in the lower pack. The boys also ran lines of stakes across the river at two points near the railroad bridges at Oil City and Franklin. These stakes were capped with red, and were accurately placed in alignment so that the slightest movement in the upper pack could be at once detected. Long before the ice was moved out the whole gorge was slowly moving down stream like a glacier, and the stakes gave the writer the first sign of this movement.

Dynamite Operations

The whole progress of the dynamiting operations is recorded in the minutes of the daily reports put in by the head of the Dynamite Committee. The operations which had been begun by the Pennsylvania Railroad, before the writer took charge of the work, had been discontinued pending the writer's initial work of reorganization. They were resumed, however, by the writer as soon as possible, as it was doing effective work in "biting off" the foot of the pack. On March fifth it was reported that in the lower end of the gorge a channel 1,000 feet long and 80 feet wide had been successfully opened with the use of 500 pounds of dynamite through ice in some places 8 to 11 feet thick.

The report of the sixth stated that in the morning they made fifteen holes 50 feet apart, and used 1,200 pounds of dynamite. In the first seven shots they used 100 pounds each, and for the other shots 50 pounds. They took out 50-foot sections, 75 feet wide, and approximately 1,700 feet of a channel was made. The first ice encountered was 6½ feet thick, while at some spots it was as much as 11 feet. Subsequently, shots were put off at regular intervals of ten minutes.

On March 8th, it was reported that 500 feet more of a channel had been opened up, but that most of the time during the day had been spent in making holes, so that the next day considerable progress could be made as most of the holes were completed and more time could be devoted to dynamiting.

On the following day it was reported that fourteen shots had been used and from 1,600 to 1,700 feet of ice taken out. The last shot made a 500-foot channel 100 feet wide. It was put off just above the first holes where the thermit had been used. In this part the spacing of the shots was increased and 100-foot sections were taken out, showing weakening effect of the thermit action under the ice. Ice taken out in this last section was 11 feet thick.

It was reported that the ice sent down by the operations of the previous day had jammed lower down the river at the railway signal tower. Efforts were made to dislodge this, using eight boxes of dynamite. The attempt was unsuccessful, and forty new holes were made for use the following day.

On March 11th, most of the day was spent in dislodging the lower gorge and making sixty-five new holes, and the report of the 13th was to the effect that 100 feet of the ice in the new gorge had been shot away, but that a block of ice 75 feet long had come down and was causing more trouble. It was decided to use smaller shots of dynamite in future operations.

Shortly after this date it was decided to discontinue the dynamiting, as little was accomplished compared to the amount used, and it was thought better, in view of the rapid work progressing with the thermit in weakening the lower gorge, to reserve the remaining stock of dynamite for any emergency that might arise. The bleeding of the ice hindered the men from making the holes for the dynamite.

Calcium Chloride Treatment

As much salt as possible was gathered from the road

Figure No. 4.—Railroad Tracks Flooded at Oil City in the First Flood.

department, and it was decided to open up 3-inch channels under the Big Rock bridge.

On the 6th, Mr. Frame reported that 1,600 pounds of calcium chloride had been put in the channel under the bridge, making lines 2,000 feet long.

No further use was made of calcium chloride, pending the decision to order a fresh supply. The action of the material already laid was watched with much interest, and it was expected that the weakening of the ice under the bridge would help to relieve the pressure on the piers.

Ash, Sand and Gravel

On March 5th, it was reported that one carload of cinders would be spread at places along the channel as would be suggested by the writer. On March eighth, one carload of cinders was unloaded at East Sandy, 300 yards being laid along the channel at that time. Arrangements were made with the Atlantic Refining Company, of Franklin, for a car load of ashes to be taken by the New York Central and dumped off the bridge at East Sandy on the ice. The Atlantic Refining Company donating the ashes and the New York Central their train service.

The report on March 9th showed that the carload of ashes was dumped on the ice at 9.30 a.m. They were spread 50 yards up the river and 350 yards below Camel Hump to a width of 15 yards. The action was noticed to make slush ice by drawing the heat of the sun.

Report on March 10th that seven men were employed in spreading ashes, 275 yards were spread up the river and 25 yards down. Around both piers of the bridge cinders

Figure No. 3.—Reno Traction Bridge at Oil City Lifted 18 inches above its Piers by the Ice.

Figure No. 5.—Reno Traction Bridge Put Back Without Damage on to its Piers with the Removal of the Ice by the Thermit Treatment.

Figure No. 6.—Big Rock Bridge Below Franklin with Two Spans Gone and One Pier Carried away by the Ice.

Figure No. 7.—Looking Down Stream from Big Rock Bridge Showing One Span Carried along on the Moving Ice.

were placed 12 feet. The ice was found not stuck on the east side of the west pier. Cinders spread the day before had penetrated the ice from a half inch to one inch.

On March 11th, the men employed in spreading gravel were used in assisting the dynamiting operations, as after this date no further ashes or gravel were used, and it was found the ice covered by the gravel gradually showed water on the surface. No further application of gravel was made, as the thermit was producing such great effects.

The Thermit Operations

The writer will now try to give some idea of the way in which the general attack on the gorge was carried out with the use of the thermit heat units.

Some experimenting had to be done during the first few days on the writer's arrival. Special containers were constructed by Mr. J. P. Coffman, superintendent of the National Transit Pump and Machinery Company, of Oil City. Arrangements were kindly made by Mr. Coffman to have the containers loaded at the shops. Before the containers were finished, some charges were prepared in 10-gallon oil barrels.

After a careful survey of the gorge, the writer laid out the points of greatest resistance in the old jam below Franklin which had resisted the onslaught of the second gorge. These points were about five to six miles apart, beginning at the foot of the pack. No attempt was made to treat the upper pack from Franklin to Oil City, because this was being weakened by the effect of the open water above Oil City at the head of the jam. The sun's heat was being carried into the pack, and the greatest danger lay in this upper ice under high water shoving down on the older pack, still hard and solid, and causing great damage to the city of Franklin, situated in the jaws of the mass.

The water, when it reached the lower pack, had had its heat all taken out of it by passing through the upper pack, and hence its melting action was reduced to a small amount. The entire gorge was divided into two parts. The lower, represented by the older gorge, which was dry and grounded with the water forcing its way around through side channels, and the newer gorge, lifted high on flood waters accumulating above Franklin. The object of the first thermit treatment was not to dislodge the ice, as the dynamiting operations had shown the uselessness of this while the cold weather lasted, but to open channels under the surface. The water had to be brought down into the old pack and by its presence do two things; relieve the flood level above, and afford water enough to lift the lower ice and get it ready to be passed on down the river without gorging and causing more floods.

With this in view, all work was concentrated on the heavy packs and the thermit containers fired as low down in the ice masses as possible. The liberation of this great heat had the effect of burning out great areas under the ice, and the force of the explosions, which resulted from the heated metal in contact with the ice and water, caused cracks and disruption which allowed the water to force its way through these places under a high head and gradually work its way down, clearing and melting a channel much larger than was evident to the eye at the time.

In the accompanying curve figure No. 8, it will be seen how the levels of water at Franklin and Oil City dropped after the thermit was applied. Each charge was noticed to produce its effect in reducing the flood water.

With the fall of water in the upper pack there was a rise of level in the lower end, and care had to be taken not to let the water down too fast so as to avoid flooding the Pennsylvania Railroad tracks at the lower part of the gorge.

All of the time up to March 18th was taken up with intelligent use of the thermit at the critical points and the operations regulated by the writer from the daily watch of the flood levels. The drop in level occurred simultaneously with the thermit treatment. (See Appendix A.)

From the 10th to the 20th, when the weather turned very mild, the gorge was held in control in this way, and the whole pack was observed to move very slowly down-

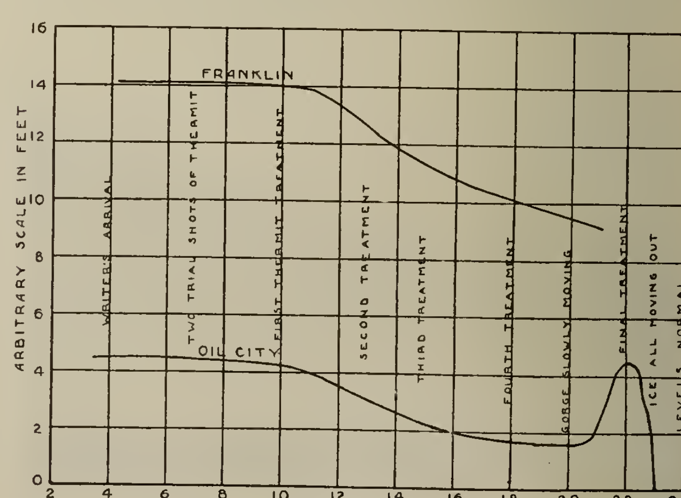

Figure No. 8.—Diagram showing Fall of Water Levels due to Thermit Heat Units.

ward as the water was brought down. From this glacial-like movement much valuable information was obtained as to the hardest and most resistant points. By the 20th, great areas had opened up, and it was found desirable to begin the final attack to remove the gorge. The writer was criticized for not taking the ice out at once, but this was unwise, for reasons already given. The whole situation was under control and the river levels held down until such time as nature could aid in the removal of the ice.

On the afternoon of the 20th, the upper pack began to move under the weakening action of the sun. This was a little sooner than the writer had expected, and in consequence new tactics had to be adopted. Everyone thought that the entire gorge would move out, but so strong was the ice still holding between Oil City and Franklin that it gorged into the ice at that point under a high head of water without moving beyond Reno. The citizens had a taste of what might have occurred to them in a much worse way had not the lower gorge been opened and the previous flood waters taken away. A considerable flood ensued at Oil City, although Franklin did not experience this flood in the least.

The same night the waters began to rise, and early the following day Oil City was in flood, with rain falling. The Reno traction bridge was in grave danger, and stood 18 inches off its piers, resting on the ice, while the power house was partially submerged and in grave danger also.

On Monday, March 21st, two heavy charges of thermit were set off at the two points in the new jam at Reno where the pack was greatest, and these were effective in relieving the flood in Oil City, and were so gauged as to put the Reno bridge safely back on its piers without damage of any kind. (See comparative photographs.)

On that day, March 21st, more thermit was rushed from Pittsburgh by motor truck and special train, and all night long the men worked heroically to fill containers for the morning.

On Tuesday, additional charges were inserted in the pack to bring the ice level down to a safe distance below the bridge, and then a concentrated attack was made on the gorge to remove it entirely.

Two thermit crews were sent out, one below Franklin at Indian Bend, the last remaining point of resistance, and the other to loosen the pack holding between Oil City and Franklin.

The men in charge of the work, Messrs. Geo. L. Bannon and Fred. Wenner, deserve the greatest praise for the courageous way in which they went at the attack in the rain and bad weather. The ice was none too firm to go on to place the charges, and frequently planks had to be used to effect a safe passage.

Under the terrific action of these thermit charges, the gorge was shaken loose in great patches and sent down the river safely, the lower pack giving just ahead of the upper, thus avoiding any flooding except for a short time at Indian Bend, where some of the track embankment was washed out. This was from the great rush of water from the upper pack meeting the resistance of the slowly-moving ice below. Very little damage was done, however, and by 6.30 o'clock in the evening the ice was all moving on down easily, and by late evening the river levels at both Oil City and Franklin were back to normal.

The United States Army engineers at Pittsburgh, who never at any time understood the function of the thermit treatment, had predicted the worst flood in the history of Oil City, with the rain and warm weather. This prediction, like their earlier ones, was not fulfilled. Had the gorge been left to nature, as they had urged, then their predictions would have doubtless come true, but under the scientific treatment accorded the ice in the gorge was removed without damage.

On Sunday night, March 21st, two spans of the Big Rock bridge were taken out by the ice movement, but this could not have been prevented as the understructure, which had been condemned as unsafe, was a prey to the slowly-moving ice and the flood waters above. It was a matter of great satisfaction to the writer that no loss of life or injury resulted from the whole operation, and the property damage was comparatively small, compared with what it might have been.

Comments on the Work

It is but fair to review some of the comments of the engineers and others who were in close touch with the whole fight.

General Manager V. A. Redfield, of the Traction Company, stated to the press that " Credit for saving the Reno bridge and for diverting the ice pack to the opposite side of the river, saving the switching equipment and preventing tremendous loss of property, resulting in interruption of service of a far more serious nature, is given to Dr. Howard T. Barnes. It is quite evident that the wall of water backing up on Monday evening was not great enough to move the big jam, which could only be placed in motion by a still greater head of flood. The thermit crew, in charge of the Montreal Scientist, devoted practically all of their efforts on Monday to attacking the ice below Reno on the opposite side of the river from the West End power house. This caused a gradual weakening of the pack below the surface of the ice, with the result that the field moved out on the opposite side of the river, avoiding the transformer yard

Figure No. 9.—Lowering Water Level. Shot No. 1.—Black Powder, 25 lbs., Thermit, 160 lbs.

Figure No. 10.—Lowering Water Level. Shot No. 2.—Black Powder, 25 lbs., Thermit, 160 lbs.

Figure No. 11.—Pennsylvania Express No. 900 to Pittsburgh shown Racing the Moving Ice to Get Through First.

and its intricate network of switches and other protective equipment and sparing Oil City and Franklin a far more serious interruption of electric service. As it was, the first movement of the ice resulted in a sudden movement which sheared off one of the big steel towers at the power house, carrying away the 11,000-volt supply lines to Franklin."

Another comment in the Pennsylvania News, and written by Mr. Shingledecker, of the Pennsylvania Railroad: "We can now review a bit. People will never forget the gruelling experiences of those three days, beginning Sunday morning, March 21st, and ending Tuesday night, March 23rd, only after Dr. Barnes had shaken and virtually burned the packs to pieces with heat mines. Thermit was rushed to Oil City over the Pennsylvania Railroad, arriving at 9 p.m. on March 22nd. All night a force worked to prepare the containers for a desperate attack on the two gorges the following day. With organized crews, Dr. Barnes launched a desperate effort against the great mass of ice. Fifteen shots were placed in the Oil City gorge during the day and four in the Brandon pack. Hour after hour the crews risked their lives to place *heat mines*. The Brandon pack broke at 5.40 p.m. and the Oil City gorge followed at 6.35 p.m., an hour after the thermit crews were driven to shore. With the aid of thermit, the gorges moved ahead of a wall of water three feet lower than the great volume the day before."

Superintendent J. J. Rhoads, of the Pennsylvania Railroad, issued the following statement on March 22nd: "I attribute the 31-inch drop in the river at Oil City to the use of thermit in the vicinity of Reno."

The following day, after conferring with Division Engineer W. S. Wilson and Supervisor J. T. Ridgley, Superintendent Rhoads issued another statement, as follows: "That the Allegheny Division's loss is not much greater, we attribute to Dr. Barnes' work, and in each case where the *heat mines* were used, the river level dropped within twelve hours. The entire community of Oil City and Franklin, as well as the Allegheny Division, were fortunate in having at their disposal the services of Dr. Barnes."

It might be well to add that the work was not carried on without many difficulties, and as the people of both cities were not familiar with the scientific method of doing such work it was not easy to have them understand what the writer was really going to do to help the situation. One question was raised as to whether the thermit would poison the water and the fish, so the medical health officer of Pennsylvania rushed there to have an interview with the writer, and, if necessary, to stop the work.

Engineers did not realize that there were not one or two ice packs, but a number of packs, and that the key to each of these separate jams had to be treated to have the work carried on successfully.

The whole cost of the operations was under six thousand dollars, which was insignificant compared to the value of the property saved. The saving of the Reno bridge alone was sufficient to justify the expenditure.

Report to the United States Government

The Ordnance Department of the United States Army appointed Reserve Officer Major H. B. Faber to make an official inspection of the writer's operations in removing the ice gorge. Accordingly, Major Faber came out to Oil City, and was present during the last two days of the work. He witnessed the final removal of the ice. His report was sent in to Washington and is on file as an official document of the War Office.

The report is of an entirely favourable character, as he was very much impressed by the whole procedure, characterizing it as "amazing."

Even after the gorge had gone out, the United States Army engineers at Pittsburgh sent out a bulletin to the effect that the ice had gone out under the pressure of high water, without giving any credit to the thermit operations. This, as will be apparent by reading the text of this paper, was not true, for the gorge withstood the highest water in the history of Oil City without moving for nearly 18 hours, and it was only when the flood level had been reduced to a safe point with thermit treatment that the ice was moved out. Then the movement was effected from the lower gorge first, which quite reverses the way these accumulations usually move. Had the lower gorge been left to nature, there is no knowing when it would have moved, since it was gathering no heat from the waters above except a little from French creek at Franklin. But it is well not to speculate on what would have happened to the city of Franklin under these conditions, as it was just at the meeting-place of the old and new gorges. It must be pointed out in comparison that the Kinzua gorge, 60 miles above Oil City, which was feared would come down any time, never moved out at all, but melted in place, the water making new channels around it.

At the beginning of the work, the writer paid a visit to Kinzua, and after a careful inspection gave it as his opinion that there was no danger from it moving down, so securely

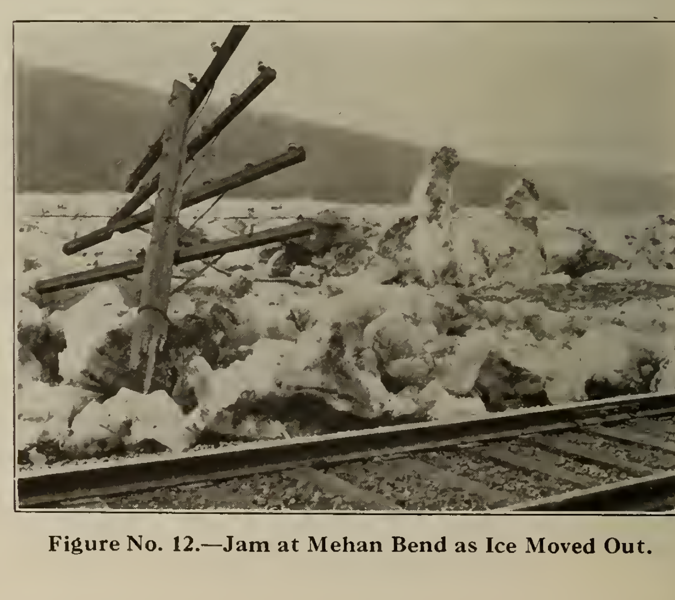

Figure No. 12.—Jam at Mehan Bend as Ice Moved Out.

wedged was it between islands and the main shore in a bend of the river.

The whole thermit work puzzled many prominent engineers all over the country, who had not been aware of the writer's recent work. Those who honoured the writer by coming to see the work and study the plans which he had worked out, all expressed astonishment at what could be accomplished, and went away favourably impressed with the work.

It is not to be expected that those who did not see the work could feel confident of success, since nothing like this had ever been attempted before.

The best evidence that the thermit accomplished the task is given from the enthusiasm of the thermit crews who daily went out in the cold and wind to place the charges and risked their lives in the work. Had they not known the effectiveness of the operations, it is not likely that these men would have been so willing to do so. No other incentive actuated them but one for the general good of the communities.

APPENDIX A.

Report of Thermit Operations to Reduce Flood Levels

Wednesday, March 10th, 1926

Shot No. 1. The first shot was placed 300 or 400 yards north of Brandon station in a swift-moving channel. The container was of the double-lined type. The thickness of the ice at this point was 6 feet, and the depth of water was 10 to 12 feet. The charge was fired at 10:55 a.m. and the reaction was not as noticeable as in the case of the shots fired in the single-lined containers the day before. There were no flames shooting high into the air or the deep rumbling and rolling motion of the ice as noted by the single-lined container. The only part of this container left was one handle which appeared to have been blown off.

Shot No. 2. The second charge was placed at the mouth of Sandy creek in 12 feet of water, and the thickness of ice was 8 feet with a quantity of slush ice underneath. This shot was fired at 11:51 a.m. and lasted for fully one minute, during this period there were two very pronounced reports. Water boiled up through the ice at a distance of 8 feet from the hole for a period of 10 minutes, and cracks radiated from the hole for a distance of 75 yards. The ice from shore to shore was shaken by a loud crumbling and rolling action. There seemed to be more of an equal distribution of energy. All reaction from this container seemed to take place underneath the ice.

Shot No. 3. The third charge was placed at Indian God Rock at 12:45 noon. The thickness of ice was 8 feet and the depth of water over 14 feet. This shot was placed at the edge of a pressure ridge between two large cracks in the ice. It also was successful, there being two very loud reports, (similar to those in the case of shot No. 2), and a few sheets of flame shot into the air to a height of 6 to 8 feet. Upon examining the hole after the shot was fired we found that it had been enlarged to 10 feet in diameter. Five minutes later the boiling action appeared very noticeable at the surface. The river at this point was about 500 feet wide and the ice shook considerably from shore to shore. This container was also lowered about 4½ feet underneath the surface of the water.

Figure No. 13.—Carrying Large Heat Unit out on the Ice.

Figure No. 14.—Placing One of the First Heat Units under the Writer's Direction.

Shot No. 4. This shot was placed at the lower end of Fosters ripples at 1:45 p.m. The thickness of ice was 4 feet, and the depth of water in the channel over 14 feet. This container was lowered 5 feet under the surface of the water. There were three loud reports and one less distinct at 3 or 4-second intervals. Balls of fire shot out of the hole at each report, and upon examining the spot we found that the container sides were not destroyed, the top and bottom only being missing. There was no violent upheaval as noted before, and although the shot did some good it was not as satisfactory as the other three.

Shot No. 5. Charge No. 5 was placed at the upper end of Fosters ripples at 2:30 p.m. The thickness of ice was 5 feet and the depth of water over 12 feet. There was a pulsation of 3 inches at this spot and this appeared to be very violent at times. This was also a successful shot, heaving the ice up 6 inches accompanied by a violent boiling action about 25 or 30 feet down river from the hole, which lasted for ten minutes.

Shot No. 6. This charge was placed at Foster station in the middle of the channel at 3:05 p.m. The thickness of ice was 6 feet and the depth of water over 12 feet. After the shot was fired a deep rolling motion took place and a series of short sharp reports, accompanied by a boiling action. The shot was very satisfactory.

Shot No. 7. This shot was placed at the mouth of Big Sandy creek, 275 yards north of East Sandy bridge, at about the middle of the river. The thickness of ice was about 11 inches with a quantity of slush ice underneath, and the depth of the water over 12 feet. This shot was fired at 4:15 p.m. and was accompanied by two loud reports and a deep rumbling and rolling motion of the ice for a radius of 300 feet, while a boiling action was also noticed.

Shot No. 8. This charge was a small double-lined container and was fired about 60 feet nearer the shore than shot No. 7. It was fired at 4:25 p.m. and it seemed to take longer for the reaction than in the case of the single-lined containers. Ice shot up into the air to a height of 75 feet, and small sheets of flame were noticed above the hole and it seemed as if too much energy was lost in this case. There was also a slight rumbling and rolling motion of the ice but not as pronounced as in the other cases.

(Signed) *G. L. BANNON.*

Thursday, March 11th, 1926

Shot No. 1. This charge was placed on the lower end of ice jam 300 yards south of the railroad tower. This ice was projecting into the open water for perhaps 50 feet from the main pack. After the shot was fired there was a reaction lasting for fully one minute. Sheets of flame and black smoke rolled out of the hole and a series of low deep rumblings took place, then a loud report was heard and ice and part of the container were thrown 200 feet into the air. Examination of the hole afterwards showed that it had been enlarged 30 feet in diameter and huge cakes of ice, 18 to 24 inches, were all jumbled and tossed about. The ice at this point was 11 feet thick

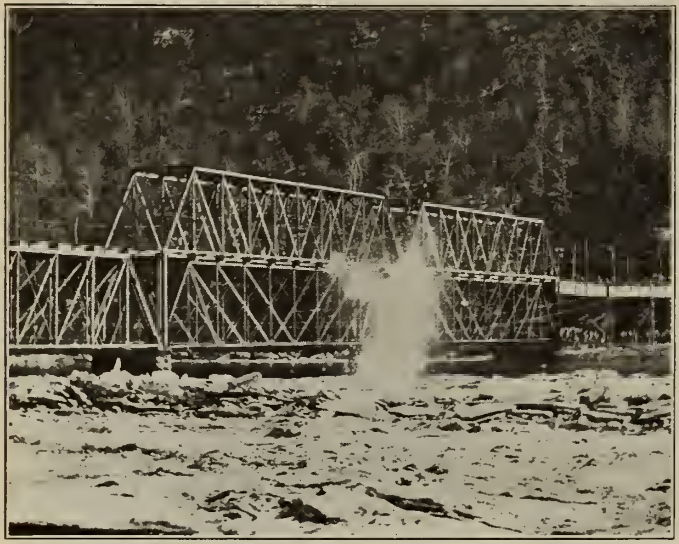

Figure No. 15.—A Thermit Heat Unit fired at Big Rock Bridge.

and resting on the river bed. A slight settling movement was noted five minutes after the shot was fired.

Shot No. 2. Was lost under the ice, and it was impossible to retrieve it.

Shot No. 3. This shot was placed at the edge of the main pack and the new jam and was of the special ice thermit. There was nothing unusual about this shot apart from the rumbling and short flames which shot out of the hole. This thermit was packed in a transit container, no iron pot being ready.

Shot No. 4. Was placed 250 feet north of shot No. 3, with a charge of dynamite 50 feet away and both fired together. A section of ice 200 feet long was moved down stream.

(Signed) *G. L. BANNON.*

MONDAY, MARCH 15TH

Shot No. 1 was fired at 11 a.m., ¼-mile below Brandon about 300 feet from shore. It shook the ice for about 500 feet and fire shot into the air for about 25 feet. Two explosions occurred and water boiled for about five minutes. There was 18 inches of ice, and a single container was used.

Shot No. 2 was fired at 11:20 a.m., ¼-mile above Brandon, a double-lined container was used and fire came out of the hole and shot about 25 feet into the air. The container came out of the hole and water boiled out for about five minutes. The thickness of the ice was about 2 feet.

Shot No. 3 was fired at 12 a.m., 500 feet below Sandy creek, where there was a thickness of 2 feet of solid ice with slush ice underneath. This shot shook the ice off the bank along the shore, and shook the ice from shore to shore. There was not much of an explosion and not much change in the hole. An iron container was used.

Shot No. 4 was fired at 12:30 p.m., 500 feet above Sandy creek. An iron container was used. The thickness of the ice was 2 feet, solid, with slush ice underneath. Fire came out of hole to a height of about 25 feet, but there was not much change in hole.

Shot No. 5 was fired at 12:50 p.m., ½-mile above Sandy creek, where there were 2½ feet of solid ice with slush ice underneath. The shot shook the ice from shore to shore, with two explosions, and left a hole about 15 feet in diameter. An iron container was used.

Shot No. 6 was fired at 1:25 p.m., ¼-mile above Indian God rock, with 3 feet of solid ice and slush ice underneath. This shook the ice from shore to shore, boiled at the hole for about five minutes, but did not make much change in the hole. An iron container was used.

Shot No. 7 was fired at 12:45 p.m., ½-mile above Foster station, where there was solid ice 18 inches thick, with slush ice underneath. This shot shook the ice from shore to shore; fire came out of the hole to a height of about 5 feet, but did not make much change in hole. An iron container was used.

Shot No. 8 was fired at 3:50 p.m., about 500 feet below the railroad bridge at Sandy. It shook the ice for about 200 feet, but not much fire came out of the hole. There was solid ice about 12 inches thick with slush underneath. There was not much change in the hole. An iron container was used.

Shot No. 9 was fired at 4:00 p.m. but did not result in much of an explosion, although water boiled at hole for about five minutes, without much change in hole. An iron container was used.

THURSDAY, MARCH 18TH

Shot No. 1 was placed 200 yards south of Big Rock bridge in the deep channel at 2:40 p.m. There was one deep report and a small quantity of black smoke. Water shot up around middle pier of bridge, covering the ice to a depth of three to four inches. It also gave the ice a good shaking. The ice was from 3 to 4 feet thick, with plenty of water.

Shot No. 2 was placed 60 feet north of No. 1. There was one loud report and flames and molten metal were hurled high into the air. This shot also gave the ice a good shaking.

Shot No. 3 was placed 200 feet north of Big Rock bridge. The ice was in layers of 18 to 24 inches in thickness to a depth of over 8 feet. There was a series of short sharp explosions, then one loud report. Water spurted out of the ice at a distance of 150 feet from where shot was fired. It also tore a hole in the ice about 30 feet in diameter.

Shot No. 4 was placed 60 feet away from No. 3, toward the west shore line, in layers of ice 18 to 24 inches thick, to a depth of over 8 feet. There were two reports and flame shot out of the hole to a height of 6 feet. It tore a hole 15 feet in diameter in the ice. There was also a small part of the container left.

SUMMARY

In all, four containers were taken to Big Rock bridge and the four were discharged without any trouble. The ice was shaken loose from the two middle piers and settled so that water covered the ice to a depth of 3 inches or more.

(Signed) *GEORGE L. BANNON,*
FRED. WENNER.

APPENDIX B

NATURE OF THE THERMIT-ICE REACTION

The thermit heat units as developed by the writer for use in ice accumulations contain ordinary welding thermit manufactured by the Metal and Thermit Corporation of New York and Toronto.

It consists of a mixture of metallic aluminum and iron oxide in such proportions that the combustion of the aluminum results in the reduction of the oxide of iron forming metallic iron according to the relation:—

$$3\ Fe_3\ O_4 + 8\ Al = 4\ Al_2\ O_3 + 9\ Fe$$

The heat of formation of the Alumina, which is generated by the reaction, raises the mass to 5000° Fahr. Heat from a body at such a temperature is radiated in the form of light and heat waves with a maximum of energy in the heat spectrum.

Water and ice are partially transparent to these short rays, as is evident to anyone who observes the rays of the

Figure No. 16.—Erie Railroad Bridge Held Down by a Heavy Coal Train.

sun penetrating water. The absorption is gradual as the rays proceed, and thus the energy can be distributed over a wide area.

To loosen the ice crystals comprising a mass of ice, only a very small amount of actual heat is necessary. The amount absorbed from a beam of sunlight, or from a charge of thermit is quite sufficient to do this.

When heat is applied in the form of steam or hot water the action is only local, as no rays are sent out from a body at that temperature which can pass through water. A small amount of energy at a high temperature is a much more effective agent in disintegrating ice than a large quantity of heat at the temperature of steam.

In addition to this, when heat is shot into ice at the high temperature of thermit the energy input causes the ice to rupture and the molten iron dissociates the ice, forming iron oxide again, and liberates hydrogen which burns with the oxygen of the air. It is well-known how hydrogen can be prepared by passing steam over red hot iron, but at the thermit temperature the dissociation is more rapid and gives rise to sudden generation of hydrogen as well as steam. This results in a slow explosion resembling a heave upwards, which is ideal in loosening ice masses. Then the activity of the explosion comes from the ice itself, which literally causes the ice to blast itself. Dynamite can in no way be compared, as the shattering effect comes from the blow delivered by the explosive.

One very important feature of the thermit-ice reaction is that it is not in any way harmful to concrete structures or earth works. Large charges have been repeatedly set off alongside of bridge piers and embankments without any effect on them.

Large masses of ice have been moved near concrete walls with no other effect than the lifting of the ice several feet in great fields with consequent large surges spreading out as a number of waves through the ice.

To fire thermit to the best advantage it is confined in a water-tight container, with lined walls, of a size suitable to the work it is designed to do. The standard unit in this work contained 160 pounds of thermit.

A central fire ignitor is inserted in the top and operated by a hot-shot battery, blasting machine or fuse. The reaction takes place in from 5 to 8 seconds, causing the thermit to be converted into a mass of molten iron which is held long enough by the thickness of the walls to burn completely to the bottom. The bottom is made of thinner metal, through which the molten metal drops by melting it. It is thus suddenly thrown into the ice or water with the evolution of the radiant beam, followed after a few seconds by the explosion which loosens the ice and burns out the channels under the ice. Ignition has to begin from the top, as the thermit will not burn upwards. The result of a thermit shot in an ice mass is to start a point of weakness which gradually grows by the infiltration of the water currents. The action in an immense pack is like the spreading of infection from a wound. The effectiveness of thermit was first tried out by the writer in the ice jams on the St. Lawrence in the winter of 1924-25. At this time, two large jams were removed by a few charges judiciously placed in the key positions. In the one at Waddington, a quarter of a million tons were taken out by three charges of 90 pounds each, while at Chimney island, a few weeks later, over a million tons were moved down the river by two charges of the same size.

Building the City of Arvida

The General Planning, Construction Methods, and Details of Materials and Equipment Used

H. R. Wake, A.M.E.I.C.
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In August 1925, the Aluminum Company of Canada, Limited, purchased property in the vicinity of Ha Ha Bay Junction, on the Canadian National Railways between Jonquiere and Chicoutimi in the Saguenay-Lake St. John district, and work was immediately started on the construction of an aluminum plant about three and one-half miles from Jonquiere and five miles from Chicoutimi. It was started in the midst of a field of oats, potatoes and pasture. There were no roads leading to it and no living accommodations. Temporary living accommodations were provided

The future City of Arvida in Present Stage of Development.

by a construction camp, which allowed time for planning the town development and permitted starting the plant construction immediately.

For plant and town purposes the company purchased about 6,000 acres in a block about three miles square. It slopes gradually from the main Jonquiere-Chicoutimi highway on the south to the bluff along the Saguenay river on the north. Between the top of the bluff and the river there are two terraces which will make excellent house locations when the natural growth of the city reaches that section.

Running in a south to north direction between the main road and the bluffs are a number of deep ravines. There are several rock outcrops at different points within the area.

In planning the town, the principal problem was not the layout of the section to be built in 1926. It was first necessary to visualize a city of from thirty to forty thousand people built on this site. From the topography, it was possible to block out the several areas which are suitable for housing purposes. It was then possible to consider the location of these several areas with reference to the plant and railroad, and select an area for the main business section of the completely developed city. In each of the housing areas it was necessary to provide for small neighbourhood stores, as many of these areas are too far to permit the people to do all of their marketing in the main business section.

With this picture, it was possible to lay out the main arteries of transportation so as to provide proper connections between the housing and business areas, and also with the neighbouring towns of Chicoutimi, Kenogami and Jonquiere.

The next step was to lay out the streets and blocks in each housing area and make additional connections between these areas where possible and advisable.

Having the general layout, it was possible to select a housing area for development in 1926. The area selected is adjacent to and northwest of the portion of the plant now under construction. It is also adjacent to and just northeast of the business section, and is about a mile from the railroad station. With this layout, the stores where the people will trade are at the edge of the residential area, but that is the only arrangement which could be made to fit in with the ultimate development. With such a general layout, each housing area can be built as conditions demand and will require only such minor changes in the areas as may be dictated at the time they are built.

After a careful study of the operating organization required for the plant which is being constructed, it was decided that two hundred and seventy houses would be sufficient; two hundred for workmen, fifty for foremen and clerical men and twenty for superintendents and department heads.

A study and inspection was made of houses in the adjoining towns and opinions were obtained from the owners regarding the types of construction best suited to this climate. Many favoured filling the walls and above the ceiling with sawdust. Others were very much opposed to this as being unsatisfactory and affording a place for the collection of vermin, rats, etc.

It was finally decided to build frame houses one and one-half and two stories in height, with full concrete basement. One hundred of these are typical Quebec houses with the flared eaves and with one large room across one-half of the house serving as a living room, dining room and kitchen. The remainder have different styles of roofs so as to provide variation in the appearance of the houses.

Of these houses,	143	have floor dimensions	20 x 26 feet
	80	" " "	24 x 24 "
	12	" " "	26 x 26 "
	24	" " "	$24\frac{1}{3}$ x $27\frac{1}{3}$ "

while the floor dimensions of the balance of the superintendents' houses vary.

There are	18	houses with	4 rooms
	8	" "	5 "
	204	" "	6 "
	41	" "	7 "

The basement walls are ten inches thick at the top with a one-half-inch batter on the outside, making them fourteen inches thick at the bottom. The basement floors are three inches thick. The frame construction is siding on paper on sheathing on the outside of the framing and plaster board and plaster on the inside. Care has been taken to fill all cracks around the doors and windows.

First and second floors are double with building paper between. The roofs are sheathed and covered with paper and asbestos shingles. Eight-inch brick chimneys are built from the basement. Each house has a large front porch and small back porch.

Except in the case of twenty houses, the windows are nine and twelve light with the upper sash stationary. In twenty houses the lower sash is a single glass instead of six light. There are three basement sash in each basement. Each house will have storm windows and storm doors.

Each house has a bathroom with bath, toilet and lavatory, and in the kitchen a sink and drain board. Two hundred and fifty are to be heated by stoves, although there is a flue connection for a furnace in the basement, should it be found desirable to install a furnace at a later date.

The plumbing is placed either in the inside walls or inside the rooms. It has been the aim to purchase plumbing materials and fixtures which are substantial and which will require a minimum of repair and maintenance.

The workmen's houses have two drop lights in the living room and one in each of the other rooms, the front porch and the basement. Water and light service will be metered. The interior trim is stained a medium dark fumed oak and the floors are sanded and filled. The walls are left white, and will be painted later as occasion demands.

The lumber for these houses is B. C. fir and Western red cedar siding. Four and one-half million feet (230 carloads) were brought around in one boat. The doors also are of B. C. fir, but the windows are of white pine and were made in Ontario. The best parafined paper is used in the walls and floors, which is expected to give much better service than the usual building paper.

Both straight and diagonal asbestos shingles are used on the roofs. They vary in colour, but there is only one colour of shingle on each roof.

The painting schedule has been carefully worked out but will be revised in light of the experience in the first two blocks that have been painted. It will only be possible to prime most of the houses this year as it is too late for finished painting.

There is the town—on paper—and that is exactly where it was on June fifteenth, at which date there were only the floor plans for four of the thirty types of houses to be built. It can be imagined how hard the draftsmen have had to work in order to get out plans ahead of the workmen. It will be said that such plans should have been drawn during the winter so that they should have been ready for the spring. They were, but those plans were all discarded—and rightly so—around the middle of May and the new designs were much more acceptable.

Having selected the types of houses to be constructed it was necessary to select a site for them. The section chosen for development this year is located in open land forming two benches of about twenty feet difference in elevation and bounded on the east and west sides by deep ravines which form natural drainage for storm water and acceptable locations for the sanitary sewer mains.

For the most part the soil is a twelve to fifteen-inch layer of loam over a very fine blue clay or rock dust. There are two small outcrops of rock but these have not materially interfered with the work this year.

The first basement excavations were started on June fifteenth with two Insley excavators. The soil was found to be saturated and the water soon filled the excavations. Accordingly work was immediately started on laying the sanitary sewers and it has been possible to keep them ahead of the excavations except in the first two blocks. This has greatly aided in draining the sections as the work progressed. Later a Keystone shovel was added and all except four of the basements have been excavated by these machines. Two hundred and seventy basements, containing about thirty-seven thousand six hundred cubic yards, were excavated in one hundred and thirty-six shovel days, during part of which time the shovels worked at night.

Prior to June first built-up forms for each type of house were prepared at the planing mill and as the dimensions of the basements were not changed they were available for use. Altogether seventeen sets of these forms were built and this number has been sufficient for the work. Several sets of forms were built for each type of house and these were stripped and moved forward as rapidly as possible as the work progressed.

Simultaneously with the starting of excavating gangs were organized for form erection and pouring concrete. The first difficulty arose when materials could not be delivered to the job fast enough. The ground was so soft that teams could hardly pull an empty wagon. One five-ton Holt tractor was on the work and another was immediately purchased. Heavy sleds were built and practically all of the materials have been delivered on sleds hauled by tractor. In addition, it was also necessary to build a railroad siding into each section, affording a closer delivery of materials to the tractors, and these tracks have been so placed that the concrete mixers could be set alongside and the sand, rock and cement delivered right at the mixers. This saved handling immense quantities of these materials, and it was not difficult or expensive to pour the concrete by using buggies and movable runways. These sidings were built down the centre of proposed streets so the ballast would later be available for street use.

As soon as the forms were stripped from the first foundations the framing crews commenced work. At the planing mill, a crew of six men and a swing saw cut all of the framing for these houses. The length of each piece was marked thereon. A bill of material showed the number of each length for each type of house and only the required number were delivered at each house. These fitted so nicely that house after house was put up without a saw being used on the framing. This greatly increased the speed of erection and reduced the lumber waste to small blocks seldom more than six inches long.

As soon as the frames were started, the sheathing gangs were organized and followed the framing crews. The plumbing and chimney contractors started at the same time. These were followed by the plaster gang, which was augmented on rainy days by men from the framing crews. In the meantime, the roofing, siding and exterior finishing crews had started and the plasterers followed as soon as the roof was covered, (sometimes before). Aluminum flashing and ridge roll were used throughout. A week after the plasterers had finished the interior trim gang took possession, to be followed by the flooring crew, the men installing the plumbing fixtures, and the painters finishing the woodwork. Meanwhile grading had been done around the houses and the exterior painted so that they were all ready for occupancy.

Of course, it does not go as smoothly as it sounds. First the plumbers would get behind, and it would take a week or two to get them back to the scheduled rate. Then the plasterers were held up because the roofers were not working fast enough. If one group slows down it invariably affects the whole job, so that it is necessary to keep pushing all the time, for, after all, *time* is the principal factor in any construction work in this climate.

That finished the houses, but it does not bring water to the basement connection, give protection in case of fire, provide for sewage disposal, make the lights shine at the turn of a switch, permit calling central by lifting a receiver, or keep people out of the mud when going about.

Provision still has to be made for streets, schools, churches, a passenger station, freight station, post office, banks, grocery and meat stores, merchandise and furniture stores, barber shop, drug store, pool hall, bowling alley, movies, dance hall, gas stations and innumerable other accommodations which are needed daily and which in most places have been supplied in the general development of the town and are consequently accepted without any thought on the part of the user. These are expected to be immediately available by the occupants of houses in a new industrial town and are being provided at Arvida as quickly as possible.

Because of the late start, it is probable that all the houses will not be completed before December first, but at least two hundred and fifty of them will be completed by November first. That will mean two hundred and fifty completed in one hundred and thirty-five days or two hundred and seventy in one hundred and sixty-five days, making no allowance for bad weather.

In the house construction, there will be used about seventy-five thousand bags of cement; four thousand eight hundred barrels of lime; six thousand yards of sand; twelve thousand yards of gravel; two million four hundred thousand feet of framing; one million six hundred thousand feet of sheathing; three hundred and sixty-three thousand feet of flooring; two thousand seven hundred and fifty squares of shingles; nine thousand two hundred and fifty squares of paper; four thousand one hundred and fifty windows; eight hundred and fifty basement sash; five thousand same for storm windows, doors and sash; one thousand and ninety-six sinks, tubs, lavatories, toilets; one million one hundred and sixteen thousand square feet of plaster board, and one thousand six hundred kegs of nails.

When fully organized, six basements were excavated per day,—two with each shovel. An average of four basements were poured per day over the entire period, but six per day were poured under favourable conditions. Eight basement floors are now being poured per day. The rate of chimney construction by contract was six per day and plumbing four per day. Shingles are put on five houses per day. There was an average of two hundred and fifty men in June; seven hundred in July; and eight hundred in August and September.

As in all work, labour was the governing feature. Very good progress was made with the water and sewer line construction, and the work was not held up by the form erectors, the concrete men or the frame erectors. Trouble was experienced in getting enough good inside and outside finishers; men who knew their work and would do good work.

The workmen's houses will be heated by stoves. The others by hot water. The walls and second floor ceilings of some houses will be filled or covered with sawdust, others will have Insulex for additional insulation. The heating of the houses will be studied this winter in order to find out whether the houses, without additional insulation, are too cold. They are, however, built better than the houses in that section, and it is believed they will prove to be warmer.

There has been some criticism to the effect that they are too small for the ordinary French-Canadian family. That may be true if you think only of the old French-Canadian with twelve to twenty children, but it is not expected that there will be many of those, as the work appeals more to the younger man who has only four or five children. As conditions require larger houses, they will be built, but we do want as much as possible to keep away from having two and three families in one house.

The streets are fifty feet, sixty feet, eighty feet and one hundred and six feet between lot lines. On the narrower streets the houses are set back not less than twenty-five feet. This makes a wide street, along both sides of which walks will be laid and trees planted. The only poles on the street will be for street lights. Light and telephone lines will all run down the rear of the lots in the centre of each block, and entrance will be at the back of each house. This will reduce the wires and poles on the streets to a minimum.

The water mains are located on one side of the street between the curb and property line. A three-quarter inch tap supplies two houses. The three-quarter inch line extends from the main to within one foot of the property line, where it divides into one-half inch service lines for each house. A curb box and cut-off is placed on each house service just outside the property line. The three-quarter inch pipe is copper, but the service lines are one-half inch galvanized iron. The street mains in this section are six inches and eight inches, supplied by two twelve-inch mains at the east and west sides.

An Austin trenching machine excavated all water line trenches at a rate of about one thousand feet per day, and the trenches were backfilled by an Austin backfiller. The trenching machine and backfiller were also used in constructing the sewer system. Sewer pipe was laid as closely behind the trencher as possible and partly backfilled at once. At least eighty per cent of the trenches for sewer and water connections to the houses were excavated by the trenching machine.

The mechanical equipment for the job consisted of two Holt tractors; three Insley excavating machines, equipped with ditcher, skimmer and crane attachments; three Austin backfillers, (one of which assisted greatly by handling twelve-inch to eighteen-inch water line pipe into the trenches; four one-half yard concrete mixers, electric-driven; a heavy street grader with the usual dump wagons, etc. These machines certainly aided in getting the work done speedily and economically.

There is the picture of the construction of the section of the city of Arvida, which has been carefully planned by men experienced in industrial housing with the hope that its inhabitants will enjoy every advantage from well-constructed houses, pleasant surroundings, sanitary, fire and police protection, social, educational and religious advantages. There have been no serious obstacles to overcome and no great engineering feats have been accomplished.

Underground Mapping of Oil, Gas and Water Horizons

Procedure Followed, Information Secured and Interpretation of this Information with Particular Reference to Operation in the Turner Valley Oil Field

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Paper read before The Calgary Branch of The Engineering Institute of Canada, February 18th, 1926

The correlation of underground rocks is at all times an interesting process, and this is particularly true during the early stages of development in an oil field. For the purpose of introducing this paper it is the intention to describe in some detail the various rocks encountered in Turner valley, and it is hoped that the description of the rocks of Turner valley will lead to a better understanding of the fundamental principles governing the production of oil and gas. In this way the interests of the legitimate operator will be furthered and the oil industry, as such, will benefit by the knowledge gained from the study of underground formations.

While this paper has some reference to geology, as such, yet in the main it is an engineering problem that faces us in underground mapping.

Securing Samples

In order that the basis of the work may be outlined in a clear manner, the methods by which information is secured will be reviewed. When a well is commenced, the drillers proceed to drill a hole into the ground, and, as each four or five feet is drilled with cable tools, it is necessary to remove, with a bailer, the mud from the bottom of the hole. In this mud are small portions of the formation that have been pounded up. The drillers have this mud washed out and the cuttings washed clean. These are then dried and placed in small bags provided for the purpose and a tag is then tied to the bag giving the number of the well and the depth at which the sample was secured.

The tools keep going down, and as each ten feet is drilled a sample is collected and placed in a bag. The samples from all wells drilled with cable tools are obtained in this manner.

Diamond drills furnish us with cores of the formation penetrated. Actually 2-inch cores are secured, and these are placed in long boxes, and are carefully labelled and later examined.

Wells drilled with the rotary have a different system. The circulating mud carries out with it cuttings from the bottom of the hole. These cuttings are collected at frequent intervals and placed in bags. In addition, it is the practice to take cores at all important points, so that an actual sample of the formation of any particular depth is secured. These cores are placed in suitable boxes, labelled and forwarded for examination.

Examination of Samples

Samples are arranged in order and are carefully examined both with the naked eye and microscopically. In addition, all samples are tested for their particular chemical composition. This is a matter that requires special training and special equipment, and is a long, tedious task.

The question is often asked—What do you see in a sample? In answer to this question, it is intended to outline briefly what has been found in the work of examining samples during the past eight months and further, so as to give some idea of the value to be attached to such information.

In the first place, examination determines just what the sample consists of, whether shale, sandstone, limestone or a mixture of all three or any two.

This examination may bring out the fact that a sample is wholly a sandstone. Sandstones have voids or spaces between the grains, and as such these beds may then contain gas, oil or water. Limestones, also, may have crevices or pore spaces, and so may contain oil, gas or water, as these limestones are usually formed from the remains of animal life, and this animal life provides us with a probable source of oil and gas. Shales are muds pressed together, and in many shallow seas there is abundant animal and plant life which may form oil.

From an examination, it may be concluded that a sample contains a shale with, say, 10 per cent sand or a sandstone with 20 per cent lime content.

The next step is to determine the colour, since in this country there are blue, green, light grey, red and brown and black shales, and there is a history connected with each colour.

Further, a search is made for evidence of marine life, whether animal or plant remains. This is important so that the age of the rocks may be determined accurately, as the ages of our various sedimentary rocks are determined from the plant and animal life.

In October, 1924, at a depth of 3,740 feet, Royalite No. 4 was *brought in* by the Royalite Oil Company, and production was secured which, in 1925, amounted to approximately 160,000 barrels 73° Be., along with some 18,000,000 cubic feet of gas per day. Just what is the significance of this well?

Rock Formation in Turner Valley

Starting at the top of a hypothetical well, drilled in Turner valley, here is what is found from the samples.

Drilling commenced in a blue black shale. This shale is called Benton shale, being upper cretaceous in age. The Benton shale does not produce any quantities of oil in Turner valley, the main reason being that probably the lack of a suitable porous horizon in which oil or gas might collect, and a second reason being that the Benton rocks are well exposed and oil or gas would have a chance to escape. The Benton contains sand lenses near its base, and these lenses contain small amounts of oil and gas.

It is a matter of importance in oil geology to be able to secure a proper seal of any oil-bearing strata, and this is the main purpose served by the Benton shale in western Canada, which acts as a blanket over the lower producing oil and gas horizons.

The Benton shales are some 2,000 feet thick, and are unmistakeable in appearance. Below these shales we find a light green, grey and maroon shale. This shale, which is called the Dakota and is of the Upper Cretaceous age, is bright green or light chocolate when wet and dries out to a light green or dark red.

Interbedded with the shales are numerous sandstone beds which are porous and which in Turner valley contain oil and gas. These sandstones are lenticular, and because of this the production varies from well to well and the sands found in one well may be absent in another, and so the oil varies in gravity, depending upon where it is found in the sand lense.

The thickness of the Dakota beds is from 500 to 660 feet in Turner valley. Further west these beds are no doubt very much thicker, and they contain a conglomeratic sandstone which has formed many of our foothill ridges running from Bow river south to the Crowsnest.

Below these light green and red shales we find a coal-bearing formation which has been named Kootenay. The coal seams at the top of this formation have been found in as widely-separated areas as Turner valley, Medicine Hat and Wainwright.

Below the coal seams are found deep red, dark green, and interbedded green, chocolate and deep purple shales. The Kootenay formation contains certain markers which have been called the Red Beds. The colouring is very distinct. This formation, also, contains sand near its base, and the sand is light greyish-green in colour with dark specks in it. Some call this sand a pepper and salt sand, as it very much resembles a mixture of pepper and salt. White quartz being the salt and black chert being the pepper. Several wells in Turner valley have secured both oil and gas from the Kootenay sands. The Kootenay formation is from 300 to 450 feet thick.

Below the Kootenay sandstones are to be found a black slatey shale with pyrites and near the base hard brown sandstones. This shale is called Fernie shale of Jurassic age, and is 90 to 110 feet thick.

Gradually our well is getting deeper, and more interesting as we go. A new formation is entered after we have passed through the Fernie shales, which is now called the Calcareous shales, and it properly belongs with the underlying Triassic formation.

The shales are black in colour, having very frequent bands of brown limey sandstone, and become more calcareous until finally, after penetrating about 450 feet of these shales, we secure hard dolomitic limestone. This limestone has more content and more pore space due to increasing $MgCO_3$ as we drill deeper into it. Royalite No. 4 went into it 300 feet, and it has been fittingly named the Royalite Dolomite. Dr. Hopkins, of the Imperial Oil Company, has, in the writer's opinion, correctly placed this limestone as Triassic dolomite.

It will now be easy to review the formation, starting at the productive horizon and coming back to the surface.

300	feet	Royalite Dolomite
450	"	Calcareous shales
110	"	Fernie shales
400	"	Kootenay
600	"	Dakota
2,000	"	Benton

Actually, Royalite No. 4 had 1,900 feet of Benton, 100 feet being eroded, so that the depth of the well would be 3,740 feet. I am going to spend a few moments in order to outline the results secured from a series of wells in Turner valley; assume that there are seven wells, and each secures the Dakota shales at the following depths, 1,600, 1,700, 1,600, 1,800, 2,400, 2,800, 3,000 feet. Some are high and some are low, and the result is that the surface of a hill or hump underground has been outlined, and in the hump there can be looked for, at the top, oil below the gas, and water below the oil.

The information secured is then used to set casing where it will be of the greatest use. It is important that water should not flow into an oil sand, or a high-pressure oil or gas into a low-pressure horizon, and this result is secured by setting casing and cementing it into the proper formations.

Again, water in a well makes drilling difficult in the Benton shales, and all surface water is shut off at the top of the hole so that it will not impede the progress of drilling by causing the hole to cave. As gas or oil is drawn from any area, water follows it up the structure, so that all oil and gas fields gradually come to an end. By careful mapping, new wells can be located on areas where the maximum production can be secured without the well going to water.

There is in Turner valley, and other foothill folds, the question of thrust faults and small folds. Turner valley is believed to be a faulted structure, and this faulting sometimes brings the productive formations nearer the surface. At other times it makes a well repeat whole formations, and consequently it is a failure.

By carefully examining samples and cores, it is possible to determine just what is happening in any well, and by this means the operators may be saved considerable expense and effort.

There is very considerable excitement over oil and gas in Calgary today, and it is of interest to note that from the above description it will be apparent that wells which start in the Benton shales have approximately 4,000 feet to go before reaching the Royalite Dolomite. Now, above the Benton shales is the Belly river sandstone, which is from 1,300 to 1,800 feet thick. This added to the 4,000 feet mentioned above gives a well from 5,300 to 5,800 feet deep, if it is begun at the top of the Belly river standstone.

While what is believed to be the normal thickness of the strata in Turner valley has been given above, it is very important to note that if the beds are tilted to an angle of 45° you are adding roughly two-fifths of their thickness to these formations, and a vertical hole will then have to be 5,600 feet deep in order to reach to the Royalite Dolomite productive horizon.

The following figures as to the cost of drilling wells in the foothills will be of interest. A well 4,000 feet deep costs from $120,000 to $150,000; a well 5,000 feet deep from $150,000 to $180,000; and a well over 5,000 feet requires in the neighbourhood of $200,000.

What is wanted in the oil industry is development, but it must be sane development, which, to the writer, means:—

1. A structure where the age of the rocks is such that oil may have been produced in the past and where now the oil and gas may be imprisoned in a porous horizon.

2. A location where a well may penetrate the rocks containing oil at a depth not exceeding 6,000 feet.

3. A first-class board of directors who know enough to employ good men, buy good materials and tools and let them alone to carry out the work the drillers are engaged to do.

4. Sufficient cash in the bank, or arranged for, before drilling starts to complete the project.

Information published recently shows that Royalite No. 4 produced approximately 20,000 barrels of crude naphtha during January 1926. However, 2,000 barrels of this was produced in December 1925.

Suppose that this crude is worth, on a gravity calculation, $6.00 a barrel, this represents $120,000 revenue in one month, or at $4.00 a barrel it is $80,000 in the month of January. This does not include the gas sales.

You may look at these figures and say to yourself, Wonderful! but consider the question of how many failures did the Imperial Oil Company have before they secured Royalite No. 4, and, again, how much money did they spend to just handle its production?

Those who first worked in Turner valley, Wm. Pearce, A. E. Cross, W. S. Herron, A. W. Dingman and others, and the Imperial Oil Company, have discovered a great possibility, but it is not yet a proven oil field. The extent is not known, and many failures may be expected.

Development is wanted in this country, but every well drilled is a gamble, and a big gamble, and there is no room in this country for the promoter who has the "get rich quick" fever.

Should it be desired to gamble in oil stocks, it will help the industry if the fullest possible information is secured by all concerned before stock is purchased. There are many good structures to test without wasting money on areas where there is not a chance of securing oil.

When considering the oilfields of the world, it is well to remember that, while there are countries producing six to seven million barrels a year, from ten to twenty oil pools, where the oil pools are each less than one hundred acres in extent, Signal Hill is about 1,000 acres in extent.

This paper but introduces the whole subject, and as yet it has not been possible to make an underground map of Turner valley.

Much valuable information has been accumulated with the assistance of oil operators in Turner valley, and by co-operating in the matter of supplying information it will help to create a new industry in Alberta, but a boom is not desirable at the present time.

Problems of Engineering Education

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Paper read before the Vancouver Branch of The Engineering Institute of Canada, October 6th, 1926

It has fallen to my lot to endeavour to set forth some of the most obvious problems which are confronting the profession of engineering in general and engineering educators in particular.

This is an engineering age, and yet there are people (among them practising engineers) who question the wisdom of expending funds for the training of more engineers. Many educators, observing the fact that over two-thirds of those who enter engineering courses fail to complete them, are earnestly seeking means of reducing this terrible academic mortality; and others are studying possible changes in curricula and in methods of instruction to determine whether or not engineering education can be made more efficient. Professional engineers are raising the question of the teaching personnel of colleges, and teachers and practising engineers alike are endeavouring to find means of establishing a closer co-ordination between the entire field of engineering education and practice, and successful citizenship.

It has been said that the more liberal courses in Arts and Science teach men " How to live "; while the more specialized courses in Applied Science and Engineering merely teach " How to earn a living." When one considers the services which engineers have rendered to civilization during the past half century alone, one is likely to doubt the truth of the statement that engineers have learned only the art of earning a living.

We are hardly inclined to be carried away by the rhetoric even of Mr. H. G. Wells when he calmly consigns universities to the scrap heaps of the future. Self-made business men there undoubtedly are; self-made journalists and novelists, one is led to suspect; but self-made engineers are as rare as genius itself. We are repeatedly confronted with the statement that the engineer is either unwilling or unable to take his proper place in the community, and that part at least of this is due to the fact that his narrow engineering curriculum provides insufficient training in the so-called humanities and classics. May we not seek the proof of the pudding in the eating, or perhaps in the digesting?

It is over twenty-five years since I began my intimate acquaintanceship with colleges and college men. Over one-half of that time I have been actively engaged in teaching within university walls; yet I am not at all convinced that the average engineer falls below the average medical man, lawyer, business man or politician in the unfoldment and practical daily demonstration of a sound philosophy of life; nor has the participation in many hundred faculty meetings, conferences and committee meetings with my colleagues of the liberal faculties led me to believe that doctors of philosophy are less prone to be childish, unreasonable and selfish than are their less fortunate brothers who have merely been trained to do things instead of talk about them.

In some manner or other engineers as a class seem to have learned something of the art of doing a great deal of hard work honestly and effectively without interfering in the affairs of other men. It may be that this lack of interference is due to a disinclination to act parts that have not been assigned; or it may be simply a matter of indifference. In either case, the complexities of modern civilization may, in the cause of good citizenship, demand that the engineer exhibit a more active interest in community affairs.

It is not the province of this address to draw comparisons in favour of the engineer; but rather to discuss whether or not he is playing as creditably as he can the part he should play in the life of the community, the nation and humanity. Correct answers to this question deeply concern the engineering student, his instructor, the practising engineer and the public in general.

The Society for the Promotion of Engineering Education has recently undertaken a most important educational research in its effort to make a study of the objects of engineering education and the fitness of the present day curricula. To indicate the exhaustive nature of this effort, I will quote from the January 1925 issue of " The Journal of Engineering Education." A mere enumeration of the specific objectives of the investigation will make its scope and importance clear. They have been outlined as follows:—

I. To clarify the educational functions and responsibilities of the colleges of engineering.

II. To establish guiding principles for the content and arrangement of curricula and the improvement of teaching.

III. To consider in what ways problems relating to engineering students, graduates and teachers may be dealt with more effectively.

IV. To examine the practicability and possible benefits of closer group relationship among the colleges and with the professional organizations of engineers.

V. To make an analytical comparison of the organization and practice of engineering education in Europe and America.

Each of these main topics has been subdivided as follows:—

I. (a) To determine to what extent the programme of engineering education serves *collegiate* type of training employing science and technology as its principal media; and to what extent it provides a *professional* type of training comparable with that in medicine.

(b) To indicate how engineering curricula may be coordinated more effectively with the needs of industry and the requirements of engineering practice.

It is the desire to determine how adjustment between the need for specific training on the one hand and for broad training on the other may be effected so as to provide to a reasonable degree for the immediate demands upon graduates in their earlier positions, and at the same time to provide the foundation for advancement to broader duties in the industrial and professional world and in public life.

(c) To determine whether or not it may be desirable and practicable to vary the extent of training in engineering to accord with:

(1) the capacities of students, and

(2) the requirements and opportunities of industry.

(d) To determine what responsibilities the colleges should assume for the further training of graduates.

To ascertain the needs of graduates for more extended training and to determine how the responsibility for such training may best be shared by the colleges and the industries.

II. (a) To formulate criteria for selection of the content of the scientific, technological, economic and cultural subjects of instruction, and for the proportioning of these major divisions of curricula.

(b) To promote more effective articulation of instruction in the various subjects which make up an engineering curriculum.

There is much evidence of the need for more effective co-operation in teaching groups of closely related subjects, such as mathematics, physics and mechanics, and the necessity for more direct and valid articulation of instruction in mathematics, economics and the physical sciences with that in technological subjects.

(c) To indicate means of more valid correlation of instruction in engineering with the technical and economic problems of engineering practice and to indicate how such problems may be used as means of teaching fundamental principles inductively.

(d) To ascertain directions which may be taken to improve methods of teaching in engineering colleges and to encourage study and experimentation in those directions.

III. (a) To determine what steps may be taken to insure the entrance of properly qualified students.

To consider how the entrance requirements of engineering colleges and the programme of secondary schools may be mutually adjusted; to consider what selective processes of a non-scholastic type may be used as a valid supplement to a scholastic requirement for admission; and to consider what information concerning an engineering career should be provided and what guidance given, both before and after admission, in the choice of educational programmes.

(b) To determine what measures may be taken to deal more effectively with the problem of eliminations.

To learn at what periods and for what reasons students are eliminated or withdrawn from college; to ascertain the fundamental causes of failures; and to determine how cases of impending failure may best be dealt with.

(c) To ascertain the methods which may best be used by the colleges to facilitate the obtaining of suitable employment by their graduates and to promote their further development.

To canvass the economic demand for engineering graduates through the co-operation of the industries and professional organizations; to ascertain the types of positions and fields of work which graduates are required to fill; and to consider what records, supplementary to the usual scholastic record, are best designed to facilitate the employment of graduates.

(d) To indicate how methods of recruiting and developing engineering teaching staffs may be improved.

To learn from what sources teachers of junior and senior rank are being drawn or may be drawn; to learn what methods are being used to develop younger teachers and how such methods may be made more effective; to determine how adequate contacts of teachers with industry and practice may be afforded; and to examine into the mutual responsibilities of the colleges, the industries and the profession for the development and maintenance of teaching staffs of high order.

IV. (a) To indicate the extent to which further development of group action by engineering colleges is desirable, and to point out how such action may be effected.

(b) To determine how the engineering colleges and the professional organizations of engineers may effect a closer association for the mutual benefit of engineering education and the profession of engineering.

V. (a) To compare the positions occupied by the engineering colleges in the educational systems of Europe and America.

(b) To compare the educational practices of the several groups of institutions relative to admission standards, teaching and examination methods, curricula, the development and status of teachers and the like.

(c) To compare the relations of the several groups of institutions to the industrial life, the governmental and public services, and the professional organizations of engineers of their respective countries.

Under the various headings outlined above, the investigation is being carried out along the following lines or successive steps:—

1. Collection of facts and data.
2. Analysis and classification of facts.
3. Interpretation of the evidence.
4. Experimentation where desirable.
5. Summaries and reports.

It is expected that there will be periods of study and discussion by faculty committees and in faculty meetings, from which conclusions should be reached and plans for action formulated. As the plans are put into effect, their results should be observed. It is not the aim to bring the project to a definite stage of conclusion, but rather to prepare the way for a continuing process of educational enquiry and adjustment, and to develop within the Society's organization the means of making the co-operation of the colleges in this process effective. Wm. E. Wickenden is Director of the Investigation.

I have extracted somewhat at length from the statement of objectives and outline of procedure of the committee because it furnishes a fairly complete idea of the problems which confront engineering educators and also because the committee has already collected such a large amount of data that we may with profit proceed to analyze and interpret it.

In any attempt to compare Canadian and American universities with those in Europe, we must bear in mind the vast distances which affect every western problem. Students entering our universities are drawn from geographical areas having median lines averaging between one and two hundred miles from the university. In Europe the institutions are closer together, and each great university has in time built up its reputation around a particular type of training or scientific research or culture. On this continent there has been a tendency to endeavour to found universities which would embody all these features within the boundaries of a single institution, this attempt being imitated by each new university in turn. The effort to bring to each locality as many advantages as possible, in spite of isolating distances, contributed to this attitude of imitation until prescribed curricula are so similar in general that our scholastic accountants, the registrars, the czars who sit in final judgment upon all phases of collegiate proficiency, have the effrontery to propose a complete standardization of courses. One can hardly conceive of a more deadly foe to educational progress.

It has been stated quite freely in university circles that the type of students attracted to engineering would be found on the average of lower intellectual standing and intelligence than the average student in the faculty of arts. This remained a mere matter of opinion until the rather general use of intelligence tests brought out the fact that not merely the engineering student but also the practising engineer was rated higher than any other group by these tests. Excuses have been made that the tests were more suited to the engineering type of mind; but it must be remembered that it was the educational psychologists, and not the engineers, who evolved them.

This statement that the engineering student is at least on a par with students in more liberal courses takes on still further significance when it is considered side by side with the fact that over 95 per cent of engineering students are native-born, with 74 per cent native-born parents and over 60 per cent native-born grandparents. I am using the term native-born to apply jointly to the United States and Canada. Ninety-one per cent of the grandparents were either native-born or came from the northwestern part of Europe. This appears to show good stock.

A study of the high school records of about 4,000 students disclosed the fact that 18 per cent were honour students, 42.6 per cent were classed in the upper third of their group, 36.8 per cent were in the middle third, while only 2.6 per cent came from the lowest third. Over two-thirds of these students did well in chemistry, physics, mathematics and other science, while less than ten per cent were poor in history and English, and about twenty per cent were poor in modern languages. Place these facts alongside of the fact that not one-third of the students entering engineering courses manage to graduate without losing one or more years, and barely forty per cent graduate at all, and you have another of the problems facing engineering educators. It might be urged that engineering courses are too severe; but no one has ever complained that engineering graduates are too well prepared, or that they are more than equal in their training to the engineering graduates of European colleges. In fact, it is stated that the Europeans are superiors, but this is once more a matter of opinion only, and the records of engineers on both continents do not appear to indicate a serious discrepancy in the ability of western men.

But if the engineering schools are drawing from the cream of high school graduates, why is it that a careful analysis of the causes of scholastic failure among students in engineering indicates that practically seventy per cent fail through poor preparation, lack of ability and lack of interest; while only 1.8 per cent fail through the much-berated over-participation in undergraduate activities? This raises the question of accredited high schools, entrance examinations, intelligence tests and other methods of determining the fitness of applicants for entrance to engineering schools. It seems unfair that 60 per cent of those who chose engineering as their life work should be turned back into the community with failure stamped across their collegiate records, while another 10 per cent graduate with minimum requirements.

An analysis of the motives leading to the choice of engineering courses indicates that only 28.6 per cent felt a definite appeal in engineering. Only 13.6 per cent made the choice on the basis of advice. It appears that well over one-half of the students have little or no conception of the field of engineering, though a majority make this most vital decision before reaching the last year of high school. One may be pardoned for wondering whether instruction in science and mathematics, in which these students were proficient, is really basic in preparing a man to become an engineer.

The average high school student is active and is interested in doing things. Indifferent though he may be in the class room, he will show plenty of interest and will work long hours in fields where there are rewards which appear to him to be worth while. At this age he seems to be just as interested in life and in himself as a living being as he was interested in learning things when as a little child he first trudged to school and was squelched by a flood of numbers and names and rules. Why is it that the child of six is such a bundle of questions and interests in everything that it is almost impossible to supply him adequately with answers and activities, yet a few years of our school system leave him apathetic and indifferent to instruction? Why is it that twelve years of instruction in mathematics still leave the average student uncertain in addition, multiplication, subtraction and division? The entire school system is in effect a preparation for entrance to colleges or universities, yet a group drawn from what are admittedly the best students is only 30 per cent efficient in passing the requirements of an engineering course.

One need not be timid in suggesting that changes are needed somewhere. Educators who are familiar with freshmen students point out that their mental grasp is practically limited to passages in the text books they study, and that they are utterly unable to read books and grasp them as a whole. Instructors in engineering find a similar difficulty regarding their training in sciences and mathematics. The student is simply stuffed with undigested, unrelated ideas and information. Is this not the necessary outcome of a system of teaching which in defiance of every rule of nature proceeds from the unrelated and abstract to the related and concrete?

It is well known that nearly any child in good health, if deprived of ordinary schooling until ten or twelve years of age, will in about two years equal in scholastic ability children of the same age who have been constantly in school. Why, in the face of all that a child of twelve should know and has never heard of, should he be forced to spend six years obtaining what he can obtain easily in two? In spite of the fact that there are still psychologists who maintain that training in one field does not carry over into other fields of knowledge, one is forced to admit that Asiatics whose scholastic preparation can hardly be said to parallel ours, are able to compete favourably with our own students in our universities and learn our language into the bargain. It would seem that the qualities which make for scholastic success exist in spite of, rather than because of, the preparation the student receives.

In those years when the child's body is growing; when the emotional and social nature is unfolding; when it is thirsty for information; can easily learn languages and yet despises grammar; when it has not yet begun to reason about things, but accepts them at their face value; why should it not be engaged in studying nature and the habits of living things, including human beings? Every educationalist admits that it is necessary to have a background of experience before it is possible to draw abstract principles from that experience; yet most of them reverse the process when they begin to teach and give the abstractions before they lay the basis in experience.

We talk glibly about providing the fundamentals of a branch of knowledge, but how many have stopped to consider whether or not the fundamental is necessarily the foundation? These two terms are used as if they were synonymous, and they are not synonymous at all. The fundamental idea of a tree is not the root. The fundamental idea of a building is not the foundation; but in each case the fundamental idea does determine the superstructure. If your fundamental idea of a building is limited to warehouses and elevators, you will hardly be able to design a modern hotel, yet the foundation and the structural materials might be the same in each instance. It is doubtless true that mathematics and the sciences are the fundamental bases of all engineering, but the foundation for engineering activity lies in an appreciation of the purposes and needs of the human race, not in the pursuit of abstract knowledge.

Where in all the years of pre-collegiate instruction has there been opportunity to bring the student into an appreciation of nature and of human beings? If it were not for the games that school children are granted as a concession to health, the ordinary curricula would leave them almost totally ignorant of their own natures and the world in which they are expected to be good citizens.

Of course, you will point to the courses in civics or history or geography, and say that here the student is taught about the life and places of abode of his fellowmen, but all that he obtains is superficial and lifeless when compared with what he might learn of the life and habits of men and animals by actual observation and even participation.

All children should know the basic principles which underlie successful gardening, but what course in botany ever supplies this knowledge? Everyone should be trained in the care of his body, but what course in biology ever prevented anyone from becoming a dyspeptic through ignorance of the laws of diet? Good citizens should know the laws of self-control, and the cause and cure of selfish, brutal quarrelling, but what course in history ever stopped a fight or prevented a theft? The training which they receive in mathematics and science only too often merely increases the skill with which they rob and betray their fellows.

All this may seem to be wandering from the subject which we are supposed to be discussing, but when we consider that the student in high school probably chooses his career in the field of engineering because that seems to offer the most intimate contact with his desire to fill a useful place in the world, and thereby merit the rewards offered to useful citizens, is it any wonder that he shrinks from a mere continuance of the apparently useless instruction he has been enduring, and turns to engineering as an opportune substitute? Thousands of students make engineering their choice as a profession or a vocation, not because of knowledge of the field, but because they feel that they may find in it a dignified and profitable outlet for the intelligence and strength they possess. They turn to it as an unvoiced protest against the abstract and narrow so-called liberal training they have received.

Having spent some time tearing the ordinary school curricula to pieces, we may now ask ourselves the question whether or not engineering curricula are similarly guilty.

Engineering curricula seem to be a compromise between academic abstractions and pure science on the one hand, and utilitarian applications on the other. In the early history of engineering instruction, the teachers of applied science were recruited almost entirely from the ranks of the pure scientists, and practically all text books were written by these recruits or by men who remained in the realm of pure science.

Engineering curricula took the form of a simple extension of the field of pure science to such applications as could be conveniently dealt with in the classroom or college laboratory. Contact with the outer world of engineering practice and with the difficulties which engineers met from day to day soon began to colour the methods of instruction and the content of courses by injecting the pragmatic influence of engineering practice; but the old fallacy remained. The instructors were thoroughly familiar with the fundamentals of science, and to them it was unbelievable that any progress in knowledge could be made before these fundamentals were established in the mind of the student, therefore all the mathematics, all the physics, and all the chemistry must be taught to the student before he be contaminated with the crude and vulgar applications which arise in engineering. As more and more it became necessary to draw upon the rank and file of engineers to satisfy the demand for engineering instructors, engineering instruction took on a more and more practical turn. Laboratory methods, instead of being merely demonstrations of previously expressed and intricate theory, became the means of training the student in engineering practice, and of research leading to improvement and discovery. The effort in regard to the student changed from merely acquainting him with that portion of science which it was expected might prove useful in his career as an engineer to an effort to train him before leaving college in the active, though elementary, practice of engineering. This inevitably opened the flood gates of engineering practice, and the courses of study became swollen with the details of engineering methods. A cry was raised for more time in the engineering laboratories and necessarily something had to be sacrificed.

Courses in languages, history, logic and economics were crowded out in order that the young engineer might be sufficiently trained in things as he would find them when he left college. It was plain that the engineer could not get along without a good grounding in mathematics and science, so anything that appeared as non-essential had to give way.

For a brief time, this modification of the course of study appeared to be satisfactory. Engineering instruction was becoming practical, and therefore it was thought to be better. Young engineering graduates were not so likely to be sent on foolish errands when they tackled their first jobs. The older men will all remember the days when the collegiate greenhorn was likely to be sent after left-handed monkey wrenches, sacks of ready-made hub holes, or sets of cast iron standard contours. But in thus extending his efforts to make the graduate engineer familiar with the details of engineering practice in his particular line, the engineering educator had created a Frankenstein which soon threatened to destroy him.

Engineering practice is constantly changing and the field of engineering is ever enlarging and its details multiply incessantly; until now the teacher of engineering has been obliged to call a halt. It is frankly impossible to do more than skim over the field which opens before the engineer in every branch, and our men are in danger of leaving college with a limited training in methods and without that essential basic training in fundamentals which alone can ensure their continued growth as engineers.

One answer to the problem has been suggested in the lengthening of the course to include five or even six years; but unless there goes with this a drastic change of purpose, it will be merely a postponement of real solution. Perhaps some light may enter our deliberations if we try to rise above the attitude of the passing generation in its slavish worship of the subject matter and the content of courses, and view the question from the standpoint of the student. Too little consideration has been given to him in the past. He has been treated simply as average raw material which must be in some manner forced through the educational mill in order that a standard product may be placed upon the market of the world's activities.

But the employers who had previously ridiculed the impractical theoretician are now complaining about the unimaginative automaton who is unable to rise to positions which make extreme demands upon men's higher creative faculties. Whereas he used to complain about the waste time spent in getting the young engineer fitted into the industrial machine, the employer now complains that the engineering graduate does not show sufficient likelihood of every occupying the driver's seat.

I have sufficient faith in the average young man to believe that he is just as well endowed with all the necessary faculties today as he ever was, and, if the product of our educational system is not what it should be, it is the system that is wrong. It may be a new idea to consider the student as the only true unit and end of education, but it is none the less a necessary one if we are to approach a solution of educational problems in general.

One of the reasons why the eleven or twelve years of preparation which a student receives before entering college do not prepare, is due to the fact that much of that time is spent in destroying his natural ability, nullifying his initiative and vigorously preventing him from thinking about anything except in unrelated fragments. More appreciation of the student's place in the educational scheme and less worship of subject matter would serve to remove this shameless outrage against all that is worth while in human destiny.

If the ordinary student can reach the high school entrance stage in two years (and there is ample evidence to show that this amount of time is sufficient), six of the previous years have been mostly wasted because this is practically all that has been accomplished.

Suppose that the child's interests had been extended instead of curtailed; that he had been given an opportunity to deal with the practical, understandable side of the world as it faces him on all sides; that the unfoldment of high ideals had been stimulated, not by precept but by exemplification in his daily relationship with his fellows in games, contests and in the active search for knowledge of the natural world; that instead of being classified and pigeonholed according to his deficiencies, he had been given freedom to unfold his abilities. Might he not come to the high school with his thirst for knowledge unquenched and still acute, and be ready for the more precise knowledge of science and the abstract mathematics and grammar because these subjects enable him to more thoroughly understand what he already partially knows? The foundation for an education does not lie in the abstract principles which learned men in all centuries have drawn from the fields of human experience, but in a realization of each man's relationship to his environment, his fellow-man and the universe.

To some who pride themselves on a coldly intellectual attitude towards these problems, this may sound like sentimentality, but the most damnable factor in human civilization to-day is the scientist who perjures himself and his calling by devising means of increasing human misery, torture and destruction. Too great a divorcement of science from the broader phases of human affairs leads to an apathy toward human suffering.

Unless man solves the problem of his relationship to his fellow-man in a manner naturally beneficial, civilization will once more destroy itself. In a similar manner, if we are to prevent our educational system from crashing through sheer top-heaviness, educational methods and the content of the curricula must not be divorced from an active interest in the growth and unfoldment of the inner powers and purposes of the student.

Many efforts are now being made to balance more carefully the instruction in engineering colleges. It has been recognized that it is unfair to ask a student to specialize too soon, so attempts have been made to make the first and sometimes the second years of applied science uniform for all branches of engineering.

It has also been evident that two years of abstract science give the student little or no intimation concerning the nature of the engineering course he expects to enter, and he often becomes aware of a mistaken choice only long after it seems too late to change that choice. Orientation courses and engineering problem courses have been introduced in many schools, partly to provide an opportunity for the student to choose his engineering branch more intelligently, and partly to correlate the instruction in mathematics, physics and engineering. Instead of waiting until the student is through a subject before giving him a necessity for its application, the student is plunged into the solution of engineering problems contemporaneously with the instruction in mathematics and science in order that he may feel the need of these branches of knowledge while he is taking them. Incidentally he may discover either a real aptitude, or a dislike, for engineering, and thereby hasten the time when he enters a more attractive field of action.

Another phase of these problem courses is definite training in the application of scientific methods to the solution of problems, as well as training in the mere mechanics of intelligible and accurate computations. In accordance with this effort to make engineering courses more effective in the training of young engineers, an engineering problem course has been established at the University of British Columbia. The students in the first year of applied science are engaged for two two-hour periods per week in the solution of engineering problems drawn from the fields of physics and mathematics, and special emphasis is laid upon individual work which must be brought up to a definite standard of excellence before it is acceptable.

In spite of initial resistance from the students who have not previously been required to tackle a problem before it has been fully explained, there is soon developed a splendid reaction to the situation, in which the best students actually resent an offer of assistance, and, at the other end of the scale of performance, the load imposed by the necessity for unaided effort brings to the mediocre or lazy student an early realization of his deficiencies. If he has grit, he really begins to work; if not, he is likely to drop out and take some more congenial course. In the second year of applied science at the University of British Columbia, this course is being continued as one three-hour period per week. The aims are the same, but much greater emphasis will be placed upon the use of higher mathematics. It is not expected that courses of this type will solve all our difficulties; but the experience of the past ten years indicates conclusively that this sort of instruction improves the work done by the students in the later years at college, and many students have testified that the training has played an important part in fitting them for their engineering activities.

Recognizing that the effort to satisfy the demands made by the employers of young graduates had led to the introduction of too great a preponderance of instruction in current engineering practice, to the exclusion of broader training, educators have been endeavouring recently to eliminate training which may be secured much more quickly and efficiently outside of college, and to introduce more courses in economics, business administration and law, as well as cultural subjects only remotely associated with engineering.

Naturally, this awakens much unthinking criticism. We often find the outside man who complains that the engineering course is too narrow, unfitting a man to play a major part in community affairs, objecting to the introduction of subjects which have a purely cultural significance. This contradictory attitude arises from the old fallacy of worshipping subject matter, instead of making the goal of educational effort the unfoldment of a thinking man within the student.

No course can give a man all the essentials of success, but any course has some effect upon his character, and may either stimulate or stultify faculties which he already possesses. Therefore an effort is being made to reach a reasonable balance between the three most important factors ruling the plan of education for an engineer; first, a foundation adequate to support the structure of life to be erected thereon; second, a superstructure of fundamental laws and basic facts essential to the chosen branch of engineering, and, third, sufficient technical training to make the structure livable.

The foundation can be laid and gradually perfected throughout the entire period of educational supervision, and must provide sufficient appreciation of the factors which determine the main currents of human affairs to enable the student to cope with the problems arising in his dealings with his fellows, be they his equals, his inferiors or his superiors. The ideals which alone make knowledge in this field safe and worth while should be stimulated by the teaching and exemplified in the environment of the child before he enters the high school; but at no time should they be allowed to sink so far into the background that he becomes unconscious of their presence. Such a foundation must open the mind of the student to a general recognition of the principal channels of civilization's activities, or else it will fall short of its goal.

In mathematics and the sciences lie those fundamental laws and principles without the application of which engineering works are impossible. The student must be made sufficiently conversant with those dealing with the branch of engineering he has chosen that he may rely upon them in the face of new difficulties, rather than upon memories of similar situations presented to him in his various text books. Without such knowledge and self-reliance, he will never leave the beaten paths of established practice and mediocre achievement. Training in mathematics and science may begin in the high school, but it must never be separated from wholesome applications and must continue throughout the entire period of university studies.

Specialized technical training in the elementary groundwork of engineering practice introduces the student to the more common activities in his chosen field and enables him to hold his own more comfortably during the period in which he is gaining experience and establishing a reputation. This valuable phase of his education must not be ignored, but it must not be allowed to grow into an effort to make the student proficient in the standard practice of all the various by-paths of his profession. Such effort belongs to the subsequent career of the individual, and can be made much more effective outside the college walls.

Although it is fairly easy to define an objective, it is not quite so easy to agree upon it, and it is hard indeed to agree upon the methods by which it is to be attained. Nevertheless, the widely-spread effort to define and solve engineering educational problems must bear some good fruit. Leading educators and leading engineers are lending their time and their training to the project, and are bringing together data from all angles. We may well hope that many splendid ideas will be brought forward and that vital suggestions will appear for the benefit of those who are constantly seeking to improve engineering education.

One phase of the investigation involves a comparison between European universities and those on this continent. It discloses an important difference. In Europe the great centres of research are in the universities, and it is to them that the industries look for new discoveries and progress; but in this country the major industries conduct their own researches, and equip themselves with vast laboratories for their own private gain. Here the keenest scientific minds are often drawn from the universities into the industries; but in Europe the very best talent which the industries produce is encouraged to enter the research laboratories of the universities.

This essential difference is further intensified by the fact that our western professional schools are actively and often fully engaged in giving undergraduate instruction to that great mass of students who are unfit for professional careers and should be receiving technical vocational training instead. These students graduate from high schools and continue their academic training for several years in higher institutions without any real desire to carry their studies beyond a glorified high school stage, and even if finally granted an engineering degree serve only to fill the ranks of routine employees. European universities make no attempt to teach this class of students, and direct them to intermediate schools specially designed to give technical and vocational training.

The foundational training for entrance to such schools should be similar to that outlined above as essential for professional careers; but the emphasis on the sciences and mathematics need not be so pronounced, and the training in the less technical branches of engineering practice should be carried far enough to provide a really efficient introduction to the more general and routine phases of engineering work.

Intermediate technical schools of this nature play practically no part in our educational system. The junior college is not a substitute; consequently the universities are carrying a heavy burden of extra high school instruction, with the inevitable result that the average teacher of engineering is reduced to the level of routine teaching, with little opportunity for advancing either his own or the world's store of knowledge. Not that teaching, as such, suffers by comparison with research; but no teacher can long remain a vital stimulus to his students if he has no time to extend his field of knowledge and engage in the invigorating search for new facts and laws.

An analysis of the teaching load in our universities shows that it is uniformly distributed among professors, instructors and assistants, both as to time and college years of students taught. Roughly speaking, the average requirement amounts to between forty-five and fifty-five hours of collegiate work per week throughout the teaching session. This varies somewhat with the faculty concerned and with the amount of committee and conference work assigned to the instructor. Comparisons are often misleading; but perhaps the fact that the average salary of teachers of engineering is only slightly over one-half that of practising engineers who graduated in the same years may throw some light on the fact that educational vocations are more often directed to remunerative ends than to the advancement of engineering knowledge.

A survey of the achievements of engineers encourages us to seek means of giving engineering students the very best preparation conceivable. Analysis of the collegiate records of successful engineers shows conclusively that they come as a body from the upper sections of their classes, and the odds are overwhelmingly in favour of the student with a high scholastic record. Our engineering graduates continue in engineering or closely allied work in very satisfying percentages, showing no more likelihood of changing than do individuals in any other walk of life, and, in spite of current opinion to the contrary, engineers are taking their share of the important tasks. Statistics show that over a long period of years engineering graduates are two-thirds of them occupying executive, administrative or directive positions.

Were it not for the fact that engineers and engineering educators take their work seriously, we might view the past with complacency and let the future take care of itself; but such is not the engineering temperament. It must improve that which it is doing, and we cannot be content while the possibility of progress stands knocking at the gates of our educational institutions.

Institute Committees for 1926

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To be appointed

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C. M. McKergow (two years)
Frederick B. Brown (one year)

HONOUR ROLL AND WAR TROPHIES

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THE

ENGINEERING JOURNAL

THE JOURNAL OF
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OF CANADA

VOLUME IX NOVEMBER 1926 No. 11

Aeronautical Research

The remarkable developments in aeronautics which have taken place during the last few years are strikingly illustrated by the work of the Aeronautical Research Committee in Great Britain, as shown by its reports.

The investigations of this committee, which works in close touch with the Society of British Aircraft Constructors, are carried out at the universities, at the National Physical Laboratory and at the Royal Aircraft Establishment, Farnborough, and are financed by the Air Ministry and the Department of Scientific and Industrial Research.

Among the problems recently dealt with may be mentioned: the stability and control of aeroplanes in stalled flight and at low speeds; the causes of various accidents arising from spins and dangerous vibrations of aeroplane wings; the investigation of novel wing sections; the theory of air-screws; the behaviour of seaplane floats at high speeds; the corrosion and durability of metal aeroplanes; the development of a satisfactory method for mooring airships to masts; detonation in high-compression internal combustion engines; the elasticity and fatigue of metals used in air-craft construction, and the development of new light alloys.

Very great interest has been aroused in two entirely new types of air-craft, namely, the "autogyro," a machine in which the ascending force is provided not by wings as in the normal design but by means of a large wind-mill rotating about a nearly vertical axis, and the Hill tailless light aeroplane, the performance of which is not inferior to that of the normal design of aeroplanes, while there are several inherent advantages in the tailless type.

The results achieved by the work of the Committee are paralleled by those of the American Advisory Committee for Aeronautics, and bear eloquent testimony to the great technical advance which results from a thoroughly organized programme of research, placed in the hands of properly trained engineers and investigators and provided with adequate financial backing.

Nominations for Officers' Ballot

Regulations

Not later than the seventh day of November, the secretary shall mail to each corporate member of *The Institute* the officers' ballot, as prepared by the nominating committee and the council.

Additional nominations for the officers' ballot signed by ten or more corporate members and accompanied by written acceptances of those nominated, if received by the secretary on or before the first day of December, shall be accepted by the council and shall be placed on the ballot. The words "Special Nomination" shall be printed conspicuously near such names, and the names of the members making such nominations shall be printed on some part of the ballot.

Notices shall be deemed to have been mailed to members as presented by the By-laws if such notices are printed in *The Journal* of *The Institute* and mailed by the dates prescribed in the By-laws.

Officers' Ballot

The following is a list of the nominees submitted by the Nominating Committee, and approved by Council at the meeting held on September thirtieth, nineteen twenty-six:—

PRESIDENT: A. R. Decary, M.E.I.C., Quebec.

VICE-PRESIDENTS: Zone a*—S. G. Porter, M.E.I.C., Calgary; Patrick Philip, M.E.I.C., Victoria; H. S. Carpenter, M.E.I.C., Regina; Wm. Smaill, M.E.I.C., Vancouver.

Zone c*—J. H. Hunter, M.E.I.C., Montreal; O. O. Lefebvre, M.E.I.C., Montreal.

COUNCILLORS: *Victoria Branch:* J. N. Anderson, A.M.E.I.C., Victoria; F. G. Aldous, A.M.E.I.C., Victoria.

Vancouver Branch: E. A. Cleveland, M.E.I.C., Vancouver; W. G. Swan, M.E.I.C., Vancouver.

Calgary Branch: A. L. Ford, M.E.I.C., Calgary; C. C. Richards, M.E.I.C., Calgary.

Edmonton Branch: R. W. Boyle, M.E.I.C., Edmonton; A. G. Stewart, A.M.E.I.C., Edmonton.

Lethbridge Branch: P. M. Sauder, M.E.I.C., Lethbridge; John Dow, M.E.I.C., Lethbridge.

Saskatchewan Branch: H. R. MacKenzie, A.M.E.I.C., Regina; P. C. Perry, A.M.E.I.C., Regina.

Winnipeg Branch: †† A. G. McGillivray, A.M.E.I.C., Winnipeg; H. A. Bowman, A.M.E.I.C., Winnipeg.

(*Continued on next page*)

Lakehead Branch: J. Antonisen, M.E.I.C., Port Arthur; M. W. Jennings, A.M.E.I.C., Buffalo, N.Y.

Sault Ste. Marie Branch: C. H. E. Rounthwaite, A.M.E.I.C., Sault Ste. Marie; Carl Stenbol, M.E.I.C., Sault Ste. Marie.

Border Cities Branch: J. Clark Keith, A.M.E.I.C., Windsor; J. J. Newman, M.E.I.C., Windsor.

Niagara Peninsula Branch: B. Atkinson, M.E.I.C., St. Catharines; E. P. Johnson, A.M.E.I.C., Welland.

London Branch: W. C. Miller, A.M.E.I.C., St. Thomas; E. V. Buchanan, M.E.I.C., London.

Hamilton Branch: W. F. McLaren, M.E.I.C., Hamilton; H. B. Stuart, A.M.E.I.C., Hamilton.

Toronto Branch: ‡ T. R. Loudon, M.E.I.C., Toronto; N. D. Wilson, M.E.I.C., Toronto.

Kingston Branch: L. F. Goodwin, M.E.I.C., Kingston; L. F. Grant, A.M.E.I.C., Kingston.

Peterborough Branch: R. L. Dobbin, M.E.I.C., Peterborough; A. H. Munro, A.M.E.I.C., Peterborough.

Ottawa Branch: †† A. F. MacCallum, M.E.I.C., Ottawa; J. D. Craig, M.E.I.C., Ottawa.

Montreal Branch: † C. J. Desbaillets, M.E.I.C., Montreal; W. C. Adams, M.E.I.C., Montreal; P. L. Pratley, M.E.I.C., Montreal; F. A. Combe, M.E.I.C., Montreal.

Quebec Branch: A. B. Normandin, A.M.E.I.C., Quebec; Alex. Lariviere, A.M.E.I.C., Quebec.

Saguenay Branch: G. F. Layne, A.M.E.I.C., Riverbend; Hew G. Cochrane, A.M.E.I.C., St. Joseph d'Alma.

Moncton Branch: J. D. McBeath, M.E.I.C., Moncton; H. W. McKiel, M.E.I.C., Sackville.

St. John Branch: W. R. Pearce, M.E.I.C., St. John; Geoffrey Stead, M.E.I.C., St. John.

Cape Breton Branch: S. C. Mifflen, A.M.E.I.C., Sydney; W. C. Risley, M.E.I.C., Sydney.

Halifax Branch: K. L. Dawson, A.M.E.I.C., Halifax; G. S. Stairs, A.M.E.I.C., Windsor.

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*(One Vice-President to be elected for two years.)
†(Two Councillors to be elected for three years each.)
‡(One Councillor to be elected for three years.)
††(One Councillor to be elected for two years.)

Annual Meeting—Tentative Programme

Brief announcements regarding the forthcoming Annual General and General Professional Meeting of The Institute have appeared in the Journal during the past few months. The Executive Committee of the Quebec Branch has now announced the tentative programme of the sessions to be held in Quebec City, and from the outline given this meeting promises to be one of great interest to engineers throughout Canada. The sessions in Quebec will occupy three days, and it will be noticed that a well-balanced programme of technical sessions, visits to points of interest and general entertainment has been provided.

The programme, including the business session in Montreal, is given below:—

Annual General Meeting in Montreal

(To be convened at Headquarters, 176 Mansfield Street, on Thursday, January 28th, 1927.)

Appointment of Scrutineers.
Appointment of Auditors.
Motion to adjourn to Quebec City, to reconvene at the Chateau Frontenac on Tuesday, February 15th, 1927.

Annual General and General Professional Meeting in Quebec

TUESDAY, FEBRUARY 15TH, 1927.

9.00 a.m.	Registration.
10.00 a.m.	Reception and discussion of reports from Council, Committees and Branches. Scrutineers' report and election of officers. Retiring President's address. Induction of new President.
1.00 p.m.	Lunch—complimentary to visitors. Welcome to members by Chairman of the Quebec Branch, who will preside. Brief address by the Mayor of Quebec and the Hon. A. Galipeault, Minister of Public Works of the Province of Quebec.
3.00 p.m.	Continuation of Annual General Meeting. Unfinished and new business.
9.00 p.m.	Ball at Chateau Frontenac. Admission by ticket.

WEDNESDAY, FEBRUARY 16TH, 1927.

10.00 a.m.	First technical session. Forest Conservation and Operation.
2.00 p.m.	Visit to Quebec Bridge, or St. Malo Shops.
7.30 p.m.	Annual dinner of Institute. Admission by ticket. President in the Chair.

THURSDAY, FEBRUARY 17TH, 1927.

10.00 a.m.	Second technical session. Papers on Power developments.
2.00 p.m.	Third technical session. Papers on Mining Activities. Discussion of papers previously presented.
5.00- 7.00 p.m.	Reception at the Lieutenant-Governor's residence, Spencer Wood.
8.30 p.m.	Smoker or special entertainment. Admission by ticket.

Education and the Engineer

Questions and problems connected with the training of young engineers have recently received much attention, particularly during the years since the War, and many of them still clamour for solution.

Why do so many young men choose the engineering courses at our universities; why do so few of them complete their courses successfully; should such courses be for the many or for the few; are our engineering schools giving the best possible training; what should be the relation between the university work and training in field or workshop; how can the young graduate be aided in obtaining employment which will continue and round out his college training? These are only a few of the lines of enquiry which suggest themselves when the subject is approached. The importance of an investigation of these and other points is obvious; the future of the profession depends upon the proper utilization of the information obtained.

The subject has been brought up repeatedly in the proceedings of our various branches, its discussion occupied a great part of the time at the Annual General Professional Meeting of The Institute in 1925, and many contributions concerning it will be found in the columns of the Journal.

A noteworthy effort to clarify the situation is being made by the Society for the Promotion of Engineering Education, an organization which has for some years been collecting data and information in the United States and Canada, some of the results being now available for analysis and consideration.

The preliminary report, contained in that Society's Journal for September 1926, gives a general view of the present situation as revealed by the Society's enquiry, and is well worthy of study, and the Society's reports have formed the basis for a thoughtful and stimulating paper recently presented before the Vancouver Branch of the Engineering Institute by Professor W. E. Duckering, and printed in the present issue of the Journal.

Such a paper might well be the subject of discussion at the meetings of more than one of our branches, for it presents constructive rather than destructive criticism, and marks the lines along which the work of reform might with advantage be directed. The facts accumulated by the enquiry do not appear to indicate the necessity for any revolutionary changes, but do undoubtedly point out the desirability of the readjustment of many of our ideas regarding the training of the young engineer.

Since the development of systematic engineering education began in the Eighties, great changes have taken place in the conditions governing engineering activities. The sphere of the consulting engineer is apparently becoming more limited, opportunities on the technical staffs of great industrial companies are more numerous and attractive, the services of members of the profession have become more largely administrative, and the importance to the engineer of the art of organizing and controlling men has become more marked.

The greater complexity of the technical knowledge in his own branch which an engineer should now possess, and the greater degree of specialization now required, makes it increasingly difficult for a man to be expert in his own realm and at the same time well informed in many others.

The work of bodies like the Engineering Institute of Canada in disseminating professional knowledge among their members does much to assist in this regard. The publications of the various engineering societies afford an opportunity to every member to continue his general engineering education and to maintain a proper interest in the achievements taking place in lines of work with which he is not specially associated. It will indeed be regrettable if the investigation and research now directed to the education of the engineer fails to give rise to definite constructive steps towards improvement in our present methods and system.

Meeting of Council

Meeting of October 15th, 1926

A meeting of Council was held at eight p.m. on Friday, October 15th, President Geo. A. Walkem, M.E.I.C., in the chair, and five members of Council being present.

The report of the Finance Committee, with the financial statement to September 30th, was approved, and a number of requests for further extension of credit to various members were considered. Two requests for reinstatement were considered and approved.

In accordance with the By-laws, Council examined and approved the report of the Nominating Committee now published in the Journal.

In response to suggestions received from members, Council considered the desirability of drawing the attention of the Dominion Government to the resolution passed by Council in June 1924 regarding the Hudson's Bay Railway, in which Council suggested that the completion of this railway and its attendant works should not be carried out until the proposed railway has been thoroughly investigated from the engineering, economic and national viewpoints. The secretary was directed to forward a copy of this resolution to all members of the present Federal Government.

Consideration was given to the question of the employment of other than Canadian engineers by the Federal Government, and the secretary was directed to address a letter to the government suggesting that, in future, important public works should be designed as well as executed by Canadian engineers.

The committee which is considering the advisability of making changes in the present method of expending the funds available for prizes for Students and others reported progress, the chairman stating that the opinions of the various branch executive committees with regard to this matter were being awaited.

The secretary reported that, largely as a result of the removal of names for non-payment of fees, a reduction in the total membership of The Institute had taken place, this being particularly marked in the case of the Student class, and he was directed to communicate with the various branch executives, pointing out the importance of enrolling suitable members in this class.

Dean H. M. MacKay, M.E.I.C., and A. G. Tapley, A.M.E.I.C., were requested to attend the meeting of the Canadian Board of Trade at St. John, N.B., as the representatives of The Institute.

A progress report was received from the Papers Committee, the chairman announcing that arrangements have been made, in several cases, for an interchange of speakers and papers between various branches. This was noted with appreciation.

The death of A. A. Dion, M.E.I.C., who was for five years a member of Council, was noted with great regret, and the secretary was directed to write to Mr. Dion's family expressing Council's condolence with them in their bereavement.

The list of officers for the Lakehead Branch for the year 1926-27 was noted and approved.

The following elections and transfers were effected:—

Elections

Members	4
Associate Members	5
Juniors	2
Students	2

Transfers

Associate Member to Member	3
Junior to Associate Member	2
Student to Associate Member	3
Student to Junior	8

Eighteen applications for admission and transfer were scrutinized and classified for the ballot returnable November 16th, 1926.

Six special cases were considered in connection with applications for admission.

The Council rose at eleven thirty-five p.m.

OBITUARIES

Alfred Adolphe Dion, M.E.I.C.

Members of the Engineering Institute have learned with deep regret of the death of Alfred Adolphe Dion, M.E.I.C., which occurred at his home in Ottawa, Ont., on October 8th, 1926. His death followed a serious operation which he underwent about two weeks prior, and for days he lingered at death's door, and after signs of slight improvement in his condition he suffered a relapse which proved fatal.

The late Mr. Dion had been a Member of The Institute since 1901 and had taken a great interest in its affairs, particularly in the days of the Canadian Society of Civil Engineers, during which time he was a member of Council of the years 1907, 1908, 1915, 1916 and 1917. As one of Canada's most prominent electrical engineers, Mr. Dion was recognized as an authority on electricity and electrical developments, and in Ottawa was widely-known through his activities in civic circles and through his connection with educational boards and societies.

ALFRED ADOLPHE DION, M.E.I.C.

Born in the city of Quebec on June 14th, 1858, the late Mr. Dion, when only sixteen years of age, became a telegraph operator with the Dominion Telegraph Company. From 1882-89 he was with the Canada Atlantic Railway and Cape Breton Railway on construction and operation. The following three years he was electrician with the Intercolonial Railway, and in 1891 he became superintendent and engineer of the Chaudiere Electric Light and Power Company, at Ottawa, five years later being appointed general superintendent and chief engineer of the Ottawa Electric Company. In 1912 he was appointed superintendent of the Ottawa Gas Company, still retaining his position with the Ottawa Electric Company, and in 1921 he was general manager and engineer for both companies when they were placed under one control and ownership. In 1917 he was appointed a director of the Ottawa Light, Heat and Power Company. In 1918 he was elected president of the Moose Jaw Electric Street Railway, which position, together with his connections in Ottawa, he held until the time of his death.

The late Mr. Dion was president of the Canadian Electrical Association in 1899 and in 1902, and again in 1911. He was elected Member of the American Institute of Electrical Engineers in 1893 and Fellow in 1912. He was also a member of the Institute of Electrical Engineers (Great Britain), a past-president of the Canada Gas Association and served on the council of the Ottawa Board of Trade.

Despite his busy life, Mr. Dion managed to contribute numerous articles and technical papers to various scientific journals in this country and elsewhere, and was regarded as an authority on all matters pertaining to his profession.

Practically every phase of the life of the Capital was represented at the funeral, the largest seen in Ottawa in recent years. The cortege included in its ranks members of the federal and provincial parliament, the mayor and controllers of Ottawa, members of the city council, representatives of the Board of Trade, the Engineering Institute of Canada, and numerous other societies and clubs.

Members of the Engineering Institute were present in large numbers to pay their last respects to a highly-respected fellow-member. The parent body was represented by Col. W. P. Anderson, M.E.I.C., and the Ottawa Branch by Chairman J. D. Craig, M.E.I.C., and the Secretary, F. C. C. Lynch, A.M.E.I.C.

Lt.-Col. Bryce Johnston Saunders, M.E.I.C.

On Monday, October 11th, 1926, there passed away one of The Institute's distinguished members and one of Edmonton's best known and popular citizens in the person of Lt.-Col. Bryce Johnston Saunders, M.E.I.C., at his residence in Edmonton, Alta. Although the late Colonel Saunders had been in ill health for some time, his sudden death came as a shock.

He was a former commissioner of the city of Edmonton and was at one time candidate for the office of mayor, and was at all times interested in affairs of the city. He was prominent in military service, being one of the four officers chosen by the Canadian Government to represent Canada at King Edward's funeral in 1908. At the time of his death he was president of the Alberta Land Surveyors' Association.

Colonel Saunders was born at Lyndhurst, Ont., on October 17th, 1860, and received his early education in the public schools of Brockville and Athens, graduating from the high school at Athens in 1877. He entered the School of Practical Science, Toronto, in 1881, but transferred to McGill University the following year, graduating in 1896 with the degree of B.A.Sc. in civil engineering. It was during the years 1882-83 that Colonel Saunders first located temporarily at Edmonton, at which time he was engaged in Dominion land surveys. In 1884 he became Dominion Land Surveyor and in 1889 Ontario Land Surveyor.

He carried on a general practice in Brockville, Ont., from 1888 to 1897, while from 1893 to 1897 he was city engineer, and was county engineer for Leeds and Granville during part of that period. During this period he designed many bridges and supervised the construction of extensive drainage works in eastern Ontario. In 1897 he was Ontario commissioner in laying out the Ontario-Manitoba boundary.

During the years 1898-99 and 1900 he was engaged on Dominion land surveys in Alberta, and in August, 1900, went to Regina as assistant chief engineer and surveyor of irrigation. In 1902 he was appointed chief engineer on this work and also deputy minister, chief engineer and surveyor of public works for the North-West Territories.

In 1904 he resumed private practice at Edmonton. He carried on his practice until 1914, when he was appointed commissioner of public works in that city. He went overseas with the first contingent of the Canadian Expeditionary Force, and on returning home in 1919 resumed private practice.

Colonel Saunders had a long and interesting military career. He was a drummer boy in 1870 in a small unit of scouts at Brockville during the Fenian Raid. In 1885 he was with the D.L.S. Intelligence Corps during the time of the North-West Rebellion, and was present at Batoche. He volunteered for service in South Africa in 1900, and in 1906 joined "A" Squadron, Canadian Mounted Rifles, at Edmonton.

He made an immediate response when the World War broke out in 1914, joining up in August. He left Valcartier in September of the same year with the First Canadian Contingent, serving in England, France and on the high seas until the conclusion of hostilities, returning to Canada in January 1919. He was mentioned in despatches and raised to the rank of lieutenant-colonel.

Colonel Saunders joined the Engineering Institute of Canada as Associate Member on April 9th, 1890, and was transferred to Member on March 16th, 1899. He was also until recently a member of the Association of Professional Engineers of Alberta.

Thomas Shanks, B.A., B.A.Sc.

Thomas Shanks, B.A., B.A.Sc., former assistant director-general of surveys, Department of Interior, at Ottawa, and one of the most prominent members of the Masonic Order in eastern Ontario, died suddenly from heart disease on the morning of October 13th, 1926. He was 57 years old and unmarried.

News of Mr. Shanks' passing came as a great blow to a host of friends, as he appeared to be in good health at a late hour on the previous evening, when he gave an address describing his recent trip around the world.

A man of lovable character, Mr. Shanks enjoyed the esteem of the entire community for his sterling worth and fine citizenship. He was born at Moose Creek, Stormont County, Ontario, on April 23, 1869, and was educated in schools of that district, the Ottawa Collegiate Institute and the Normal School.

Ready for university at 16 years of age, Mr. Shanks could not enter college owing to his youth, so he taught school for several years. He then enrolled at the University of Toronto in the School of Practical Science, where he graduated in 1900 with the degree of B.A.Sc. He also graduated with the degree of Bachelor of Arts. In 1902 he was commissioned as a Dominion Land Surveyor.

Entering the Federal Civil Service at Ottawa in 1900, as a member of the staff of the Topographical Survey, Mr. Shanks' talents were quickly appreciated. In 1911 he was appointed chief draughtsman and in 1914 was made assistant surveyor-general. On October 1st, 1923, he was promoted to the position of assistant director-general of surveys, from which he was superannuated on November 1st, 1924, owing to ill-health.

Since his retirement, Mr. Shanks had spent much of his time in travel, first to the Mediterranean, and but recently he had returned from an eight-months' trip around the world.

Mr. Shanks was equally prominent in club life. He was a charter member of the Rivermead Golf Club and the Laurentian Club, and he was also a Rotarian. He joined the Engineering Institute of Canada in 1922, being elected

THOMAS SHANKS, B.A., B.A.Sc.

Member on May 22nd of that year, but subsequent to his retirement from active work he resigned from The Institute on November 17th, 1925.

The very high regard in which Mr. Shanks was held was given tangible expression when citizens representative of every phase of the life of the Capital were present at his funeral to pay their last tribute of respect.

Recent Additions to the Library

Proceedings, Transactions, Etc.

PRESENTED BY THE SOCIETIES:

Calendar of the Royal Technical College of Glasgow, 1926-27.
List of Members of the Mining Institute of Scotland, 1926.
Transactions of the Institution of Mining and Metallurgy, Vol. 34, pt. 2, 1925.
Proceedings of the New Zealand Society of Civil Engineers, Vol. 12, 1925-26.
Proceedings of the Institution of Mechanical Engineers, January to May. Vol. 1, 1926.

Reports, Etc.

PRESENTED BY THE CARNEGIE LIBRARY OF PITTSBURGH:
Annual Report, 1925.

PRESENTED BY THE HYDRO-ELECTRIC POWER COMMISSION OF ONTARIO:
Annual Report, 1924-25.

PRESENTED BY THE SECRETARY, NATIONAL FOREIGN TRADE CONVENTION:
Official Report of the Thirteenth National Foreign Trade Convention at Charleston, S.C., April, 1926.

PRESENTED BY RICHARD PFLAUM PUBLISHING COMPANY:
Wasser-Kraft Jahrbuch, 1925-26.

PRESENTED BY THE DEPARTMENT OF TRADE AND COMMERCE, CANADA:
The Canada Year Book, 1925.

Technical Books

PRESENTED BY FRANKLIN AND CHARLES:
Transmission Line Theory and Some Related Topics, by W. S. Franklin and F. E. Terman.

PRESENTED BY MCGRAW-HILL BOOK COMPANY, INC.:
Concrete Designer's Manual, by G. A. Hool and C. S. Whitney.

PRESENTED BY JOHN WILEY AND SONS, INC.:
Elements of Heat Power Engineering, Part I, by W. N. Barnard, F. O. Ellenwood and C. F. Hirshfeld.

PURCHASED FROM THE ENCYCLOPEDIA BRITANNICA, INC.:
Thirteenth Edition New Volumes Encyclopedia Britannica.

PERSONALS

H. K. Wyman, A.M.E.I.C., of the Shawinigan Engineering Company, has been transferred by the company from St. Narcisse, Champlain County, Que., to St. Alban, Portneuf County, Que.

Arnold V. Armstrong, S.E.I.C., is at present located in Toronto, Ont., with the English Electric Company of Canada, Limited. Mr. Armstrong received his degree of B.Sc. from McGill University in 1923.

A. d'Orsonnens, A.M.E.I.C., of the Topographical Surveys Branch of the Federal Government, has been transferred to the Natural Resources Intelligence Service, Department of the Interior, Ottawa.

Prof. L. M. Arkley, M.E.I.C., head of the Department of Mechanical Engineering of Queen's University, has been appointed a member of a committee of the National Research Council of Canada, on the Insulation and Heating of Buildings.

John R. Kaye, S.E.I.C., who graduated from McGill University in 1924, is at present with the Venezuela Power Company, Limited, at Maracaibo. Mr. Kaye is a native of Halifax, N.S., and graduated from Dalhousie University, subsequently completing his engineering studies at McGill.

C. R. Bown, Jr.E.I.C., who has been with Messrs. Stone and Webster, Inc., at Beaumont, Texas, has been transferred to Paulsboro, N.J., and is resident engineer for the company on the remodelling of the boiler house of the Vacuum Oil Company. Mr. Bown is a graduate of McGill University of the year 1923.

K. M. Kent, S.E.I.C., of Montreal, is now residing in London, England, where he is manager for the Armstrong Cork and Insulation Company, Limited, and his present address is Sardinia House, Kingsway, London, W.C.2. Mr. Kent graduated from McGill University with the degree of B.Sc. in 1924.

T. W. W. Parker, A.M.E.I.C., until recently with Messrs. Monsarrat and Pratley, consulting engineers, Montreal, is now with the Anticosti Corporation, in Montreal. Mr. Parker was for a time assistant in the office of A. D. Swan, M.E.I.C., in Montreal, and was subsequently in the resident engineer's office of the new harbour works at Vancouver, B.C.

President Geo. A. Walkem, M.L.A., M.E.I.C., has just returned from a visit to a number of The Institute branches, and while in Eastern Canada took the opportunity to attend the McGill Reunion in Montreal. Major Walkem was the representative of The Institute at the recent annual meeting of the American Society of Civil Engineers at Philadelphia, Pa.

Brig.-Gen. C. J. Armstrong, C.B., C.M.G., M.E.I.C., for the past seven years Officer Commanding Military District No. 4 at Montreal, has left to take command of Military District No. 1 at London, Ont. General Armstrong joined The Institute as Student in 1894, and was transferred to Associate Member in 1902 and to Member in 1912. He is at present chairman of the Honour Roll and War Trophies Committee of The Institute.

Brig.-Gen. T. L. Tremblay, C.M.G., D.S.O., M.E.I.C., was re-elected vice-president of the American Association of Port Authorities at the recent annual convention at Norfolk, Va. General Tremblay is a native of Quebec, having been born at Chicoutimi in 1886. He is a graduate of the Royal Military College of Canada of the year 1907, and at the present time occupies the position of commissioner and chief engineer of the port of Quebec.

Chas. Ed. Potter, Jr., Jr.E.I.C., has severed his connection with the Wayagamack Pulp and Paper Company, and is now located in Toronto with the Toronto Transportation Commission. Mr. Potter graduated from the University of Toronto with the degree of B.A.Sc. in 1925, subsequently being employed with the Geodetic Survey of Canada, and early in 1926 accepted the position of transitman with the Wayagamack Pulp and Paper Company, at Three Rivers, Que.

Charles E. Marlatt, Jr.E.I.C., is with the Consolidated Mining, Smelting and Power Company, in the engineering office at Trail, B.C. Mr. Marlatt graduated from Queen's University in 1923 with the degree of B.Sc., and immediately following graduation was topographer with the Department of Highways with the British Columbia government. Subsequently, in March 1924, he joined the engineering staff of the West Kootenay Light and Power Company as instrumentman in connection with the construction of the company's new hydro-electric plant.

R. H. Farnsworth, Jr.E.I.C., has been appointed to the engineering staff of Price Brothers and Company, Limited, and is located at the company's head office in Quebec city. Mr. Farnsworth has until recently been with the Newfoundland Power and Paper Company, Limited, Corner Brook, Nfld. He is a graduate of Queen's University of the year 1916, and at the end of the War took post-graduate work at London University. On returning to Canada, he was appointed to the engineering staff of the Brompton Pulp and Paper Company, at East Angus, Que., and subsequently was engaged on design in connection with the work at the St. Lawrence Paper Mills, Three Rivers, Que.

Roy A. Crysler, A.M.E.I.C., of Toronto, has resigned from his position with the Rust Engineering Company, of Pittsburgh, Pa., and is now with Messrs. H. K. Ferguson Company, of Cleveland, Ohio. Mr. Crysler graduated from the University of Toronto in 1920, and, following graduation, was assistant engineer with the Ontario Provincial Board of Health for a few months, later joining the staff of the Hydro-Electric Power Commission of Ontario, at Niagara Falls, Ont. During the past six years, Mr. Crysler has been engaged mainly on reinforced concrete work, particularly in design. He was concrete engineer with the architect's department, city of Toronto, for nearly four years, and was later with Messrs. Chapman and Oxley, of Toronto, Ont.

C. H. Donnelly, A.M.E.I.C., has since May of this year been on the staff of the United States Light and Heat Corporation, at Niagara Falls, N.Y., with which firm he was appointed assistant maintenance engineer at that date. Mr. Donnelly has for the past six years been with the construction department of the Hydro-Electric Power Commission of Ontario as assistant to the superintendent at the Queenston power house. He is an honour graduate of Queen's University, from which he received the degree of B.A. in 1914 and B.Sc. in 1919. His first engineering work was with the Donnelly Salvage and Wrecking Company, Kingston, where he was employed during the summer months of his university course. He served overseas with the Canadian Field Artillery from 1915 until the end of the War. After receiving his degree in science, he was engaged with a firm of engineers and architects in Toronto on the design of reinforced concrete building, and later with the Trussed Concrete Steel Company on similar work.

T. C. MacNabb, A.M.E.I.C., Receives Appointment

T. C. MacNabb, A.M.E.I.C., who since 1917 has been superintendent for the Canadian Pacific Railway Company at Revelstoke, B.C., has been appointed engineer of construction of the company's western lines with office at Winnipeg, Man.

Mr. MacNabb is a graduate of the University of Manitoba, from which he received his degree of Bachelor of Arts with honours in 1902. Immediately following graduation, he joined the staff of the Canadian Pacific Railway Company, and has been engaged on various works with that company throughout Canada ever since. His first work was with the construction department, and in succession he occupied various positions, commencing as chainman and rodman in 1902, being promoted to topographer in 1903, and later draughtsman in the field office at Winnipeg, in the following year instrumentman and in 1905 resident engineer. In this latter capacity his work took him to Saskatoon, Lethbridge and Battle River. In 1908 he became assistant engineer on construction, the following year division engineer on maintenance and in 1916 assistant engineer for Saskatchewan and in the following year superintendent at Revelstoke.

T. C. MacNABB, A.M.E.I.C.

Mr. MacNabb is also a member of the American Railway Engineering Society and the American Association of Railway Superintendents.

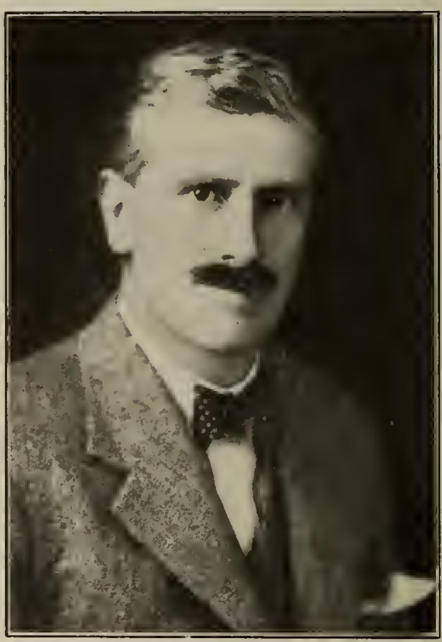
H. M. Goodman, A.M.E.I.C., Enters Legal Profession

H. M. Goodman, A.M.E.I.C., formerly of Goodman and Goodman, accountants and bankruptcy trustees, Toronto, Ont., has entered partnership with Alderman Nathan Phillips, and will in future practice law in Toronto under the firm name of Nathan Phillips and Goodman. Mr. Goodman is a graduate of the University of Toronto, where he received his degree of B.A.Sc., in 1913. During his course he was engaged in hydrographic, general survey and construction work in connection with irrigation in Saskatchewan. During the first eighteen months following graduation he was engaged on various works where he secured experience in steel bridge and building construction, after which for four years he was with the engineering department of the city of Montreal on the outside construction staff engaged in construction of sewers, waterworks, pavements, bridges, etc. He later joined his brother under the firm name of Goodman and Goodman, engineers and accountants, and was in charge of the branch office in Toronto from 1921 until he recently formed partnership with Alderman Phillips. His recent work entailed the close study of accountancy and required him to specialize in bankruptcy work, and as a result he was led to take up the study of law, which he completed last spring, and was finally called to the Ontario Bar on September 16th last.

L. F. Merrylees, A.M.E.I.C., Chief Engineer, Anticosti Corporation

L. F. Merrylees, A.M.E.I.C., has been appointed chief engineer of the Anticosti Corporation to deal with the development of harbours and railways on Anticosti Island, and the entire problem of transportation and shipping.

Mr. Merrylees was born and educated in Scotland. He was articled to James Barron, M.INST.C.E., consulting engineer in Aberdeen, Scotland, and after the term of his pupilage acted as assistant engineer on a number of harbour construction schemes around the north of Scotland and the east coast of England and Ireland.



L. F. MERRYLEES, A.M.E.I.C.

On coming to this continent in 1909, Mr. Merrylees was successively employed on municipal and survey work with Mason L. Brown and Company, of Detroit, Michigan; the Canadian Pacific Railway Company on maintenance-of-way; the Canadian Northern Railway Company on construction; and on the Quebec Bridge under the Board of Engineers. He left for overseas on the outbreak of war, in August 1914, and served with the Royal Engineers in the 26th (Field) Company, 1st Division, and later with the 212th and 222nd (Field) Companies of the 33rd Division.

After his return in 1919, Mr. Merrylees was engaged in various works in Ontario and Quebec and as inspecting engineer on the valuation of the Grand Trunk Railway, and went to Vancouver in 1921 to act as construction engineer for the Northern Construction Company and J. W. Stewart, on the Ballantyne pier, and later on the No. 2 elevator.

Mr. Merrylees has been in private practice in Vancouver since 1924, and has been identified with a variety of work in the province, and leaves it only to take charge of a very large undertaking which will occupy him fully for a number of years.

On the occasion of the departure of Mr. and Mrs. Merrylees from Vancouver, they were met by a number of engineers, and a bouquet of flowers was presented to Mrs. Merrylees, with the following letter of appreciation to Mr. Merrylees:—

"The Executive of the Vancouver Branch of the Engineering Institute of Canada, together with the Council of the Association of Professional Engineers of the Province of British Columbia, in wishing you farewell with all good wishes, take this opportunity of expressing their appreciation for the services you have rendered them in the past few years by your activity in branch affairs, and by the activity you have shown in the Engineering Bureau of the Board of Trade, and both Bodies wish you all success and good fortune for the future."

EMPLOYMENT BUREAU

Situation Wanted

Civil Engineer

B.Sc., member Corporation of Professional Engineers of Quebec, age 40, in excellent health, speaking both languages, with 12 years of experience on hydro-electric construction, municipal and industrial work, desires connection with engineering or contracting firm where quick, accurate and efficient work is desired. At present employed but available on few weeks' notice. Personal interview sought. Address replies to Box 216-W, Engineering Journal.

Situations Vacant

Mechanical Engineer

Graduate mechanical engineer for large paper specialty mill to take charge of maintenance under engineering department. Must be well experienced to supervise shop and repair department, do incidental machine design and keep records of maintenance and interruptions. Broad experience and executive ability. Give full particulars in first letter. Address replies to Box 158-V, Engineering Journal.

Mechanical Draughtsman

Graduate mechanical draughtsman with practical paper mill experience wanted for general work. Address replies to Box 159-V, Engineering Journal.

Mapping the Area Adjoining Red Lake in Ontario

The federal authorities have been engaged upon a mapping programme covering the region in the vicinity of Red lake, and in accordance with this programme a provisional map of the Red lake district itself was issued to meet the urgent need for the presentation of authentic topographic information, and the subsequent publication of map sheets lying on all sides of the Red lake region was provided for. Two of these projected sheets were issued during the past few weeks, namely, the Lac Seul sheet and the Pointe du Bois sheet, lying respectively to the southeast and the southwest of Red lake, and north from the main line of the Canadian National railways. The mapping programme has been carried on by the Topographical Survey, Department of the Interior, in co-operation with the Surveys Branch of the Department of Lands and Forests, Ontario, and the Royal Canadian Air Force.

A third sheet is now ready for issue to the public. This is known as the Carroll lake sheet and comprises an area lying northwest of and adjoining Red lake, included within latitudes 51° and 52° and longitudes 94° and 96°.

These sheets are published on the scale of four miles to the inch. They are issued in folder form for convenience in carrying in the pocket or in plain form, unfolded.

ELECTIONS AND TRANSFERS

At the meeting of Council held on October 15th, 1926, the following elections and transfers were effected:—

Members

KING, Harry Molyneux, operating supt., Ontario Power Plant, H.E.P.C., Niagara Falls, Ont.

LAVOIE, Alphonse Joseph, President Lavoie Automotive Devices Ltd., Montreal, Que.

NORRIS, Richard Norman Bond, managing director, Harland Engrg. Co. of Canada Ltd., Montreal, Que.

SCHREIBER, John W., M.E., (Univ. of Pittsburgh) asst. to ch. engr., Aluminum Co. of America, Pittsburgh, Pa.

Associate Members

BARBER, Herbert Campbell, B.A.Sc., (Univ. of Toronto), mgr. of Ontario district, Standard Underground Cable Co., Toronto, Ont.

BRUCE, William Joseph, C.E., (Univ. of Toronto), engr. i/c surveys for Foundation Co. of Canada Ltd., Maniwaki, Que.

COATES, James Percy, locating and res. engr., Dept. of Public Works, B.C., Nelson, B.C.

FRASER, Archibald Norman, B.Sc., (McGill Univ.), senior radio elect'l engr., Radiotelegraph Branch of Naval Service, Ottawa, Ont.

STARLEY, Bernard, asst. engr. Nigerian Eastern Ry. Construction survey, Kakuri, N.P., Nigeria, West Africa.

Juniors

BAILLIE, Edward Leonard, B.Sc., (N. S. Tech. Coll.), asst. engr. on highway constrn. with N. S. Highway Board, Stellarton, N.S.

FISHER, Frederick Sorley, B.Sc., (Univ. of Alta.), equipment engrg., Northern Electric Co., Montreal, Que.

Transferred from class of Associate Member to that of Member

BOWNESS, Ernest William, B.Sc., (McGill Univ.), consulting engr. in Edmonton, Alta.

DEVEY, John Hardy, designer, Chesapeake & Ohio Ry. Co., steel and concrete structures, Richmond, Va.

SMYTHIES, Reginald Eric, vice-pres. and ch. engr., Lincoln Electric Co. of Can. Ltd., Toronto, Ont.

Transferred from class of Junior to that of Associate Member

ADAM, Joseph A., Public Works Department, Montreal, Que.

GLOVER, Thomas Stanley, B.A.Sc. (Univ. of Toronto), asst. engr., Public Works Dept., Nigeria.

Transferred from class of Student to that of Associate Member

COLES, Eric Morrell, B.A.Sc., (Univ. of B. C.), instructor of elect'l engrg., Univ. of B. C., Vancouver, B.C.

GALBRAITH, Reginald Arthur Harvey, B.A.Sc., M.A., (Univ. of Toronto), officer i/c R.C.C.S. radio station, Fort Simpson, N.W.T.

POLLOCK, Frank Jones, B.A.Sc., (Univ. of Toronto), transmission tower dept., Can. Bridge Co., Walkerville, Ont.

Transferred from class of Student to that of Junior

COLLYER, Ernest, B.Sc., (Queen's Univ.), erecting engr., Can. Gen. Electric Co., Toronto, Ont.

COSSITT, Lawrence Sulis, B.Sc., (McGill Univ.), dftsman in estimating dept., Robert Mitchell Co., Montreal, Que.

DESBARATS, George Henry, B.Sc., (McGill Univ.), journeyman electrician, with Can. Comstock Co., Ottawa, Ont.

FARRAR, Norman, B.Sc., (McGill Univ.), instrman., Riordon Pulp Corp. Ltd., Montreal, Que.

FARRELL, Alfred James, B.Sc., (McGill Univ.), installation of rubber flooring for Can. Cons. Rubber Co., Montreal, Que.

GRAY-DONALD, Erceldonne, B.Sc., (McGill Univ.), apprenticeship course with Shawinigan Water & Power Co., Montreal, Que.

RICHARDSON, Roderick McDougald, B.A., (Dalhousie Univ.), foreman, cable mtce. in constrn. dept. Bell Telephone Co., Montreal, Que.

STAIRS, Henry Gerald, rodman, Town Dept., Temiskaming, Que.

Power Developments on the Gatineau River

On October 16th, 1926, through the courtesy of the International Paper Company, members of the Ottawa Branch of the Institute, together with a large number of engineers from other points in eastern Canada, were afforded an opportunity of visiting the power developments on the Gatineau river as the guests of the Fraser Brace Engineering Company, and as these developments are rapidly nearing completion it will be of interest to record here a few details of this extensive undertaking, the present work being the first part of what ultimately will be the complete power development of the Gatineau river.

The work naturally divides itself into two distinct parts, (1), the regulation of the Gatineau river and, (2), the development of power.

Regulation of the River

Under the present natural conditions, the flow of the river varies from 2,500 c.f.s. to about 75,000 c.f.s. and regulating works are being constructed in order that the flow may be more uniformly distributed throughout the year.

This will be accomplished by damming the river about 35 miles above Maniwaki, below the outlet of lake Baskatoug, and creating a new lake that will include lake Baskatong. This lake will have a capacity substantially exceeding 80,000,000,000 cubic feet, and is expected to increase the minimum flow of the river from 2,500 c.f.s. to from 8,000 to 10,000 c.f.s.

Power Development

Two plants are now in construction, one at Chelsea falls and the other at Farmers Rapids, while a third at Paugan chutes will probably be undertaken in the near future.

Chelsea Falls Hydro-Electric Development

The dam and power house which are now being constructed at Chelsea falls will create a lake of considerable size, extending some twelve miles above the development. This has necessitated the relocation of some seven miles of railway track and also the diversion of the Gatineau highway.

The Chelsea falls plant is about nine miles north of Ottawa, and on the completion of the work, the effective head created at this point will be 95 feet. The main dam at this site will be approximately 100 feet in height while the height of the power house will be 160 feet.

The initial installation will consist of three 34,000-h.p. vertical Francis type turbines which are being built by the Dominion Engineering Works, Montreal. Provision is made for a fourth unit of the same capacity. The effective head will be 95 feet, the minimum being 88 and the maximum 100 feet.

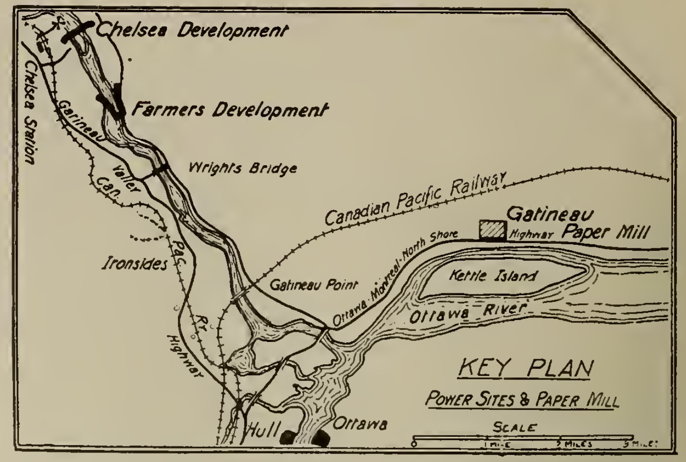


Figure No. 2.—Key Plan—Power Sites and Paper Mill.

The speed of the turbines will be 100 r.p.m., at full load and normal head, and Woodward type governors will be provided.

The generators will consist of two 34,000-kv.a., 60-cycle, 6,600-volt, 3-phase, and one 32,000-kv.a. 25-cycle, 6,600-volt,3-phase.

The transformers will be six 11,000-kv.a., 60-cycle, 6,600/110,000-volt, single-phase and three 11,000-kv.a. 25-cycle, 6,600/110,000-volt, single-phase.

There will also be eight 110,000-volt oil circuit breakers. This electrical equipment is all being manufactured and supplied by the Canadian Westinghouse Company.

A 110,000-volt outdoor switching station will be located near the power house on the west bank of the river, comprising oil circuit breakers for two 60-cycle and one 25-cycle feeder line.

A steel tower transmission line is under construction between Chelsea and the company's new paper mill, comprising two 3-phase circuits of 605,000 C.M. steel core aluminum cable for transmitting 60-cycle power at 110,000 volts to the company's mill. A second steel tower transmission line for 25-cycle power is to be constructed in the near future.

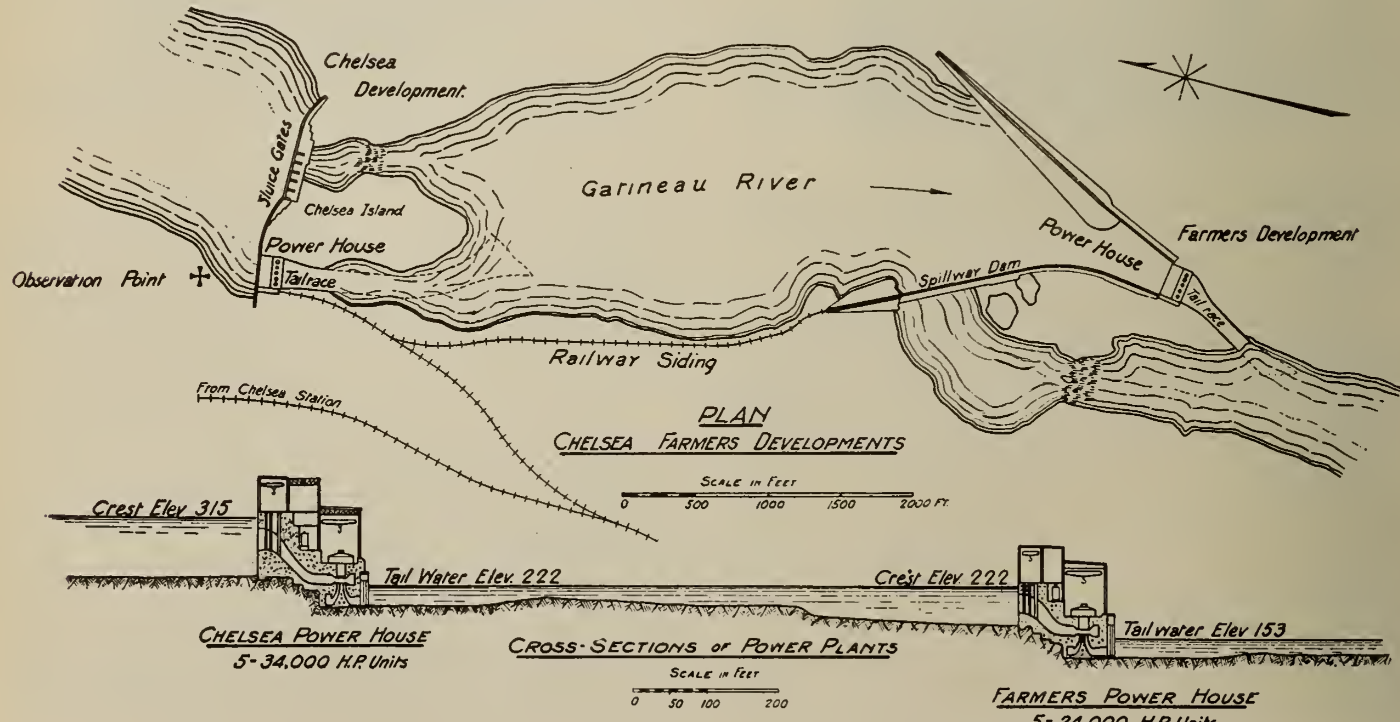


Figure No. 1.—Gatineau River Hydro-electric Developments.

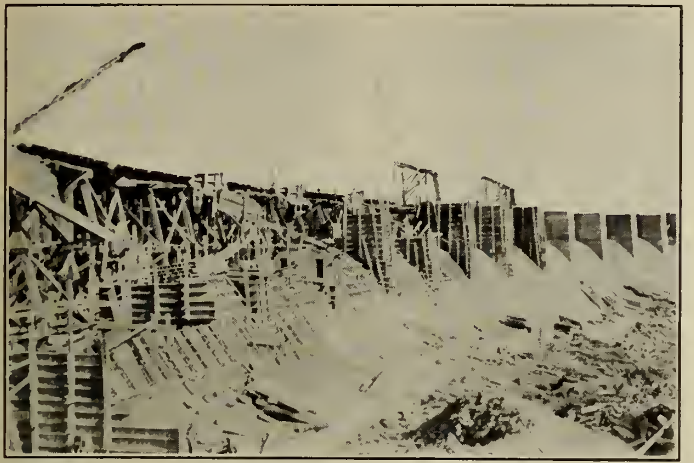


Figure No. 3.—Farmers Rapids—Downstream Side of Dam.

Farmers Rapids Hydro-Electric Developments

This development is located five and a half miles from the city of Ottawa, where an effective head of 65 feet will be created, the minimum head being 55 feet and the maximum 72 feet.

The ultimate development at this site will be 120,000 h.p., and the initial installation will be 72,000 h.p., with three 24,000 h.p. vertical runner Francis type turbines, manufactured by the Dominion Engineering Works. The speed will be 90 r.p.m., at full load and normal head. The wheels will be equipped with Woodward type governors.

The electrical equipment is being supplied by the Canadian General Electric Company, and will consist of two 25,000-kv.a., 60-cycle, 6,600-volt, 3-phase generators, one 22,500-kv.a., 25-cycle, 6,600-volt, 3-phase generator, six 8,333-kv.a., 60-cycle, 6,600/110,000 single-phase transformers, and three 7,500-kv.a., 25-cycle, 6,600/110,000 single-phase transformers. There will also be eight 110,000-volt oil circuit breakers supplied by the Canadian Westinghouse Company.

A 110,000-volt outdoor switching station comprising two 60-cycle and one 25-cycle feeder at 110,000 volts and one 60-cycle feeder at 11,000 volts will be located on the east bank of the river, outside the station, while connections will be made for the 110,000-volt switching station to the 60- and 25-cycle lines running from Chelsea to the new mill.

The dam at this point will have a total length of 4,600 feet.

The work on the Chelsea developments was commenced in November, 1925, and that on the Farmers Rapids plant at the end of January, 1926.

Gatineau Paper Mill

This mill is being constructed at a point known as West Templeton, a few miles below the city of Ottawa on the Ottawa river. It is designed for an initial installation of four paper machines with provisions for enlargement at a later date.

These machines are designed each to produce a sheet of paper 256 inches wide at the rate of more than 1,000 feet per minute. The total capacity of the four machines should exceed 500 tons per day.

Figure No. 4.—Gatineau Mill—View from Water Tower.

The mill will include slasher and barker plant, ground wood mill, sulphite mill, newsprint and wrapper machines, and all accessories necessary to turn the logs as they come down from the river into completed newsprint.

The buildings now under construction will cover more than 10 acres, and they require 200,000 cubic yards of excavation, 65,000 cubic yards of concrete, 8,000 tons of structural steel and six million bricks.

The storage reservoir work is being carried on by the company in conjunction with the Quebec Streams Commission, of which O. O. Lefebvre, M.E.I.C., is chief engineer; the dams are being constructed by The Foundation Company; the power plants at Chelsea and Farmers Rapids are being designed by the Fraser Brace Engineering Company Limited, associated with the Shawinigan Engineering Company, and the works are being constructed by the Fraser Brace Engineering Company Limited. The paper mill has been designed by the company's own staff. The entire work is being carried on by the Canadian International Paper Company and the Gatineau Power Company, of which A. R. Graustein is president, General J. B. White, vice-president; A. H. White, M.E.I.C., chief engineer; A. I. Cunningham, resident engineer. G. Gordon Gale, M.E.I.C., is general manager of the Gatineau Power Company.

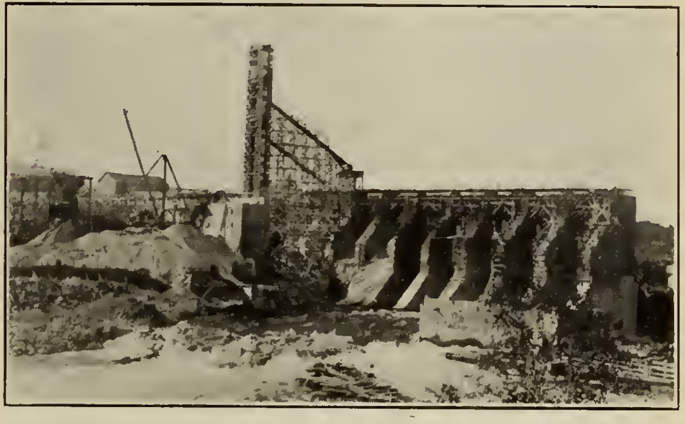


Figure No. 5.—Bitobee Dam—Looking West of the Downstream Side of Spillway Sluices from East Bank.

ANNOUNCEMENT OF MEETINGS

Information may be secured from the secretaries of the various Branches, whose addresses will be found under "Officers of Branches" on page 452 of the Journal.

MONTREAL BRANCH

Secretary-Treasurer, C. K. McLeod, A.M.E.I.C.

Nov. 4th: Address on "The American Railway Engineering Association and Its Work," by J. E. Armstrong, Esq., M.E.I.C.

Nov. 11th: Student Papers.

Nov. 18th: Address on "Vacuum Process for Drying Paper," by Mr. Ogden Minton.

Nov. 25th: Address on "Hydro-Electric Development of Bryson," by H. E. Pawson, Esq., M.E.I.C.

Dec. 2nd: Address on "Railway Supplies," by L. C. Thompson, Esq.

VANCOUVER BRANCH

Secretary-Treasurer, E. A. Wheatley, A.M.E.I.C.

Nov. 3rd: Address on "The Influence of the Medical Profession on the Education of a Medical Student," by Dr. H. W. Hill, M.B., M.D., D.P.H., L.M.C.C., Director, Vancouver General Hospital Laboratories.

Nov. 10th: Address on "The Geology of Britannia Mines," by S. J. Schofield, M.A., B.SC., PH.D., F.G.S.A., F.R.S.C.

Nov. 17th: Open date.

Nov. 24th: Address on "Reproducing Engineering Drawings," by H. B. Muckleston, Esq., M.E.I.C.

Dec. 1st: Open date.

ABSTRACT OF PAPER

Diesel Engines

Professor E. A. Allcut, M.E.I.C., Associate Professor of Mechanical Engineering, University of Toronto, Toronto, Ont.

Niagara Peninsula Branch, September 25th, 1926

One of the most remarkable developments of the twentieth century has been the rapid rise of the Diesel engine to its present status in the engineering world. Dr. Rudolf Diesel took out his patents in 1892, and therefore this type of prime mover is only thirty-four years old. Originally it was an attempt to realize in practice the potential economy of the Carnot cycle, and the fuel first used was pulverized coal, but on account of troubles due to ash in the cylinder and other practical disadvantages, oil was substituted for this at an early stage and is the fuel now used.

The ordinary constant volume cycle gives its best efficiency when the compression ratio is high, and the constant pressure cycle used in the Diesel engine follows the same general rule. For this reason a high compression pressure is used, and as this also involves a high compression temperature, the oil is ignited automatically as it is injected into the cylinder at or near the end of the compression stroke. This high compression ratio makes it possible to obtain much higher efficiencies and lower fuel consumptions than can be obtained with the constant volume cycle. In the constant pressure cycle, however, the ratio of expansion is less than the ratio of compression and therefore, the greater the amount of fuel put into the cylinder, the lower will be the expansion ratio and the less the possible efficiency.

Cut off	Maximum temp. in cycle	Possible efficiency
1/22 of stroke	1641° F.	59.3 per cent
1/11 "	2342° F.	56.7 per cent
1/6 "	3743° F.	51.7 per cent

Thus, if no fuel were injected, the maximum efficiency could be obtained, but no power would be developed, and therefore in practice it is necessary to arrive at some compromise between power and economy. All kinds of liquid fuels, such as crude oils, shale oils and coal tars may be used, but thick oils must be heated to about 100° F. so that they will flow readily through the pipes and valves.

If the engine operates on a cut-off of 10 per cent at 200 r.p.m., the firing period occupies 1/30 second, and some engines, (e.g. the "Maybach"), run at 1,300 r.p.m. With so short a period available for injection and combustion, it is evident that the best possible combustion conditions must prevail in the cylinder, and this involves the following essentials, some of which are mutually exclusive:—

(1) *Atomization.*—The fuel must be split up into small fragments to enable the globules of oil to burn completely and quickly without "cracking." The experiments of Dr. Kuehn in Germany give average diameters of 0.0028-inch at 640 lbs. per sq. in. injection pressure to 0.0071-inch at 71 lbs. per sq. in. The pressure of injection, therefore, must be high.

(2) *Penetration.*—Small particles have little momentum and, therefore, will not penetrate sufficiently far into the very dense air contained in the compression space to give good combustion.

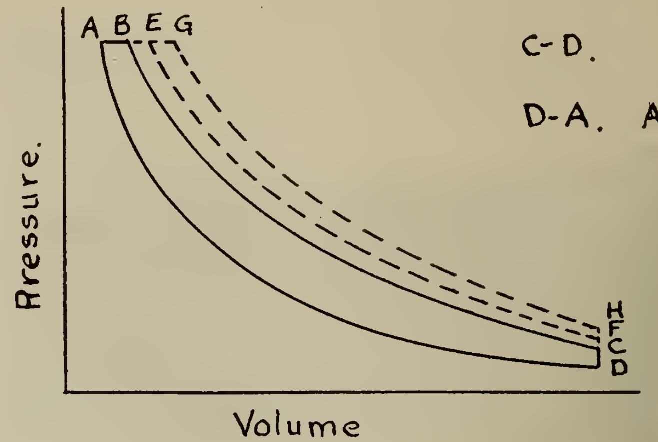
(3) *Shape of Combustion Chamber.*—This should have the smallest ratio of surface to volume, so that the cooling losses may be minimized. The ideal form is spherical, but this is not always easy to obtain.

(4) *Turbulence.*—The air and fuel should be moving as rapidly as possible to give the maximum opportunity for air and fuel particles to meet in a short time. This may be produced by:

- (*a*) A plunger on the end of the piston.
- (*b*) A projection on the piston head to direct the air flow.
- (*c*) Tangential fuel sprays which give a rotary motion to the air.

The small quantity of oil injected per stroke demands a rapid and accurate method of measurement. This quantity may be varied by:—

- (*a*) Variable stroke to the fuel pump.
- (*b*) Governor control for the suction valve of the fuel pump.



Diesel or Constant Pressure Cycle.

A-B Fuel burning at constant pressure.
B-C Adiabatic expansion of products of combustion.
C-D Rejection of heat at constant volume.
D-A Adiabatic compression.

Dotted lines E-F and G-H show effect of increasing the quantity of fuel injected. More work is done but more heat is rejected.

- (*c*) A valve to interrupt the delivery of oil from the fuel pump to the cylinder for a definite period.*

Methods of Injecting Fuel Into Cylinder

There are three principal methods used for injecting the fuel into the cylinder:—

(1) *Air Injection.*—This was the first method used and is still widely employed. As the compression pressure is about 450 lbs. per sq. in. the air pressure for injecting the fuel must be about 800 lbs. per sq. in. for low speeds and 1,000 to 1,200 lbs. for high speeds. The quantity of air used is about 6 per cent of the air in the cylinder, and its expansive action gives good atomization and turbulence. The adiabatic expansion of the air entering the cylinder, however, lowers the temperature about 100° F., and this makes firing difficult at light loads. As the temperature must be at least 700° F. for self-ignition, a higher compression pressure than would otherwise be necessary, must be used. Also the cost and complication of a three or four stage air compressor must be incurred, and the power absorbed by it reduces the mechanical efficiency of the engine.

(2) *Mechanical or Solid Injection.*—In this case a pump is used, giving a fuel pressure of about 9,000 lbs. per sq. in. In this case earlier injection of fuel is necessary, and a rise of pressure averaging about 100 lbs. per sq. in. takes place at the end of the compression stroke, but as a lower compression pressure is used, (about 300 lbs. per sq. in.), the maximum cylinder pressure is not greater than in the case of air injection. The mean effective pressure is about 25 per cent less, but on account of the greater simplicity of operation this method is superseding air injection in many of the modern engines.

(3) *Partial combustion* of the oil (as in the "Hvid" system) to inject the remainder of the fuel.

As in other internal combustion engines, the Diesel engines are divisible into four and two-stroke types. The latter gives about 70 per cent more work for the same cylinder dimensions and has a much simpler cylinder head, but the heat flow is greater and the efficiency rather less. The cylinder head of the four-stroke engine is very complicated, and unless very carefully designed and constructed, heavy casting stresses are liable to be set up. It is also difficult to cool on account of the large number of valves which have to be accommodated. It would appear that the two-stroke engine is more likely to be adopted in future for large powers.

Scavenging, or the removal of exhaust products, is produced by rotary blowers delivering air at about 5 lbs. per sq. in., and this, combined with supercharging, makes it possible to produce about 40 per cent more power per cylinder.

These and other refinements have contributed to the develop-

*This is a recent development described by Chorlton ("The High Efficiency Oil Engine") Proc. Inst. Mech. Eng., March, 1926.

ment of the engine for large powers, particularly in marine work, so that most of the new tonnage under construction is being equipped with internal combustion engines. A notable example is the "Asturias" which completed her maiden voyage a few months ago. This is a passenger liner of 22,500 tons displacement, and has two engines of 10,000 h.p. each. A large German engine produced during the war had an overload capacity of 3,200 h.p. per cylinder and an oil consumption of 0.44 lbs. per b.h.p. hour. The adoption of this type of engine for passenger marine work is the best proof of its reliability and freedom from breakdowns.†

With its perfection and adoption for large powers and its low fuel consumption, the Diesel engine promises to play an important part in power production, particularly in view of the fact that our fuel supplies are not inexhaustible, and that fuel economy will therefore become increasingly important in the future. Also, as the Diesel engine rejects its heat at a high temperature, the attainment of further economies by utilizing the exhaust and waste heat is very probable.

†At this point the author gave a description of several of the latest types of engine, including the Cammell-Laird-Fullagar opposed piston, Beardmore director valve and MacLagan sliding cylinder.

BOOK REVIEWS

Elementary Steam Engineering

E. V. Lallier, D. Van Nostrand Company, New York, 1926, 2nd ed. Cloth, 5¼ x 7¾ in., 288 pp., diagrs., $2.50.

This is the second and revised edition of a work first published in 1913 and written by E. V. Lallier, instructor in engineering, Hebrew Technical Institute, New York, and a professional engineer. The book is said to have been written to help both the theoretical man lacking practical experience, and the practical man lacking technical training, and it makes use of only the most simple formulas, and even these are not numerous.

Looking over the chapter headings one finds Heat, Formation of Steam, Fuel, Boilers, Boiler Calculations, etc., Engines with their Gears and Governors, Engine Calculations, etc., Pipes and Fittings, Auxiliary Apparatus, Packing and Lubrication, and finally Internal Combustion Engines—the latter scarcely coming under the category laid out in the title of the work.

In order to give an idea of the method of treatment adopted throughout, one of the chapters is selected at random, namely, that headed "Reciprocating Engines", which is covered by fifteen pages and nine illustrations. Starting with a description of the Corliss engine, the action of the cut-off gear and dash pot are explained, this being followed by a three-page description of the Unaflow Engine, which is all too brief. Four pages illustrate and describe the two types of compound engines, and the chapter closes with two pages on condensers. A list of fourteen questions is also given.

It will be seen that the treatment is extremely brief and elementary and the illustrations are very largely diagrammatic, instead of being taken from practice. The cuts are not particularly well made, but the book has a place in some schools and amongst men who wish information on steam engines in a very simple form. There are 116 figures.

R. W. Angus, M.E.I.C.

An Elementary Treatise on Statically Indeterminate Stresses

John Ira Parcel and George Alfred Maney. John Wiley & Sons, Inc., New York; Cloth, 6 x 9 in.; 368 pp.; Illus., $5.00.

Professors Parcel and Maney have done a conspicuous service to those who have to teach the analysis of statically indeterminate structures and to those who have to work up the subject by themselves, in their preparation of this volume. Few writers on this admittedly difficult subject have succeeded in approaching the clearness of presentation that characterizes the work under review. Undoubtedly, long experience in teaching and the knowledge of the particular points of difficulty encountered by students has enabled the authors to do their work exceedingly well. An incidental feature contributing interest to this reputedly dry subject, is the frequency of historical references and examples.

The volume opens with an effective exposition of the nature of statical indetermination and of the principle of consistent distortions. Chapters I to III, comprising more than one-third of the book, are given over to a presentation of the theory of elastic deflections and to a broad statement of the general problem of indeterminate stresses. It is not a one-idea presentation that is followed. While the general basic method for the treatment of deflections adopted by the authors is the method of work, it is recognized that this is not generally the shortest or most direct method for dealing with special problems, but that as a broad fundamental method for use in developing a comprehensive general theory, its advantages are conspicuous. Consequently, the authors have found it desirable to deal with the subject of deflections, not only with the Maxwell-Mohr method and that of Castigliano, but also by the special methods of moment areas, elastic weights and Williot diagrams.

Continuous beams and girders receive a somewhat brief but effective treatment in Chapter IV, and application of the theory discussed is made to a swing bridge. Special consideration is given to the subject of rigid frames, now rapidly growing in importance, Chapter V being devoted entirely to this subject. The slope-deflection method is considered by the authors as by far the most effective analytical instrument in the investigation of these problems and the method is used almost exclusively in this chapter. The elastic arch, both of the two-hinged and the hingeless variety, is discussed in Chapter VI. While the treatment is comparatively brief, it is nevertheless clear and effective. Secondary stresses form the subject of Chapter VII. Brevity and clearness here again go hand in hand.

Chapter VIII contains a general discussion of statically indeterminate construction, a historical review, and a bibliography. The authors here assemble for the reader a series of opinions of authorities as to the merits of statically indeterminate construction as compared with the statically determinate variety. The extraordinary divergence of opinion amongst authorities of equal standing is one of the most striking facts in structural engineering at the present time. The authors accept the notable conclusions of F. H. Cilley that there is no intrinsic economic advantage in statically indeterminate construction, but nevertheless hold that there are many cases where such construction can be profitably employed. They might have added the illuminating generalization stated recently by A. G. Hayden and Henry Babcock that where the deflection under the loading is less in the indeterminate structure than in the determinate one, the former will be more economical of material than the latter. This frequently occurs.

Careful perusal of the book shows that it is by no means so formidable as the reader might at first fear. It is after all not any advanced work with the difficulties that commonly accompany such, but is really an elementary treatise on the subject. As such, it is a particularly good one and one that should receive the hearty approval of both instructors and learners in this field.

C. R. Young, M.E.I.C.

Mathematical and Physical Papers

B. O. Peirce, Harvard University Press, Cambridge, Mass., 1926. Cloth, 6½ x 9½ in., 444 pp., illus., $5.00.

On looking over this series of papers by Professor B. O. Peirce, one cannot help being struck by the remarkable way in which the writer has brought to bear the skill of the accomplished mathematician, the wide knowledge of the physicist, and the practical outlook of the engineer.

The subject matter might be divided as follows:—

(a) Papers of a mathematical character dealing mainly with questions in potential theory;

(b) Papers bearing on the characteristics and design of instruments used in electrical and magnetic measurement;

(c) Papers dealing with practical questions of magnetic testing.

The two latter classes will appeal more particularly to readers of this Journal. The group of papers dealing with instruments includes the treatment of a number of questions of importance in accurate electrical measurements, such as the temperature coefficient and ageing of galvanometer magnets, the determination of the proper damping factor to be applied to ballistic galvanometer readings, and the theory and design of ballistic galvanometers of very long period, which are essential whenever the electrical impulse to be measured is not instantaneous. Among the papers on magnetic testing there are a number of studies of the magnetic properties of finely divided cores, on the building up of the current in electromagnet windings, as well as on the testing of various types of magnetic material ranging from pure Norway iron to hardened tool steels. Anyone interested in accurate testing and design will certainly find this volume a very useful work of reference.

Etienne T. Bieler.

Wasserkraft—Jahrbuch, 1925-1926

Richard Pflaum, Munich, 1926, Cloth, 6 x 9¼ in., 386 pp. Illus. and tables

The new edition of this annual maintains the standard set by the first issue, and while dealing more particularly with hydraulic engineering practice in Europe, contains papers which will be found of interest.

For example, an article on "Beauty in Engineering Works" gives an idea of the importance attached to appearance in European engineering practice, and its illustrations show the characteristic and usually pleasing effect that has been secured in the buildings and dams of many German and Scandinavian hydro-electric installations.

Among other contents may be mentioned useful data on the present status of water power development in various countries; articles on electro-metallurgical work, including the aluminum industry; on water measurement, surge problems, installations using runners of the Kaplan type, with some results obtained; and studies of the effect of draft tubes on efficiency.

Diesel Engines, Marine, Locomotive and Stationary

D. L. Jones. N. W. Henley Publishing Co., New York, 1926. Cloth, 6 x 9½ in., 565 pp., illus., $5.00.

This book is written on one of the most interesting developments going on at the present time in the power field, i.e., the application of the Diesel engine to transportation. The high thermal efficiency of the Diesel engine has been recognized for years, but like all new machines it required some time to develop it to the degree of reliability which is essential in a prime mover.

The author devotes the first chapter to a very elementary discussion of thermodynamics and in the second chapter describes the elementary principles of operation of the two- and four-stroke cycle engines. In chapter three the efficiencies of different types of gas engine and steam plants are compared. The next five chapters are used in describing details of construction of the engine and accessories, such as spray valves, fuel pumps, governors, fuel systems, valve gears, starting and reversing gears and lubrication. These things are discussed in a thoroughly practical way and the cuts used are excellent. In the next chapter is given a very complete description of the Diesel-electric drive for ships, together with some data on operating costs. A short chapter on the properties of lubricating and fuel oils follows, and then a chapter is devoted to marine rules for vessels propelled by Diesel oil engines.

The application of the Diesel engine to railroad service is described and an interesting comparison of the cost of operation of a Diesel electric and a steam locomotive given.

The book does not go far into the theoretical design of the Diesel engine, but will prove especially valuable to any one in charge of the operation of this type of prime mover.

This volume contains 565 pages, with many excellent illustrations and is published by the Norman W. Henley Publishing Company, New York City.

L. M. Arkley, M.E.I.C.

Canadian Engineering Standards Association

Reports of Recent Meetings and Conferences

Machine Screw Threads

Under the auspices of the Canadian Engineering Standards Association, a conference on Machine Screw Threads was held in Toronto on September 8th.

After considerable discussion it was felt that the situation with regard to machine screw threads in Canada could be greatly improved, especially in the reduction in the number of varieties of threads, and it was further felt that the carrying on of a campaign of education among customers would tend to gradually reduce variety in orders received. A small panel of the committee was formed to go further into the problem and prepare tentative data sheets to be used in the drafting offices of the various concerns interested, and on which would be shown the standard screw threads which would be stocked, all other threads being classed as special and their use gradually discouraged. Information from various company representatives will be collected and used in the preparation of these data sheets. The consensus of opinion was that the Canadian market could be met with a two-thread series, using a close fit tolerance, and it is hoped to prepare tentative data sheets on these lines.

Sheet Metal Gauges

The association have organized a committee in the sheet metal trade to discuss the question of simplifying sheet metal gauges. This committee had its first conference in Toronto on September 10th.

The discussion at this conference revealed the fact that the situation with regard to sheet metal gauges is very confused in Canada at the present time, owing to the fact that British and United States gauges are both used, also that appraisals for customs are made on Imperial Standard gauge, which differs from Birmingham gauge and also from United States gauge. There seemed to be no doubt but that it was in the interests of Canadian firms generally to conform to the United States gauge, this fact having been recognized by certain British manufacturers, who now make shipments of material rolled to United States gauge. A panel of the committee was appointed to go further into this question, and it is hoped before long to make practical suggestions for the simplification of the situation. The general feeling at the meeting was that an investigation into the situation was desirable and that considerable improvement could be effected.

Standardization of Power and Distribution Transformers

The Committee on Power Transformers held its third meeting at the headquarters of the Engineering Institute of Canada in Montreal on September 24th.

This committee was organized by the Canadian Engineering Standards Association to consider the drafting of standard specifications for single-phase and three-phase power transformers along similar lines to the specification for single-phase distribution transformers, issued by the Association in December, 1920. The committee was instructed at the same time to consider any suggested revisions to this latter specification. At the meeting in Montreal, reports covering a tentative specification for power transformers, from Mr. A. B. Cooper of the Ferranti Meter and Transformer Company, were received. Discussion at the meeting centred on the suggested revisions to the specification for distribution transformers, and a new draft was approved. The specification as issued had effected considerable improvement in the transformer situation, but experience in its use had suggested some revisions. When these revisions have been approved by the Association, it is proposed to issue a new edition of the specification, and it is believed that this revised edition will appeal particularly to consumers.

Revisions to Bridge Specifications

On September 22nd a meeting of the Joint Committees on Steel Railway Bridges and Steel Highway Bridges was held at the headquarters of the Engineering Institute of Canada in Montreal.

Consideration was given to revisions of specifications as issued by the Association in 1922. The chief items under discussion were the proposal to add a specification covering the use of silicon steel and drafting of new paint specifications. It was decided to abandon the specifications now used for the use of nickel steel and substitute therefor a specification for silicon steel. The question of a new paint specification was also considered and it was decided to work in co-operation with the Canadian Paint, Oil and Varnish Association. To that end it is proposed to organize a panel on paint, the membership to include representatives from the Canadian Engineering Standards Association and the Canadian Paint, Oil and Varnish Association, with the idea of endeavouring to formulate a specification which will meet with the approval of the manufacturers as well as the users.

The question of increasing the allowable unit stresses was considered and an increase from 16,000 to 18,000 pounds per square inch was suggested for the highway bridge specification. It was felt, however, that further study should be made before recommending any increase in the allowable unit stresses for railway bridges. A panel of the committee was appointed to look into this.

It was also decided that plates should be ordered by thickness only and not by thickness or weight, as stated in the specification now in use.

Another panel of the committee was appointed to gather together up to date information on live loads for highway bridges, with the object of making revisions in the load schedules now specified.

It is planned to issue a new edition of both the Railway Bridge and Highway Bridge Specifications, in which all these revisions will be incorporated.

BRANCH NEWS

Lethbridge Branch

N. H. Bradley, A.M.E.I.C., Secretary-Treasurer.

About thirty-five years ago a sixteen-year-old boy rode into southern Alberta on a load of baled hay. Alternately he had walked or ridden all the way from the state of Montana. It was a cold journey, snow was on the ground and many nights were spent on the prairie.

Ahead of him was the promise of his first job in his chosen profession. He was to be rear-chainman on a narrow-gauge line, the Turkey Trail as it was known then, under construction between Lethbridge and Medicine Hat. It is not related just what salary he received. The job was the big thing, and the boy thought so much of the opportunity that he was willing to walk 150 miles to get it.

The job was finished. The road was through. Years went by and the old Turkey Trail was forgotten. The little coal mining town of Coalbanks grew into the splendid city of Lethbridge. The old trail from Montana that had crossed a prairie strewn with buffalo skulls was now traversed with steel rails. Bumping hay wagons and bull teams were replaced by powerful locomotives. The rear-chainers who had wrought these changes were forgotten.

The sixteen-year-old boy went on to other fields. He saw opportunity in the wide reaches of the Pacific ocean. He discovered a faith in Canada's newest seaport. He went to Vancouver when it was young, grew up with it and developed a large machinery and towage industry. He took an active part in public affairs, sat in the council of his home town; was honoured with a seat in the legislature of his province; served as a soldier when Canada called to her men.

Thirty-five years—and then this rear-chainman of the yesterdays came back to southern Alberta. Came back this time as *Head* "Chainman." Members of his profession gathered to do him honour. Engineers young and old were grouped around the tables.

"Gentlemen," the Chairman said, "it is my privilege to introduce to you Major George A. Walkem, M.L.A., M.E.I.C., President of the Engineering Institute of Canada."

The Lethbridge Branch delighted in doing honour to Major Walkem when he passed through on his way to Philadelphia. His visit was rather unexpected. We had little advance notice, but nevertheless forty sat down to the dinner in his honour on Saturday night, September 25th.

The Major has been with us before. On the last occasion he came with our Charter. In the light of what we have since learned of his earlier connection with Lethbridge, it was peculiarly appropriate that it should have been from his hands that Lethbridge was officially enrolled in the brotherhood of the Institute.

We promise to the Major that if he will visit us again we will put on a real celebration.

Niagara Peninsula Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

The first meeting of this season was celebrated on Saturday, September 25th, in a somewhat moist manner. In provinces other than Ontario there might be two meanings to that statement, but in this case the moisture was caused solely by water.

The itinerary included visits to the new filtration plants of both St. Catharines and Welland. The steady downpour of rain was incidental and due, it is understood, to a slight underestimation of their powers by the executive.

Unfortunately, the St. Catharines station is on a by-way and the road became impassable. Chairman Alex. Milne, A.M.E.I.C., who is also manager of the Water Commission, sent one of the Commission's cars over the trail in the morning and the driver reported an average speed of one m.p.h. It was a good car, too, when it started. That trip was cancelled. The main highway, however, was in fair condition, so the party met at the Welland pumping station about 4.30 p.m.

The new wing was the centre of interest. It contains the sand filtration beds, alum run and precipitation tanks, as well as the most modern recording gauges and operating controls.

After listening to expressions of approval for some time, Mr. Milne glanced out to make sure that it was still raining and then remarked that he was sorry we couldn't have seen his plant.

Of some interest also were the two old-fashioned turbine driven, horizontal, triplex pumps, very few of which are in operation on this continent. The superintendent, a most practical man, is enthusiastic about them. "You don't have to touch them at all," he says, "just let them run."

It was unfortunate that Willis Chipman, M.E.I.C., the designer, could not have been present to explain his handiwork, particularly as there seems to have been some delicate problems in the foundation work, but in his absence Mr. Milne did the honours.

The dinner was excellent. Afterwards Messrs. Sam Lambert and F. W. Barley essayed a piano duet and then Professor E. A. Allcut, M.E.I.C., of Toronto, gave a most agreeable dissertation on the merits of the Diesel engine—even that, it appears, is water cooled.

In moving the vote of thanks, E. G. Cameron, A.M.E.I.C., and E. P. Johnson, A.M.E.I.C., expressed the feeling of the meeting by saying that an abstruse and technical subject had been handled in such a clear manner that even the casual engineers were able to grasp the details.

Visit of London Branch

Members of the London Branch motored to and through the Niagara Peninsula on Saturday, October 2nd. The trip was arranged by W. P. Near, M.E.I.C., who, before going to London, was city engineer of St. Catharines.

As the primary object was to see something of the Welland ship canal while in process of construction, the party proceeded to lock No. 1 and Port Weller harbour at the lake Ontario end and from there drove along the canal to the large double flight locks at the escarpment.

In common with most other engineers and laymen who have visited this district, they expressed their surprise at the magnitude of the work. "One hundred and thirty feet straight drop from the top of this lock to the bottom of the lock below? Why! That's incredible. How many cubic yards of concrete are there in the whole works? I would certainly like to get a contract for something like this." "Yes," his friend queried, "and have to put up about a million dollars security for a bond?" Finis.

After dinner that evening A. W. L. Butler, A.M.E.I.C., of the ship canal staff, gave a short talk on various features of the canal illustrated by lantern slides, after which the party drove to Niagara Falls to witness the illumination.

The following day was taken up with that section on the lake Erie level between the escarpment at Thorold and Port Colborne, and also in visiting the St. Catharines water filtration plant at DeCew Falls.

E. G. Cameron, A.M.E.I.C., assistant chief engineer of the Welland ship canal, and several of the staff accompanied the party and were sorely pressed at times to give accurate answers to the many questions that were asked.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

Visit to Gatineau Power Developments

The two great power development projects of the Canadian International Paper Company of Canada, known as the Gatineau Power Company, at Chelsea and Farmers Rapids, are rapidly nearing completion.

Members of the Ottawa Branch of the Institute, numbering nearly 350, with ladies and prominent engineers from all parts of eastern Canada, who, through the courtesy of the International Paper Company, were the guests of the Fraser Brace Engineering Company at the Chelsea plant on Saturday afternoon, October 16th, were frankly astonished at the progress which has been made in such short time.

The first sod was turned in November last year, and yet the visitors, who were afforded every possible facility for viewing the huge development work, saw the power houses nearing completion, while the dams in each case are across the river and only await the filling-in process prior to the fitting of the sluice gates.

The visitors, headed by J. D. Craig, M.E.I.C., chairman of the Ottawa Branch, assembled at Parliament Hill at 12:45 noon and thence motored to the Chelsea plant of the International Paper Company.

Met at the plant by Major J. H. Brace, M.E.I.C., G. Gordon Gale, M.E.I.C., general manager of the Gatineau Power Company, A. H. White, M.E.I.C., chief engineer of the International Paper Company, and a host of other officials of the International and Fraser Brace companies, the visitors were ushered into the big dining room of the company, where the inner man was amply refreshed by a meal which was as excellent in quality as it was surprising.

Following luncheon Mr. Craig, who was in the chair, in a few well chosen words expressed, on behalf of the visitors, their appreciation of the privilege accorded them in the visit to the plant, and the fine hospitality of their hosts. Mr. Craig struck a responsive chord among his hearers when he urged that the developments of the International Paper Company should be looked upon as a local rather than an outside enterprise. "I feel we are quite right in taking this attitude," said Mr. Craig, "in view of the fact that an Ottawa engineer, a past-chairman of our branch, is the general manager of the Gatineau Power Company. I am sure that there are few in Ottawa who realize the magnitude and importance of these developments in their application to the future of the Capital of Canada and the Dominion as a whole."

Chief engineer A. H. White, M.E.I.C., of the International Paper Company, then delivered an interesting address in which he outlined the development, paid a tribute to Major J. A. Brace for his genius in construction and engineering, and said the company was to be congratulated in the choice of Mr. Gale as the general manager.

Major Brace, called upon to speak, belittled his own accomplishment, furnished some figures with regard to specifications for the two big plants, outlined the proposed trip, and paid a tribute to the genius and good engineering sense of Chief Engineer White, which, he stated, he had never seen equalled. Major Brace informed the visitors that the first of the five power units to be installed at the Chelsea plant will be in operation by January first next year, while the wheels of the Farmers Rapids plant will likely begin to revolve early in March. He submitted figures showing what construction materials has gone into the two plants since they were started a year ago and up until October first, 1926: At the Chelsea plant 110,730 cu. yds. of concrete, 3,260,000 lbs. reinforcing steel, 1,810,000 lbs. structural steel have been placed, and 136,050 cu. yds. of rock and 63,350 cu. yds. of earth excavated; at Farmers Rapids, 107,804 cu. yds. concrete poured, 2,320,000 lbs. reinforcing steel and 112,030 cu. yds. rock and 73,900 cu. yds. earth.

Leaving the luncheon room the guests were taken by Major Brace and a number of his officers, including Superintendent Morris, on a sightseeing trip.

Work has already been started and is well under way at the Paugan Falls project of the International Paper Company in Low township, where five hundred men have built permanent camps and are at work. The primary power to be produced at this plant will be 200,000 h.p. All three plants will be inter-connected.

Those who had been on the trip to the plants in May last with the Technical Electric Association were very much surprised at the great progress which has been accomplished during the past six months, and expert opinion was that the completion of two plants of such magnitude in little over a year is an engineering and construction feat worthy of note.

Peterborough Branch

W. E. Ross, A.M.E.I.C., Secretary.
B. Ottewell, A.M.E.I.C., Branch News Editor.

Visit to Sewage Disposal Plant

The first meeting of the season took the form of a visit to Peterborough's new disposal plant on September 22nd, 1926, the occasion of its formal opening by Mayor W. T. Holloway. This was arranged through the courtesy of R. H. Parsons, M.E.I.C., city engineer, who has been responsible for the design of this plant, which is of the activated sludge type. The equipment is of course electrically operated, the blowers, pumps, etc., being driven by induction motors.

Following the visit the party gathered at the cottage of one of the members on the Otonabee river and indulged in "hot dogs," "golden bantam" and coffee, around a bonfire.

Peterborough's Sewage Disposal Plant

The system adopted for the disposal of the sewage is that known as activated sludge. This consists essentially of a prolonged aeration and agitation of the sewage followed by a settling of the solids. The design provides for return of the effluent to the Otonabee river and the disposal of the sludge by lagooning.

The whole plant is designed to dispose of a maximum of 6,000,000 Imperial gallons of sewage per day with a maximum hourly flow of one-eighteenth of the above. The average flow at the present time is about 3,500,000 Imperial gallons per day.

Under this system the sewage will be conveyed from the chamber at the foot of Park street through two eighteen-inch cast iron pipes under the Otonabee river to the pumping sump at the sewage disposal site.

From the sump, sewage is raised by means of pumps and conveyed to aerating tanks. The electric control will be so arranged that as the flow of sewage increases and the sewage level in the sump rises, the pumps will be automatically put into operation, and as the sewage level falls they will be cut out.

The aerating tanks are divided into two independent units with two independent sludge re-aerating tanks between them. The capacity of the aerating tanks is 119,000 cubic feet. This is based on a two-hour detention of the maximum flow plus an allowance for sludge returned. The two sludge re-aerating tanks located between the sewage aerating tanks are entirely independent of each other and each has a capacity of 8,200 cubic feet.

There are two settling tanks with a combined capacity of 113,000 cubic feet. This allows a settling period of about two hours during the time of maximum flow. These settling tanks are equipped with sludge concentrating devices which consist essentially of revolving arms equipped with vanes moving in a circular direction close to the bottom of the tank. The vanes are set at such an angle that the sludge is slowly pushed down into the sump at the centre of the tank. From this sump the sludge is either returned to the aeration tanks or drawn off to the lagoons.

There are about 560 square feet of air diffusing plates in each aerating tank and about 112 square feet in each sludge re-aerating tank. These plates are set in containers and piping is so arranged that the plates can be taken out in short sections even when the tanks are in operation. The ratio of plate area to the total surface area in the sewage aeration tanks is approximately 1 to 10 and in the sludge re-aerating tanks about 1 to 7.5. Air is supplied to the under side of the plates under a pressure of about ten pounds through a system of wrought-iron pipe.

The compressed air is supplied by three blowers each direct connected to a slow-speed motor. The total capacity of the three blowers is 5,400 cubic feet of free air per minute or 7,776,000 cubic feet per day against a pressure of ten pounds per square inch. This is at the rate of about 1.3 cubic feet per gallon when all three compressors are working. With the capacity of the tanks as designed, one of the compressors acts as a stand-by.

Sludge for the sludge re-aerating tanks is raised from the bottom of the settling tanks by air lift pumps. The excess sludge is drawn off into lagoons for final disposal until such time as a more efficient method is discovered.

The pump house is a brick structure and houses the pumps and motors for raising the sewage to the tanks and also the compressors and motors for supplying air under pressure to the aerating tanks.

Regular Meeting, October 14, 1926

With recollections of the fine address given by Wing Commander E. W. Stedman, M.E.I.C., last year, members were not slow to respond to the invitation to another paper on the work of the Royal Air Force. In introducing the speaker, Flight Lieutenant T. A. Lawrence, the chairman, B. L. Barns, A.M.E.I.C., referred to the splendidly illustrated article by another officer of the Royal Canadian Air Force in the current National Geographic Magazine. Lieutenant Lawrence gave a most interesting talk, describing in a clear and concise way the formation of the Force, the work carried out at the various stations and the value of this work to the country.

The speaker referred to the fact that it was twenty-three years ago that the Wright brothers flew the first aeroplane, and since then aeronautics have passed through a period of very rapid progress. From 1903 to 1908 things went along slowly, but from 1908 to 1914 a quickening in the pace of air flying was seen and by 1914 there was already under way an attempt to fly the Atlantic, but, with the war, civil aviation came to an end, for up to that time it had been more of a sporting venture. By 1919 it was beginning to take the form of a commercial enterprise.

Since then aviation has had a hard struggle, for the promoters forgot to take into account that the people had to be educated to commercial aviation and that it was a very expensive means of travelling. So they had to find other ways of employing the air force and in Canada a way soon presented itself in the form of patrolling the forests and making photographic surveys.

The speaker then described the Air Force and its various departments. Today there are stations at Vancouver, High River, Winnipeg, Halifax, Ottawa and Camp Borden. The first station after the war was Camp Borden and the equipment used had been left by the American force which had been patrolling the eastern coast in war days at Halifax. There was no intention of having the force a military one at that time, but in 1922 the Government put the force under the Minister of National Defence and all stations commenced to operate on a military basis, which has proved a great help. All the air craft now used have been built to Canadian designs. All aviators have a certificate and the air craft have to be examined once a year.

Lieutenant Lawrence then showed, by a fine series of slides, the work the force does and the different air stations. Many of these had been taken in the air and were very interesting.

It was explained by the speaker that in the cruising of the woodlands, forestry officers have been able to estimate the number of feet of lumber just as exactly as they could by cruising the wood lot on foot, doing in two hours work which would take three weeks on the ground.

The Halifax station was left after the war by the Americans and the chief duty of this station is to take aerial photographs. Roberval station, in the lake St. John district, was one of the first forest patrol stations, but to-day it is being run by the Quebec Government. Ottawa is the head operating station and has four machines for photographic work and one for the use of the department. At present these machines are doing a great deal of work in the Rouyn district. It is at this station that all new experiments are tried out.

Winnipeg is the largest Canadian station and has five sub-stations. The chief duty is forest patrol. Forest fires are discovered by small machines with one passenger and these report the fire by wireless to the station and here a larger machine starts out equipped with a pump and 1,000 feet of hose. Of the 200 fires which have been discovered this year in the district surrounding these stations, all have been successfully suppressed. They also do much photographic work at these stations for the department in Ottawa.

At the High River station in Alberta there is the most difficult and dangerous flying, and each machine in this station is equipped with a parachute. This station patrols the valleys and the forests of that country.

The Vancouver station is for sea flight training, fishery patrols and for acting as escorts to the ships coming in from the Orient so as to prevent the throwing over of opium and other narcotics to smaller boats as the ship nears land. In the Province of Ontario the Department of Forests has its own machines for patrolling and fire fighting.

Visit of the President, October 16, 1926

The branch was honoured by a visit from the president of the Institute, Major Geo. A. Walkem, M.L.A., M.E.I.C., on Saturday, October 16th. In the afternoon he inspected the plants of the Canadian General Electric Company and Wm. Hamilton Limited, and in the evening was entertained at an informal dinner at the Empress Hotel, about 35 members being present.

A most cordial welcome to the city was tendered him by Mayor W. T. Holloway, E. A. Peck, M.P., and B. L. Barns, A.M.E.I.C., branch chairman.

Major Walkem gave a most interesting address, dealing with his recent trip to eastern Canada. The rapid development of the Saguenay district came in for special mention, in particular the great plant of the Aluminum Company of Canada, at the new city of Arvida. He will have visited all the branches, except three, and took his hearers across Canada mentioning the characteristics and activities of each branch in turn.

A number of those present were from British Columbia and by special request Major Walkem described the natural resources and outstanding engineering developments of that province. He also spoke on the subject of student prizes, a proposal being under consideration at the present time for an increase in the number and value of these prizes.

At the conclusion a hearty vote of thanks, tendered Major Walkem by A. L. Killaly, M.E.I.C., was enthusiastically approved by those present.

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

Visit to Cable Ship "Restorer"

On September 18th the Victoria Branch members were able to enjoy an unusually interesting visit, on the invitation of Captain Livingston, to the Commercial Pacific Cable Company's ship "Restorer."

Some fifty members and friends, including a good number of ladies and young people, gathered at the Ogden Point docks and at 3 p.m. were welcomed by the Captain aboard ship. Splitting up into several parties, one led by the Captain, the others by officers of the ship, a tour of inspection was made of the main deck.

The "Restorer," constructed at Newcastle-on-the-Tyne in 1903, is a vessel of 3,180 gross tons, with a length of 377 feet over all, beam 44 feet and draught 21 feet.

Samples of the grapnels that were used in getting hold of the cable in order to raise it for repairs had been laid out on deck and were of interesting variety, four-pronged, chain-link, umbrella automatic, etc., according to the type of floor, rock, coral or sand, on which the cable lay. The locating of the cable itself in the waters of an ocean such as the Pacific is a matter of considerable trouble, and is solved not only by the application of scientific means as to the exact position of the ship by latitude and longitude, but by that happy intuition that some men have in every line of endeavour, and that Captain Livingston is reported to possess in the matter of locating cables.

The location of the break in the cable having been found as closely as possible by use of a Wheatstone bridge or a Kelvin galvonometer, the "Restorer" proceeds to the spot indicated and prepares for work.

The deck of the ship is carried a considerable distance ahead of the bow, and looked at from the side appears somewhat like a crane. At the forward end are three sheaves, over the centre one of which is run the rope to which the grappling iron is attached. The depth, which is known at every point along the whole course of the cable, is first checked by a sounding line, and the ship then steams at right angles to the line of cable, a close watch being kept on the dynamometer, which indicates the pull on the rope. Should the prongs catch in rock the pull would greatly increase, and experience soon teaches when it is the cable that is hooked.

At a depth of a mile or so and, incidentally, Captain Livingston mentioned having assisted in repairing a break that occurred at a depth of 3,032 fathoms, or 18,192 feet, the small percentage of give in a cable precludes it being raised to the surface, and it is necessary to cut it, bringing the ends to the surface in turn. For this a patent grapnel is used that, after hooking the cable, twists it into a position to be tightly gripped. As the progress of the ship increases the pull, a bolt with a weakened section breaks, releasing a pair of jaws that shear the cable, and the end tightly held is drawn to the surface. The knives are so arranged on the jaws that the cable is automatically cut on whichever side of the grip is desired. Both ends having been secured and buoyed, the distance to the break is tested and calculated by the electrical department, a new length of cable is spliced in and the cable relowered.

The ship contains four cable tanks, and inspection of one of these showed a considerable mileage of cable lying in some seventeen feet of water, which is changed every week in order that storage conditions may approximate to final working conditions, the cable lasting must longer when kept from exposure to the air.

The drums and machinery by which the cable is fed, either in or out of the ship, were fully explained, and the job of walking round and round the 33-foot diameter tanks to guide the incoming cable in ever-increasing or diminishing circles was recommended as a unique form of exercise.

To the uninitiated the engine-room, with its height and depth and narrow open-barred gangways and ladders, seemed a great maze of pipes, rods and engines. The twin screws are driven by 4,500 I.H.P. engines, steam being raised by oil-fired boilers, the oil being heated to 200° Fahr. before being fed to the furnaces.

The stern of the vessel is constructed for the laying of cable; drums, dynamometers, and roller guides being duplicated on each side of the deck to carry the cable from the tanks. Among many other interesting things was a row of various devices used in sounding, by which samples of the bottom formation could be obtained. Captain Livingston explained the necessity for running a survey line, and obtaining a profile of the bottom, and some knowledge of its formation before a cable was laid, in order to avoid deep holes, sharp ridges, or precipices of a thousand feet or more, giving as an example the way the cable was brought round the north end of the Island of Guam to a point on the western shore to avoid an area to the east known as the Nero Depth, that is some 5,269 fathoms, or 31,614 feet deep.

The officers' quarters occasioned much interest, also the large batch of bread fresh from the oven; while the ladies and, it is believed, a good many of the men, too, can testify to the excellent pastry, cake and tea that were provided for their refreshment.

It was with a good deal of regret to many that the time came to leave, for there was so much of interest, one bit of knowledge gained creating a thirst for more; and it was with the hearty endorsement of all who shared in the visit that the branch chairman, J. H. Anderson, A.M.E.I.C., expressed the thanks of the members to Captain Livingston and his officers for making such an interesting visit possible.

It was noted with pleasure that some of the less frequently seen members of the Branch were in evidence.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

A regular meeting was held on September 24th, 1926, in the Y.W.C.A. rooms following a dinner.

Vice-Chairman G. H. Kohl, A.M.E.I.C., called the meeting to order and the general business was first dealt with. A letter was read from President Walkem saying that he would be unable to visit the branch this fall. The members all expressed their regret at this as they had looked forward with pleasure to having him with us again.

The following were appointed members of the Nominating Committee: F. Smallwood, M.E.I.C.; R. A. Campbell, A.M.E.I.C.; H. A. Morey, A.M.E.I.C.

As this was the first meeting after the summer months, C. Stenbol, M.E.I.C., chairman of the Papers Committee, was unable to get a speaker, but he promised a real live one for next meeting. A general discussion of engineering, fishing, and other problems was carried on by the members.

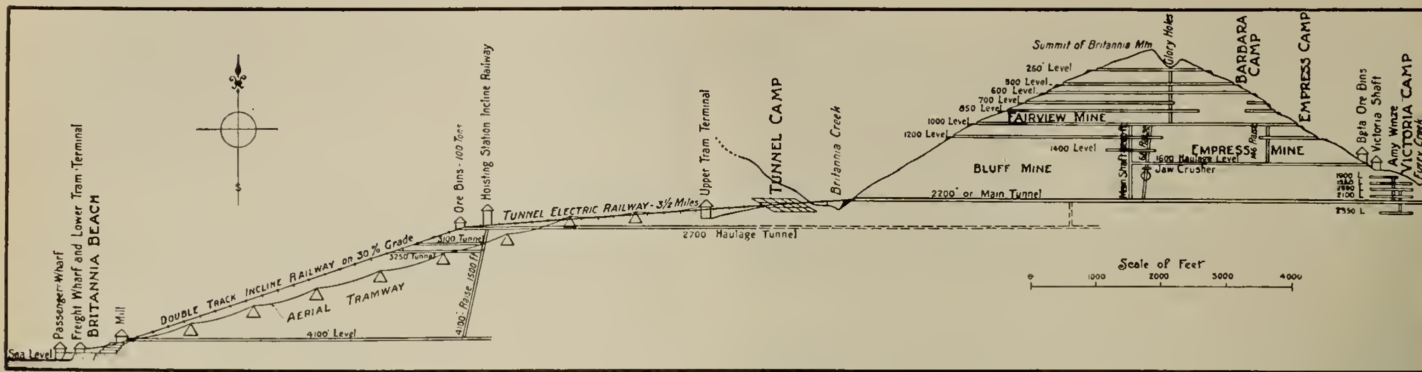


Figure No. 1.—Section of Britannia Mine.

Vancouver Branch

E. A. Wheatley, A.M.E.I.C., Secretary-Treasurer.

Inspection of Britannia Mine

A party of ninety engineers, being members of the Vancouver Branch of the Institute, together with some members of the Vancouver section of the American Institute of Electrical Engineers, and some members of the Association of Professional Engineers, made a trip of inspection to the Howe Sound Mining Corporation at Britannia Beach, B.C.

The day was glorious and the party embarked on the new steamer "Lady Cynthia" of the Union Steamship Company at 9 o'clock and proceeded up the coast to Howe Sound. They were met at the mine by Mr. C. P. Browning, E.M., (Columbia).

The party then divided, some seventy members going by electric railway to the Upper or Mine camp, where Mr. J. I. Moore, Jr., superintendent of the mines, took charge of the party and acted as their host. Mr. Browning took charge of the lower party of some twenty.

Flow sheets of the concentrator and a sectional drawing of the mine were handed to all the party, and in each case a short explanation was given.

A luncheon was then held which was provided by the company. As usual, the table groaned under the good cheer provided.

The thanks of the concentrator party was voiced by H. B. Muckleston, M.E.I.C., and was replied to by Mr. C. P. Browning.

The mine camp party had as their speaker the chairman of the branch, W. H. Powell, M.E.I.C. Mr. Powell conveyed the thanks of the Institute, and his remarks were replied to by Mr. J. I. Moore, Jr.

The mine and the concentrator were then closely examined, the party breaking into smaller numbers with a technical guide provided in each case. The concentrator party were fortunate in having the advice of Mr. O. Wiser, the consulting metallurgist of the company. Some of the difficulties which the company have met and have overcome were explained by Mr. Wiser and his technical assistants.

The party re-embarked at 4:30 o'clock, after which refreshments and a concert party under the masterly direction of A. E. Foreman, M.E.I.C., with Mr. H. L. Lloyd at the piano, enlivened the return to town.

A vote of thanks was passed to the executive of the branch for a most enjoyable and successful day.

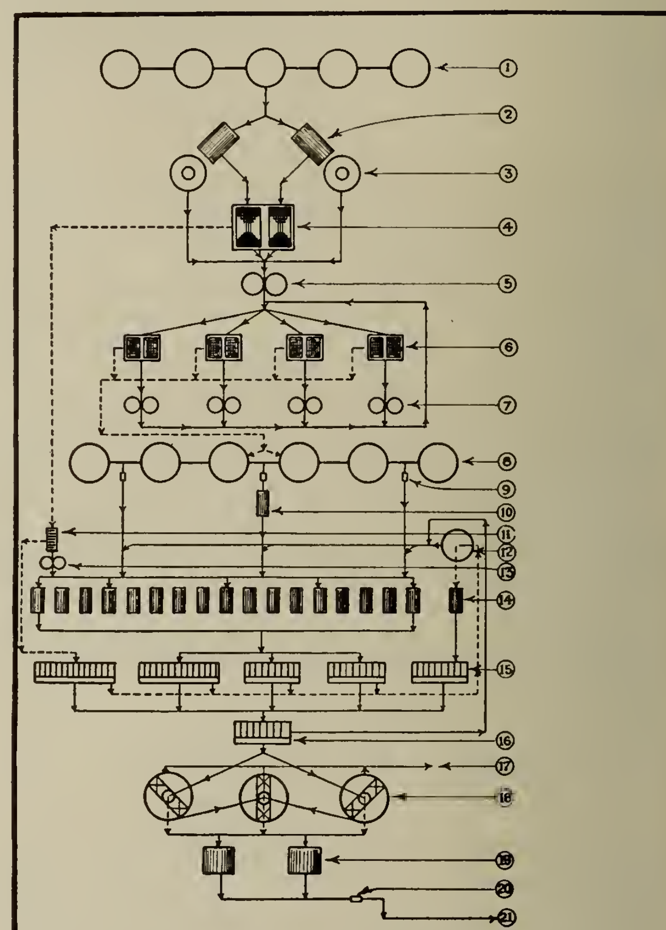


Figure No. 2.—Flow Sheet No. 3 Britannia Mill.

1—Five 500-ton Coarse Ore Bins.
2—Two sets of 7' Grizzly Bars.
3—Two 7½ K-Gyratory Crushers.
4—Four Washing Screens.
5—One set 72" x 20" Traylor Rolls.
6—Eight Hammer Dry Screens.
7—Four sets 54" x 20" Traylor Rolls.
8—Six 600-ton Fine Ore Bins.
9—Three Merrick Weightometers.
10—One Roller Rod Mill.
11—One 7' x 10' Drag Classifier.
12—One 20' Dorr Thickener.
13—One set 42" x 16" Rolls.
14—Eighteen 7' x 10' Traylor Mills, each with 3' x 20' Simplex Dorr Classifier in Closed Circuit.
15—Three 14 and two 21-Cell M.S. Roughers.
16—One 14-Cell M.S. Cleaner.
17—Overflow to Waste.
18—Three 44' x 14' Dorr Thickeners.
19—Two 6-Leaf American Filters.
20—Concentrates Weightometers.
21—Concentrates to Storage.

Preliminary Notice

of Applications for Admission and for Transfer

October 19th, 1926.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in November, 1926.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BUSS—PAUL E., of Thorold, Ont., Born at Three Rivers, Mich., Aug. 31st, 1891; Educ., chem. and mech. engrg., Univ of Michigan, 1916 (3 yrs.); 1917, constrn. engr., Provincial Paper Mill, Port Arthur; 1918-19, 33rd Engrs. A.E.F. on docks, rys., lines of communication; 1923, mech. dftsman, Dom. Engrg. Works; 1924-26, plant engr., Provincial Paper Mills Ltd., Thorold, Ont.

References: R. W. Downie, C. H. Scheman, H. L. Bucks, T. L. Crossley, J. Sears.

CRAIG—SHIRLEY ABBOTT, of Hamilton, Ont., Born at Ottawa, Oct. 23rd, 1904; Educ., B.Sc., McGill Univ., 1926; at present, employed by Canadian Westinghouse Co., Ltd., on student engrg. course.

References: C. V. Christie, H. M. MacKay, E. G. Burr, C. M. McKergow, E. Brown.

HOBSON—ARTHUR JOHN, of Lumby, B.C., Born at London, Eng., Nov. 23rd, 1880; Educ., B.A. 1904, M.A. 1919, Oxon, England; S. African War, 1899-1901; Gt. War R.F.A. (M.C.); 1906-08, pupil on Great Northern Ry.; 1908, passed all papers for A.M. Inst. C.E., inc. hydraulics; 1908-13, on Great Northern Rly. as res. engr. at Brodsworth Colliery Rly., 2 miles, Tickhill Light Rly., 8 miles, Kirkstead Rly., 15 miles; 1908-11, asst. div. engr., Western district, including 2 canals; 1919, came to Canada; at present, settled under Soldier Settlement Board.

References: J. C. Dufresne, F. H. Latimer, F. W. Groves, H. H. Gahan, W. K. Gwyer.

O'HARA—GEORGE DENNIS, of Vancouver, B.C., Born at Walker, Ky., Nov. 28th, 1877; Educ., B.Sc., Princeton, 1898; 1899-1901, E. W. Bliss & Co., Brooklyn, N.Y., 18 mos. apptceship, 6 mos. shop foreman, 11 mos. master mech.; 1904-12, Utah Petroleum & Oil Refining Co., 3 mos. as master mech. after that i/c plant; 1912, raising the U.S.S. Maine in Havana, asst. engr.; 1913-14, designing and research engr. for Sir William Mackenzie, research work was for utilizing of waste products, designed and placed in operation a reduction plant to utilize the waste from fish plants; 1914-18, with Engrs. in France; 1918-25, consulting engr. with office and laboratory in San Francisco; at present, engagements pending in Vancouver, establishing various plants for fish reduction, and erection and design of lumber and pulp plants on Vancouver Island.

References: E. A. Wheatley, N. P. Cotton, W. B. Greig, A. G. Graham, R. P. Wilson.

PARKER—CHARLES ALEXANDER, of Montreal, Que., Born at Ottawa, May 28th, 1898; Educ., B.Sc., McGill Univ., 1922; 1922-23, elect'l. engr., Brown Corp., LaTuque, Que.; 1916-19, Lieut. Can. Engrs. C.E.F.; at present, English Electric Co. of Canada.

References: C. V. Christie, E. Brown, J. W. Anderson, J. H. McLaren, C. McKergow.

SILCOX—CLIFFORD HENRY, of Pembroke Dock, Wales, Born at Pembroke Dock, Dec. 9th, 1889; Educ., County School, Pembroke, and H.M. Dockyard School; 1906-12, marine engrg. apptce. in H.M. Dockyard, Pembroke; 1912-14, marine engrg. drftsman, Vickers Ltd.; 1914-20, sr. dftsman, submarine dept., Swan & Hunters; 1920-23, sr. marine dftsman, Northumberland Shipbuilding Co.; 1923 to present, asst. engr. survey, Gold Coast Rly.

References: L. E. Silcox, E. H. Hunt, E. G. Richards, A. G. Graham, G. Sproule.

FOR TRANSFER FROM ASSOCIATE MEMBER TO MEMBER

PETERS—HUGH, of Esquimalt, B.C., Born at Victoria, B.C., Aug. 21, 1890; Educ., graduated R.M.C., 1910; 1910, topographer, C.N.R. surveys, Vanc. Island; 1911, asst. engr. marine dept., Victoria; 1912, asst. to supt., Pacific Coast Constrn. Co., Victoria; 1913-15, asst. to dist. engr., Dom. Public Works; 1915-19, War service with Pioneers and Railway Troops; 1919-21, jr. engr., Dom. Public Works, Victoria; 1921-26, asst. engr. with same department.

References: A. E. Hodgins, J. P. Forde, A. F. Mitchell, F. C. Green, E. E. Brydone-Jack, K. M. Cameron, F. H. Peters, G. B. Mitchell.

WOLFF—A. OSCAR, of Brownville, Jct., Me., Born at Copenhagen, Denmark, May 14th, 1889; Educ., private tuition, I.C.S. grad. in civil engrg.; 1908-12, transitman on general rly. mtce. and constrn. with C.P.R.; 1913-15, i/c field work, etc., Windsor St. yard improvements, asst. engr.; 1916 to date, resident and division engr.

References: J. M. R. Fairbairn, J. W. Orrock, A. C. Mackenzie, J. E. Armstrong, C. C. Kirby.

FOR TRANSFER FROM JUNIOR TO A HIGHER GRADE

CUNNINGHAM—ADAM, of Riverbend, Que., Born at Edinburgh, Scotland, Aug. 23rd, 1897; Educ., B.Sc., Univ. of Edinburgh, 1923; 1913, for 5 yrs. apptce. with West End Engine Works Co., Edinburgh; 2 yrs. 8 mos. in Imperial Army in Palestine and Egypt in technical unit; mech. staff sergt. i/c of sect. of base heavy repair dept., Alexandria; 1923-24, Mactaggart Scott & Co., Scotland, on design of hydraulic gear, cranes, etc., for the British Admiralty; 1924 to present time, with Price Bros. & Co. Ltd., in record dept. Kenogami paper mills for 8 mos., since then asst. to mech. supt. at Riverbend paper mill, supervision of steam plant, repair shops and general mtce. work, design and erection of paper mill equipment.

References: A. A. MacDiarmid, W. G. Mitchell, G. E. Lamothe, C. N. Shanly, G. F. Layne.

FOR TRANSFER FROM STUDENT TO A HIGHER GRADE

ELLEGETT—HENRY VICTOR, of Toronto, Ont., Born at London, England, Dec. 8th, 1898; Educ., concrete engrg. I.C.S.; 1923, tracer, jr. dftsman., Dom. Bridge Co., Winnipeg; 1924, asst. dftsman special boiler work, Dom. Engrg. Co., Winnipeg; 1925, supervisor reinforcing steel, Son Valley Sewage disposal plant, H. A. Wickett Co.; at present, tech. supervisor of reinforcing steel for Goldie Constrn. Co., Danforth Park sewage disposal plant.

References: E. C. Goldie, R. O. Wynne-Roberts, L. W. Wynne-Roberts, L. F. Grant, F. P. Fleet.

GREENWOOD—WILLIAM, of New Liskeard, Ont., Born at Toronto, Ont., Mch. 2nd, 1898; Educ., B.Sc., Queen's Univ., 1922; 1920 (summer), rodman and instman., Geol. Survey of Canada; 1921 (summer), topographer for Ont. Dept. of Mines; 1922 (summer), asst. geologist, Ont. Dept. of Mines; Nov. and Dec. 1922, instman. for Ont. Dept. of Highways, as asst. engr. on highway constrn; 1923-25, i/c field party on survey work in Peru, S.A., doing precise triangulation, boundary surveys, railroad location, etc.; 1926, i/c surveys for Int. Petroleum Co. in Peru, S.A., this inc'd. supervision of two to three field parties.

References: A. A. Paoli, W. F. Noonan, C. B. Bate, H. C. Cochrane, L. Malcolm.

GRENZEBACH—SYLVESTER LESLIE, of Toronto, Ont., Born at Tavistock, Ont., Nov. 26th, 1892; Educ., B.A.Sc., Univ. of Toronto, 1924; 1914-17, running threshing outfit with gas engine expert work as side line; 1923, 4 mos. and 1924, 6 mos., power station constrn. work; Dec. 1924 to present, load supervising engr., Toronto Hydro-Electric System, supervision of all switching operations on the Toronto Hydro system.

References: R. W. Angus, C. R. Loudon, J. R. Cockburn, C. R. Young, C. H. Mitchell.

MACNAUGHTON—MORAY FRASER, of Westmount, Que., Born at Westmount, Apl. 8th, 1899; Educ., B.Sc., McGill Univ., 1922; M.S., Univ. of Mich., 1924; 1915-1916, testing of materials and general laboratory work, Milton Hersey Co.; 1917-19, overseas with R.C.H.A. brigade signals; 1920 and 1922 (summers), inspector, paving dept., Milton Hersey Co.; 1923-24 (winter), Roy D. Chapin fellow in highway engrg., Univ. of Mich.; 1923-24 (summers), ch. inspector, paving dept., Milton Hersey Co.; 1925 to date, employed by Milton Hersey as ch. inspector on constrn. of sub-structure Mtl. South Shore Bridge.

References: C. A. Mullen, E. A. Forward, P. L. Pratley, A. C. Tagge, C. N. Monsarrat.

SPRIGGS—WILLIAM, of Montreal, Que., Born at Birmingham, England, Mch. 25th, 1898; Educ., B.Sc., McGill Univ., 1923; 1918-19, aeroplane pilot; 1921 (summer), Geological Survey; 1922 (summer), constrn. work; 1923-24, grad. students' course at Westinghouse E. & Mfg. Co., Pittsburgh; 1924 to March 1926, metering engr. in the supply engrg. dept. of Westinghouse Electric & Mfg. Co., Pittsburgh, responsible for experimental development design and application of the equipment of the impulse type of meter, spent considerable time supt'g. installation; at present, working on relay protection with Shawinigan Engineering Co.

References: J. A. McCrory, C. V. Christie, A. B. Rogers, J. W. Hayward, E. Brown.

VARDON—LESTER MILTON, of Toronto, Ont., Born at Springford, Ont., Dec 8th, 1897; Educ., B.A.Sc., Univ. of Toronto, 1921; 1917-18, overseas with Can. Engrs., sapper 1917, sgt. 1918; rodman with Frank Barker, May to Oct. 1920; 1921-22, instrumentman, Barker Wynne-Roberts & Seymour, Toronto; Jan. to Dec. 1922, dftsman, Frank Barker and Associates, Toronto; 1922-26, engr. on traffic statistics with Toronto Transportation Commission.

References: A. E. K. Bunnell, O. M. Falls, C. B. Ferris, F. B. Goedike, T. D. LeMay, H. W. Tate, R. O. Wynne-Roberts.

THE

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THE JOURNAL OF
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Foundations in the Winnipeg District

An Outline of Conditions, a Description of Experience of Various Works and a Comparison of Types of Foundations and Cost

A. W. Fosness, A.M.E.I.C.
Designing Engineer, Carter-Halls Aldinger Company, Winnipeg, Man.

Paper read before the Winnipeg Branch of The Engineering Institute of Canada, October 7th, 1926

The entire Winnipeg district is underlaid with limestone bed rock. The highest elevation we have encountered in caisson work in the city was at the site of the Hudson's Bay Company's new store and was 51½ feet from prairie grade. The lowest was the Manitoba Cold Storage building and was 73 feet from grade. Test holes in various parts of the city have shown bed rock as low as 100 feet from grade, but these are not in the central part of the city and the test hole may have struck a pocket or seam in the rock. A good average for the central district is 60 feet from grade.

The level of the rock over any particular building area seldom varies more than a few inches except for spots where glacial action has ripped out blocks of various sizes or where strains in the rock bed caused by ordinary earth crust movements have shattered the rock with vertical fissures running in very irregular lines; these fissures being filled with the shattered rock. In many cases the broken rock has only been moved a fraction of an inch from its old location, especially in the lower part of the fissure, while in the upper part naturally a considerable portion has been removed by glacial action. Until the caissons for the Hudson's Bay Company's store were put in, the writer was of the opinion that glacial action was the cause of most of the pockets found in the bed rock, but, although we were fortunate enough to find good bed rock at a high level on this job, we ran across more trouble with rock pockets than on any work we have had in the city.

These were certainly fissures in the rock and not glacial rips. One crevice ran across the south-west corner of the building, and although several caissons were just on the bed rock at the edge of the crack only one hit directly on it. The other fissure on the north-east corner of the building ran directly under six caissons, although it was not more than twelve feet wide at the top. These crevices were filled with sharp-edged shattered limestone except for the top few feet, and this broken rock certainly had never been glaciated. Along with the shattered rock was a filling of fine white sand with some white clay in it, and just above the solid rock at the bottom of the fissure there were very often pockets of fine jet black clay; these materials being entirely different from the hardpan material above and must have been deposited before or during the early part of the glacial period.

The caissons along these fissures were sunk 80 to 95 feet below grade, and in no case were we at the bottom of the fissure, but were able to get good bearing either on one wall of the fissure or by bridging across at the bottom of the caisson where the fissure was very narrow. The bed rock got very hard as we got below water level, in fact at 95 feet we were scarcely able to drill it with a large size jackhammer running at high pressure.

Just above the good bed rock is a thin strata of a pink coloured rock commonly called " shale," but which is really decomposed limestone. This is about 18 inches thick as a rule and must be cleaned off to get a good bearing for the caisson. Above this is a glacial deposit which is called " hardpan " locally. This, of course, varies greatly in thickness on account of its character and is composed of boulders of granite and limestone in a mixture of sand, glacial clay and ground up limestone dust, making a mixture practically as impervious as the clay above. In Winnipeg, this hardpan layer averages about 5 to 10 feet thick, although when we were excavating for the School for the Deaf we struck boulders in hardpan at one corner of the building 12 feet below grade. Sometimes this hardpan is underlaid by a small layer of sand and gravel and in some cases is replaced by large glacial moraines, as at Birds Hill.

Above the hardpan is a thin layer of soft white clay of a somewhat different character than the blue clay above and containing considerable water. Above this, to the surface of the ground, is clay deposited in the bottom of old lake Agassiz. The top few feet of this clay is surface soil and yellow clay running gradually into brown clay, and as a rule at a depth of from 8 to 13½ feet is a sharply-defined band of yellow clay about six inches thick. The lowest level at which the writer has seen this layer, except along the rivers, is at the Daniel McIntyre school, where it was 13½ feet below grade. It may be lower further west in the city, but we have not any data for that district. Nine feet is about the standard depth through the business part of the city. This band of yellow clay runs over the entire Winnipeg district except in places along the rivers where the soil has been washed out to a lower level and silt deposited. This streak of yellow clay has been the curse of many of the old foundations in this district.

From this point down to the white clay above the hardpan is a fairly firm clay locally called blue clay. This blue clay, although it contains a fairly high percentage of moisture, is practically impervious to the passage of water through it. This bed of blue clay is usually about 40 feet thick.

In some parts of the city this blue clay is streaked with brown clay for a considerable depth, which of course somewhat reduces the bearing value of the soil. On the St. Boniface side of the river the percentage of brown clay in the blue clay gets considerably larger, so that conditions for floating foundations are considerably worse than in the central part of Winnipeg.

The best clay in Winnipeg, fortunately, is in the central business section, say roughly from Eaton's to the McArthur building. At the Hudson's Bay building site considerable brown clay was mixed with the blue to a depth of 25 feet in some places. A similar condition existed at the Public Press building, and the writer understands from Mr. Russell the same condition was noted at the Y.M.C.A. building. Along the river, where considerable cut and fill has been caused by the water, soil conditions are often very different. Not only does silt replace the top soil, but for some reason or other the blue clay is replaced by brown and yellow clay in some cases to a depth of as much as 35 feet from grade. This condition exists sometimes for at least a block back from the river. Since this yellow clay absorbs a great amount of water with a corresponding change in volume and firmness, and apparently permits water movements through it to a much greater extent than the blue clay, it makes a very bad foundation condition.

Allowable Bearing on Soil Foundations

The general opinion as to the allowable bearing on soil foundations has changed considerably within recent years. When heavy buildings first were put up in the city 3 tons per square foot on blue clay was considered permissible for warehouses and 2½ tons for office buildings, and they were not always careful to see that the footings were on blue clay. As settlement troubles developed with the old buildings, the allowable bearing values were decreased until in the new building code we are endeavouring to bring out the following bearing capacities are permitted for various soils. The higher value allowed is for warehouses, manufacturing buildings, etc., and the lower value for office buildings, apartments, etc.:—

Firm blue clay with no underlaying strata of yellow clay	2 tons	and	1½	ton per square foot
Mixed clay—moderately dry...	1 ton	"	¾	" " " "
Soft yellow clay and silt......	½ "	"	⅜	" " " "

The reason for the lower allowance for office buildings, etc., is that settlement in this type of a building makes so much more trouble with the interior finish and plumbing. In all cases we are endeavouring to keep the live load to a reasonable value and are in addition allowing a cumulative live load reduction that should give a design load at the foundation very close to the actual load. Foundation sizes are then to be based on the combined dead and live load, with no adjustment for the relative percentage of dead and live loads on the different footings. In modern fireproof construction the dead load is so large that this adjustment does not amount to much in any case. We have been fairly conservative in unit stress allowances in columns, and this seems to be a far more logical way to design a building frame than to call for a larger floor load than will ever be required, and then allow high stresses in the columns the way some ordinances do at the present time.

Of course the ordinance will not prohibit an owner from having his floors designed for heavy loads throughout the entire building to permit of his changing departments, or moving heavy concentrated loads, and taking a larger percentage reduction as long as he keeps within the ordinance's minimum requirements. For instance, consider a 6-storey mail order warehouse. The architect may plan with the owner that the heavy hardware and groceries will go on the basement, first and second floors, crockery on the third floor, and so on up to furniture on the sixth floor. He designs the lower floors for 300 pounds and the upper floors from 200 to 100 pounds. The first thing a new manager will do when he takes over the plant will be to change the grocery department to the sixth floor and the furniture to the second floor. This causes trouble with over-loading of the top floor. If all the floors were designed for 300 pounds, and a large cumulative live load reduction taken on the columns, the owner would have a very flexible building with no larger columns. The building department would then only need to see that there were not too many floors placarded for the heavy loads at the same time. The same method would apply to buildings with concentrated loads, such as printing buildings.

The allowance for wooden piles in the new code is a maximum of 20 tons per pile and for concrete caissons 30 tons per square foot or 417 pounds per square inch at the base of the caisson if on rock. If the caisson is stopped on hardpan it must be belled to twice its diameter, which gives an allowable value of 7½ tons per square foot on the hardpan. For both piles and caisson foundations an additional 25 per cent reduction in the live load is to be permitted in order to encourage owners to use either of these types in preference to a floating foundation.

Floating Foundations

There are two types of floating foundations. One where each column has its own independent footing and the other with a complete mattress over the whole building area. The mattress foundation has the advantage of taking up the whole available area for bearing, and not permitting heaving of the basement paving between footings, but it has one bad disadvantage for building construction.

If the building is on soft soil the ground under the matt begins to squeeze out under load. Since the matt covers the whole building, the material can only squeeze outside. As a result, the centre of the building settles only a little, while the walls of the building settle considerably. This happened on a building we built on a matt foundation in the Winnipeg district some time ago; within a short time after the building was erected, there was a variation in level of 1½ inch between the floor at the walls and at the interior of the building. With separate footings the settlement would have been more and the basement paving would have heaved, but the floors above would have been level. Extending the matt beyond the basement walls as far as is structurally possible would have helped this condition, but would not have remedied it entirely. The ideal use for a matt foundation is under a set of concrete grain tanks, where settlement must be uniform over the entire area on account of the monolithic construction of the reinforced concrete tank walls.

Another type of footing, consisting of a combination mattress and short pile footing, has been used only once, as far as the writer knows, in the city, and that is on the Watkins Medical building. The total load on the matt under this building is about 1½ tons per square foot. The soil in that part of Winnipeg has a poor bearing value. However, the distance to rock for a pile foundation was excessive, and instead of endeavouring to put in a pile foundation to rock, 30-foot piles were driven about 2½-foot centres both ways over the whole area. This not only compressed the soil and increased its bearing value at the top, but also through the friction on the piles transferred some of the load to the clay at lower levels, and although the piles drove quite easily the combined matt and pile foundation has given excellent satisfaction and there has been practically no settlement in the building although it is very heavily loaded.

There are no very great difficulties to be overcome in connection with putting in clay foundations in Winnipeg, except the trouble with shoring the banks and trenches. When blue clay is fairly dry, as in the winter or during a dry spell in the summer, it stands up well with quite a steep bank, but when the frost is coming out in the spring or during wet weather an unshored bank needs to have a slope of at least one horizontal to one and one-half vertical to stand any length of time, and a 45° slope is desirable, if possible. Where vertical banks are necessary and shoring must be used, the most important thing is to keep the *toe* of the bank well braced, since this is where the slide invariably starts. The shores should have a firm base to strut against. This is easy in the winter because the frozen ground in the bottom of the general excavation gives an excellent bearing, and in summer work, if possible, the interior footings should be poured first to give support to the struts before the bank is cut down and shored. Putting the base of the shoring timbers against a short timber in the mud is not very satisfactory because the least movement allows the bank to break and the pressure is then very greatly increased. In fact, after a bank breaks, shoring against ordinary mud sills simply will not hold except on low banks. The main things to keep in mind are: keep the main struts against the toe of the bank, have a rigid bearing for the thrust of the struts, and keep them wedged tight so that the bank will not break.

In cases where the excavation goes to the street or pro-

Figure No. 1.—Taking out General Excavation and Sinking Caissons on Hudson's Bay Building, Winnipeg, Man.

The light coloured material at the mouth of some of the shafts is hardpan and soft limestone rock. The thin yellow clay streak at 8 feet 6 inches from grade, which causes trouble with many of the shallow floating foundations in the city, can be seen on the farthest bank just under the gravel-heating grid of the winter concreting plant.

perty line the safest way is to take out the general excavation, leaving a generous slope back from the property line. The exterior walls can then be trenched and braced, using the interior berm of unexcavated material to brace against. The walls can then be formed, poured, and backfilled on the outside, and the ground floor framing can be used as a brace before removing the berm of unexcavated material in the basement, or timber struts can be used to the interior footings from the inside face of the completed wall.

In spite of all this good advice, we nearly lost the south bank of the Hudson's Bay job. A sub-basement that goes down 45 feet below grade runs along this entire end of the building. Our plan was to excavate the general basement, which is 19 feet deep, and slope it out 18 feet beyond the south building line. Then we took out 10 feet of the sub-basement with a steam shovel. This was done to permit the forming of the basement floor above the sub-basement which is used to strut the top of the sub-basement walls. Then the caissons along the sub-basement walls were sunk and poured to the bottom of the sub-basement, following which the trenching for the sub-basement wall was started. This trench was 8 feet wide and lagged with 3-inch vertical lagging on both sides as we went down and with 8- by 12-inch whalers about 3-foot centres on both sides, with 8- by 8-inch struts about 5-foot centres along the whalers, all of these struts being jacked into place with trench jacks. We had just finished the trenching and were ready to pour the footing when the entire south bank broke at a line about 40 feet away from the building. The bottom of our trench was in the white clay just above the hardpan, and apparently the slide started at this line, squeezing our trench over several inches at the bottom. It then held at this point and the maximum pressure seemed to keep coming at higher levels every day; the top of the bank meanwhile moving a fraction of an inch every day. We could see how the pressure zone kept raising by the way the strut timbers crushed into the whalers. The maximum pressure at the base must have been one ton per square foot. Finally the top of the trench began to move north, and we then put in heavy timbers against the bank, which had a frozen crust about 4 feet thick, just above the trench and braced against the frozen crust of ground in the sub-basement. These were jacked into place with 45-ton jacks, and at last the bank was stopped. We then started transferring struts in the bottom of the trench and pouring the wall and caissons in 3-foot lifts, which was not very easy to do.

With caissons, the only great difficulty comes after going through the hardpan. If the hardpan is directly on the bed rock, water will not interfere with the work. The clay and hardpan make such an excellent seal that a pump is practically never necessary, no matter to what height the water rises in an adjacent bad hole. The method used in Winnipeg to put in caissons, or piers in open shafts or wells as they should be called, is to dig a circular hole 4 feet deep, lag this with 2-inch vertical staves, then put in two split steel rings and wedge them tight. Then another 4-foot hole is dug in the open and the process repeated, the excavated material being taken up with a tripod winch and bucket. Sometimes the lagging is only 3 feet or 2 feet at a lift if the pressure is bad. After the hardpan is reached lagging is usually dispensed with. There are frequently large boulders in the hardpan, which are often larger than the caisson shaft and have to be broken up by drilling and plugging.

If there is a layer of gravel just above the rock you do not get any indication of it, as a rule, until you break through the last of the hardpan, when the water rushes in sometimes at the rate of a foot a minute, or more. This is what happened with most of the caissons we put in at the Manitoba Cold Storage building, at the St. Norbert bridge and at the Canada Cement plant. At St. Norbert the water rose over the top of the shaft and ran down into the river several feet below. So far, the holes of this type that we have encountered have had a comparatively shallow layer of gravel, so that pumps could control the water as fast as it came in. Sometimes two large pulsometers have been required per hole, and in one case the only way we could control the water was by lowering a large vertical drive centrifugal pump into the hole and driving it with a 60-h.p. engine at grade. This condition is the exception inside the city.

The only other trouble to be encountered is fissures in the rock. If these fissures have broken rock and clay for a filling you are fortunate, because this can be dug out and lagged the same as the clay, except that it is much slower. Then you also have the pumping to contend with. Your worst trouble is with the white sand in a wet caisson. This sand is firm and easy to dig and lag when dry, but is as bad as quicksand when wet. It flows into your pump sump in spite of anything you can do, and this causes the walls behind your lagging to disappear and forms cavities above where you are working, with the danger that these will fill in with a rush, break the lagging, and fill in the caisson below, with the loss of the lives of the diggers. It is nearly always impossible to drive lagging ahead of you in these holes on account of the broken rock.

Of the first three bad caissons to be started on the Hudson's Bay job all three were on the same fissure, all in broken rock and sand. In one of them, however, the rock was packed almost solid while in the other two there was more sand than rock. The first to be attempted was one of the sand holes, and in endeavouring to pump this caisson we formed the famous cave under Portage avenue, which was nothing but an opening about 4 feet high and about 8 feet wide, and maybe 20 feet long, caused by leaching the sand out of the bottom of the trench and causing the broken rock to slide down and leave the hardpan cap. This cavity, by the way, was filled with concrete when the caisson was finally poured. When we found that several of these holes were on the same fissure we abandoned the bad ones and sunk the one that was in the closely-packed rock and could be easily lagged, to a depth of nearly 95 feet, at which point the fissure was very narrow and good bearing could be obtained on both sides. We then left this caisson open as a pump shaft and the sand dried out in the other holes which were at a higher level, and these were then sunk in the dry without any trouble and concreted. The deep caisson was then allowed to fill with water and was poured by means of a tremmi, the only one on the job not poured in the dry. On one other caisson at the opposite end of the building we finally gave up our attempt to find bottom and put down a trench across the crevice and bridged it with a heavy reinforced concrete girder.

Relative Cost of Various Foundations

As to the relative cost of various types of foundations. It seems that there is an idea in the mind of most owners and architects that a caisson foundation is rather an expensive luxury. On account of the desirability of a rigid foundation wherever it is economically feasible, the following comparisons are given:—

In the first place, the cost of a floating foundation increases rapidly as the column load increases. The reason for this is that as the load increases not only is the area of the footing increased but the depth increases also in order to provide for shearing stresses and the reinforcing increases rapidly to take care of the bending moment. For example, a 1½-ton independent footing, to take care of a column load of 750,000 pounds, costs about $400 including excavation, while a 1½-ton footing to take care of a column load of 1,500,000 pounds costs about $1,050.

On the other hand, the cost of a caisson foundation increases at a slower rate than the load. The reason for this is that shear and bending moment do not enter into the design but merely cross-section, since it is nothing but a centrally loaded pier. A larger hole is easier for the men to work in than a small one, and the unit rate per cubic yard for excavation is therefore less, also the cost of lagging and rings only increases at the same rate as the diameter, or as the square root of the ratio of increase of the load. As an example, with a ten-foot basement and 55 feet from grade to rock a caisson to carry a column load of 1,500,000 pounds would be 6 feet in diameter and cost $1,000, while a caisson to carry half that load, or 750,000 pounds, would be 4 feet 3 inches in diameter and cost $650. These are average costs and are based on conditions in the central business district of the city, and would cover caissons anywhere from the line of the Parliament Buildings and Hudson's Bay building to Main street, at least, and probably much further west. We are assuming nine out of ten caissons to hit rock at the regular level without trouble and the tenth to cost at least double on account of striking a pocket or crevice and thus running into greater depth of very bad digging and lagging, with the added cost of pumping and additional concrete.

No building in this central district has had a higher percentage of bad caissons than that assumed above, although naturally it is somewhat of a gamble as to what you will strike on any particular site. A test hole or two on any site would help clear up some of the uncertainty. As mentioned previously, if gravel or sand is encountered above the rock pumping becomes a large part of the cost, and the cost of caissons in such a location is often double or more the cost where the caisson can be put down dry. Another point that helps the comparative cost of caissons is a deep basement or high rock level either of which shortens the caisson but does not affect a floating footing. From the above prices it will be seen that for loads of 1,500,000 pounds per column a 1½-ton floating foundation costs as much as a caisson foundation in this central district, and a 750,000-pound caisson only costs $250 more than a 1½-ton floating foundation. This load of 750,000 pounds is about what you would get with a 10- to 12-storey office building with 16- to 20-foot panels, or a 6-storey warehouse. For an office building of this height costing $1,000,000 the

Figure No. 2.—Forming for Basement Floor over Sub-basement on Hudson's Bay Building, Winnipeg, Man.

The trench, which started to fill in from the sliding of the bank, is along the left side of the picture along the line of the caisson lagging. The bank broke on a line that ran through the centre of the shack at the extreme left. At the time this picture was taken the movement of the bank had been stopped.

extra cost of the foundations would be under $10,000, or less than 1 per cent of the total building cost, and the owner will save several per cent by using caissons due to the trouble settlement in an office building causes with the finish in the building, and the mechanical trades. Also, there is the uncertainty of how much settlement future water conditions in the soil or excavation near the site will cause and the worry incidental thereto.

The only drawback to a caisson foundation for low buildings is that a 4-foot diameter caisson is about as small as can be economically put down. If made any smaller the difficulty of working in the small space takes as much extra money as you save in the lessened qualities of excavation and concrete. A caisson this size will carry 700,000 pounds and cost about $600. This means that while the cost of a floating foundation decreases rapidly for loads under this amount the cost of caissons remains a constant, and for a 7- or 8-storey office building the cost of a caisson foundation would be double that of a 1½-ton floating foundation, or $600 against $300 per column. If the building is quite low a one-ton foundation on blue clay makes a fairly good substitute for caissons since the settlement at this load is very small.

Any conditions that cause heavy column loads, such as heavy live and dead loads, big panels, a large number of storeys or deep basements and high rock levels, are in favour of the use of caissons.

The most remarkable case we have ever had as regards cost is the Hudson's Bay job. The building is designed for a future height of ten storeys; the panels are very large, 24 by 28 feet; the live and dead loads are about 250 pounds per square foot, and the basement column load on a typical interior column is 1,500,000 pounds requiring a 6-foot diameter caisson, the heaviest being 2,500,000 pounds. The basement is 19 feet deep and bed rock only 51½ feet from grade, making a 32½-foot shaft for the caissons. These caissons averaged in cost less than $750 each complete, or $1.00 per ton. This meant a saving of $60,000 on the entire job over the cost of a 1½-ton floating foundation, or a saving of $10,000 over the cost of a 2-ton floating foundation. It certainly is an unusual thing to have a caisson foundation costing less than a two-ton floating foundation. As the loads increase to 2,000,000 pounds or more, nothing can touch the cost of caissons.

Caissons to hardpan only are not to be recommended except under exceptional circumstances. Where the hardpan is only 5 feet thick it is just about as cheap to go through it to bed rock, and certainly a lot more satisfactory since you are then on a bearing that water conditions above the rock will not interfere with in the future. However, if the hardpan should be 15 feet thick, or more, it would greatly shorten the shaft to stop on hardpan and thus save a considerable part of the cost. Another condition where caissons to hardpan only would save a great deal of expense is where the hardpan is underlaid with water bearing gravel. Here the saving would be very great. In both these cases drill holes should be put down in each caisson to be sure that solid bed rock exists under the hardpan and gravel, and that there is not a fissure or pocket of soft materials directly under. Also, if gravel underlays the hardpan it should be definitely determined that the gravel does not contain much fine sand that would be liable to flow or squeeze out. If the hardpan cap is quite thick a small fissure in the rock could be bridged over without much danger. However, caissons to rock are to be preferred wherever possible.

Pile Foundations

The next preference to a caisson foundation is a pile foundation. The length of piles required for most parts of the city to drive to refusal from about a 10-foot basement is 35 to 55 feet, except for certain districts along the river where longer piles are required. These piles drive to refusal in the hardpan and boulders, seldom going to bed rock. The new ordinance is allowing 20 tons per pile for wooden piles driven to refusal, and assuming an average of 45-foot piles these will cost about $20.00 each driven, or $1.00 per ton. To this must be added the cost of the footing cap, and assuming a spacing of 2 feet 6 inches each way for the piles this cap will cost about half the cost of a 1½-ton floating foundation for the same load. Again, taking the example of a 750,000-pound load, a complete pile and cap foundation will cost about $600, or very nearly the same as a caisson foundation for the same load. The advantage of pile foundations over caissons in the matter of cost shows up for the smaller loads, since the number of piles and the cost can be varied to agree with the load, while, as mentioned before, a caisson cannot be reduced in cost below the 700,000-pound size. A pile footing and cap for a 250,000-pound load will cost complete about $200; a floating foundation for the same load at 1½ tons $75, at one ton $115, and a caisson foundation $600. Another place where a pile foundation has a great advantage is along the rivers or wherever water conditions would interfere with the building of caissons. In these locations the pile foundation would cost less than the caissons for even heavy loads.

Approximate relative cost of various types of footings for varying loads in the central business district of Winnipeg:—

Types of Foundations—Loads	250,000 pounds	500,000 pounds	750,000 pounds	1,500,000 pounds	2,250,000 pounds
Caisson	$600	$600	$650	$1,000	$1,300
Wood piles and cap	200	375	600	1,300	2,200
2-ton footing	55	150	275	785	1,450
1½-ton footing	75	210	400	1,050	.....
1-ton footing	115	315	600	.....	.....

Note: Caissons running into water trouble may easily cost double the amount given above.

Where a mattress foundation without piles is used it will cost about the same as an independent floating foundation to cover three-quarters of the area. In other words, a mattress foundation at 1½ tons costs about the same as a series of 2-ton independent footings.

Concrete piles vary in relative cost the same as wood piles, but are relatively somewhat more expensive here and are therefore not often used.

All the above prices are based on foundations for new buildings. On account of the large number of caissons that have been used for underpinning in this city, a large part of the unit prices that have been obtained are too high for new work.

Causes of Foundation Settlement

The causes of settlement of foundations are numerous. In the first place, a caisson foundation to rock or hardpan, or a pile foundation driven to refusal, if properly designed and built, should give a practically rigid foundation. The only thing that can affect a caisson is alkali, and the only trouble that can occur with a pile foundation is from dry rot.

As regards alkali, there have been few cases of this action on building foundations that have come to my attention. A footing poured in place in the clay is very effectively sealed against seepage of ground water, and without movement of ground water carrying alkali leached out of the soil this chemical action on the cement cannot take place. Small pockets of alkali in the clay that are in contact with the concrete will sometimes cause local action, but this is not dangerous. The writer has seen the footings uncovered at different times of many Winnipeg buildings, and the only cases of alkali trouble were where drains had broken near a footing or around the outside walls where they were not waterproofed and the weeping drains did not properly take the surface water away.

The only really bad case was on a building where the downspouts from the roof were connected to the weepers, and the outlet from the weepers was two feet above their level around the building. As a result, the basement was flooded after every rain and was pumped out sometimes. This went on for fifteen years and gave a wonderful chance for the alkali in the soil to leach out and get at the concrete along the outside ledge of the wall footings. As a result, alkali action penetrated from one to six inches. This was a most unusual case, however, and with proper methods of handling the rain water and weepers, this would never have happened. Walls of buildings adjacent to this one, which had no weepers and had clay backfill, were not affected in any way. Caissons that do not run into water troubles are the same in respect to alkali action as footings in the clay, and where water troubles are encountered the best protection against alkali is to use a very rich concrete, (say a 1:1:2), in the lower part of the caisson up to a point that seals off the water entirely.

As to dry rot in pile caps, this is very likely to happen unless care is taken to keep the cut-off level in moist ground, (not necessarily below water), and sealed from the air. Trouble from this source rarely happens where there is a concrete cap poured over the top of the piles, and the concrete capping is poured against the clay on all sides, and the cut-off is in blue clay. The blue clay retains moisture so well that, if air is kept away from it, rotting of the piles is almost impossible.

Nearly every case of trouble with pile foundations that the writer has seen has been where there was a wooden basement floor with no concrete paving and very shallow caps on the piles. This allowed the air to be in contact with the soil and dry it out to a depth below the cut-off, and the piles naturally started to decay.

Drying out of the soil on account of ovens, boilers, etc., also has caused trouble with two cases of pile foundations in the city. When we were remodelling the old Clarendon Hotel building, the footings, consisting of heavy spruce or pine plank, were found to be in perfect condition and were used to support the present building. They were about 12 feet from grade in moist blue clay. Since this is one of the oldest buildings on Portage avenue, it is as good an example as can be found.

Foundations on Clay

Foundations on clay all settle, since it is the nature of clay to flow under pressure. Where this type of foundation is used the footings should be so designed as to make the settlement as uniform as possible, and of an amount in keeping with the character of the building.

The amount of settlement of a properly designed footing in blue clay is hard to compute exactly. If the soil is not in very bad water conditions blue clay will harden under pressure and the settlement will continue at a much reduced rate. When the Paris building was being built it was necessary to underpin the wall of the Avenue Block adjacent, which had a bearing of about three tons per square foot. This footing was in blue clay, and the clay below the footing was so hard that picks had to be used to break it up. On the other hand, the yellow clay above the blue clay does not show this property of hardening under pressure, probably because of the greater permeability of the material. Cases have occurred in Winnipeg of buildings built on this yellow clay that have stood fairly well for a number of years and then started to collapse. When this occurs the yellow clay is always found to be wet and very soft.

The best record the writer has of amount of settlement under heavy load is in connection with a set of grain tanks we built in the city a few years ago. The basement connection between this set of tanks and the old tanks had a flush ceiling joint. The tanks were loaded to capacity immediately after completion and the total pressure on the floating mattress foundation was 3¼ tons per square foot. Under this load the tanks settled 2 inches while being loaded, and the total settlement at the end of two years was 4 inches. The soil at this location is quite badly saturated, which somewhat increases the amount of settlement. The total additional settlement in the next ten or fifteen years will probably be about 2 inches, making a total of 6 inches.

The only office building of which the writer has any records as to settlement is the Paris building. The footings on this building are in good blue clay and designed for two tons per square foot dead and live load. When the first five storeys were erected the settlement was very small, since the total dead and live load was under one ton per square foot. When the upper six storeys were added the building settled ¾ inch the first year, ⅛ inch the second year and slight settlement has occurred each year since; the total settlement now being about 1½ inch. The settlement at the present time is very small.

In spite of this 1½-inch settlement, no noticeable cracking has occurred in the partitions throughout the building due to the careful proportioning of the footings. Far more trouble can be caused by unequal settlement than by a comparatively large uniform settlement. Taking the Paris building again as an example, some of the column loads in this building are not much over half of other columns. If the footing required for the heaviest column had been used throughout the building as a typical footing, the settlement would have varied from ¾ to 1½ inch in many cases at adjoining panels, with a consequent shattering of every partition in the building. If it were proper to do so, the writer could name dozens of buildings in the city where this very thing has been done with consequent trouble afterwards; in fact, it is by far the most common source of trouble. As mentioned before, the new building code is being prepared with an idea of eliminating this trouble as far as possible, but the only safe rule is to proportion every footing according to the load, no matter how unimportant it may seem. The following are some of the more common mistakes of this character:—

(*a*) Making all the column footings the same size in a building which has different-sized panels.

(*b*) Making the corner column footings in a skeleton building the same size as the other wall column footings when the load is usually considerably lighter. This causes the corners of the building to stand up more rigidly than the balance and diagonal shear cracks occur in the end walls or spandrils. There are two good examples of this in the city.

(*c*) Designing, say, an apartment house wall footing for a three-storey load and containing this same width under a one-storey section along a light court. The one-storey part stands up more rigidly and the arch action in the brick wall causes the building to *break its back*. This is a common trouble with apartments, churches and wall-bearing buildings of all kinds.

(*d*) Having interior basement brick partition walls, such as coal bin walls, rigidly built into the outside walls. As a rule, these inside wall footings are kept in a drier condition than the outside footings or are not loaded as heavily, and as a result stand up comparatively rigid while the outside walls settle. This causes the inside wall to act as a lever and pushes the outside wall out at the top causing the wall to tip and the joists to pull out. This is a common cause of trouble in many houses of the larger type and apartments, and you often see repairs attempted by tie rods, etc., when all that is needed is to disconnect the inside partition wall and footing from the outside wall.

(*e*) Permitting surface water to get at the wall footings and cause them to settle while the interior footings are dry. This is particularly noticeable in footings in brown and yellow clay, such as many apartment blocks have.

Foundations in the soft brown and yellow clays overlaying the blue clay should be discouraged except for very light loads. In the early days of heavy building in this city this was not realized as fully as it is now, with the result that many of these fairly heavy buildings were built on this yellow clay and have given trouble ever since. The yellow clay is very soft when wet, and since it absorbs water easily it simply squeezes out under load and apparently does not harden under pressure unless kept dry. Many of the apartment buildings being erected in the city at the present time have their footings in this yellow and brown clay. After they are up for a few years nearly all of them need underpinning when at a comparatively small additional cost they could get a good foundation in the first place.

Water conditions make a considerable difference in the amount of settlement of a footing. Even the blue clay in its plastic form contains a high percentage of moisture. Since it is so nearly impervious it absorbs water slowly, but if the surface water level is kept above the footing level for a long period an increase in settlement will be noticed over normal conditions. Artificial drying out of the clay will also cause settlement, since the volume of the clay shrinks greatly as the water is removed and the footing is thus let down. The writer has seen four very good examples of this in the city, two under bake ovens, one under a boiler installation and one under a gas retort. The best example was under the old Spiers-Parnell ovens. We removed these when building the new addition. The ovens were two storeys high and started with fire pots on the basement floor. The soil under them was dried to a powder for from 4 to 6 feet, and not only the ovens had settled but the whole building in the vicinity of the ovens.

Foundations at Different Levels

Having the foundations of a building at different levels is another source of trouble. The footings at the higher level slip and squeeze down to the lower level if at all possible, and the soil at the higher level dries out due to the drainage of the low part, all of which causes the higher footings to settle more than those at the lower level. Where a difference in level cannot be avoided, the levels should be stepped back as gradually as possible.

Frost

Frost is another common trouble maker. As the clay under a footing freezes it naturally expands, and if the load is not too heavy on the footing the wall or column is raised accordingly, the amount of heaving depending on the amount of moisture in the soil and the depth to which the frost extends. Sometimes, if the load on the footing is very heavy, a different action occurs. In one of the cold storage warehouses in the city the owners decided to make one of the basement rooms a freezing storage room. It was kept at below freezing temperatures for several years with no sign of heaving. It was finally decided to change this room back to a warm storage, and a few months later the columns in this room settled two inches, cracking the reinforced concrete girders framing into these columns at all floors. What happened was that, the load on the columns being very heavy, when the frost penetrated to the soil under the footings the clay squeezed sideways into the unfrozen area around this room and when the ground thawed out the footings settled. In all cases of heaving from frost and subsequent settlement from thawing, the amount of settlement depends on the load per square foot on the footing. In the case of light loads, such as house foundations, etc., the footings sometimes settle back very little, while in the case of heavily-loaded footings the settlement is often more than the heaving.

Another peculiar case of frost action was in connection with a set of grain tanks in the city. This battery of tanks was 40 feet wide by 100 feet long, and the long axis was east and west. The tanks rested on a mattress footing with 3¼ tons per square foot bearing. The basement was unheated, with the result that the ground was frozen several feet under the mattress. In the spring the sun shining on the south side of the tanks melted the bank along the south side and permitted ground water to get at the footings along this side long before the north side thawed out; in fact, the frost was scarcely out of the north bank before cold weather set in. As a result, the clay along the south, softened by the sun and the surface water, permitted the soil below the mattress to squeeze out along this side very much more than at the north, with the result that in fifteen years the tanks leaned to the south 26½ inches. Most of this occurred during the first two years, the blue clay becoming packed hard enough by that time to retard this action greatly.

Foundations Along River Banks

The last foundation difficulty is in connection with the river banks. A whole paper could be given on this alone. Settlement of buildings along the river is caused mainly by two things,—both of which are related to the change in river levels. In the first place, when the locks are closed in the spring the river is kept to an artificial level considerably above normal summer level. The water soaks back into the banks, especially where the yellow and brown clay goes to low levels, as it does in some places along the river, and since this yellow clay will absorb a large amount of water and will permit water to be absorbed through it quite rapidly, this action sometimes goes back quite a distance from the river's edge. This soaking of the clay seems to somewhat increase its volume because in the fall when the locks are opened and the water level drops the water is drained out of the soil, and many houses all over the city along the rivers immediately show settlement. This is distinct from the sliding of the banks.

One very fine house in North Winnipeg, several hundred feet back from the river, has this happen every year, and, as previously mentioned, we tested the soil below this house and found brown clay for 34 feet, and then a bright yellow streak one foot thick and then very wet blue clay. This was not river silt but regular Winnipeg clay.

The breaking of the banks and sliding is the cause of trouble with many houses and apartments very close to the bank. The reason is very similar to the former case. The high summer water level soaks up the clay in the bank and at the same time by its hydrostatic head tends to keep the bank in balance. When the water is let out in the fall this back pressure of the river on the bank is suddenly removed while the soil in the lower stratas of the bank is thoroughly "lubricated," and, since the banks are always in a rather delicate state of balance, the bank breaks and slides down until the stresses are again in balance.

A walk along the Assiniboine river banks in the fall after the locks are opened will show this very conclusively. The most unfortunate cases are where the break in the bank happens to come through a building. Permanent repairs in a case like this are nearly hopeless, because the bank may slide along the same plane again and take any underpinning with it.

If building must be done near a river, the following precautions should be taken:—

> Trying to keep the bank from slipping by the use of piles along the water's edge is of no permanent value unless the piles are driven through a fairly thick strata of very firm material, or unless the top of the piles are anchored far back into the bank to rows of anchor piles and deadmen. Even with this anchorage of the top, the toe of the piles must be in firm material. Along the Assiniboine river, in most cases, the water's edge is practically at hardpan and boulders, so that only very short piles can be driven, and in many cases there is little or no firm material for an anchorage.
>
> Another way of taking care of the slip of the bank in a location where rock level is not too far from water level is to put in a reinforced concrete retaining wall near the water's edge, keyed and anchored into the rock. This would need to extend only a few feet above water level, but it would positively keep the bank from starting to slide. The only trouble is the expense. Along the banks of the Assiniboine this would cost at least $50 per foot.
>
> No increase in load should be put on the bank. A light building with a basement will not increase the load on the bank if the excavated material is taken away. Excavated material should never be graded along the bank, since this is just inviting trouble. If grading must be done, take it off the bank instead of putting it on.
>
> Heavy buildings should be on piles or caissons, thus carrying the load to the hardpan and rock below direct. Also, the mattress or foundation capping these piles or caissons should be well tied together.

Conclusion

In conclusion, when designing foundations in the Winnipeg district, and where the size and value of the building will permit, use a rigid foundation of caissons or piles,—caissons probably are to be preferred where conditions are favourable. If a floating foundation must be used, keep the bearing on the low side if settlement will cause trouble; keep the size of footings proportioned to the loads; keep them on as near the same level as possible; and use good concrete.

Power Distribution Problems of the Toronto Transportation Commission

Some Features of Operation and Maintenance Affecting the Electrical Department

J. F. Neild, Electrical Engineer,
Toronto Transportation Commission, Toronto, Ont.

Paper read before the Toronto Branch of The Engineering Institute of Canada, November 11th, 1926

The Toronto Transportation Commission is in the business of selling transportation, and each employee must have as his objective safe, rapid, efficient and economical service.

The service must be safe because our modern ideas demand it. It must be rapid because our modern conditions require it. It must be efficient because our modern commercial system compels it. It must be economical because it is a peoples' project, and, as their servants, the Commission must give them full value for their money.

Source of Power

The Commission purchases its power from the Toronto Hydro-Electric System, who in turn receive it from the Hydro-Electric Power Commission of Ontario. This power reaches Toronto over two different rights-of-way, and is received at four terminal stations, as shown in figure No. 1. The lines are in phase, but not necessarily always in synchronism. As each line may be fed from a different source of power at Niagara Falls, the inter-connection of the substations to feeders running from the various terminals gives the Toronto Transportation Commission a ready alternative source of power if either fails. Direct current power is distributed to the trolley from eleven substations; four of these having a capacity of 16,000 kilowatts in rotary converters are the property of the Toronto Transportation Commission; the remaining seven having a capacity of 16,000 kilowatts in rotary converters are the property of the Toronto Hydro-Electric System, who sell the converted power at the bus bar.

Special Operating and Maintenance Facilities

In the equipping of the Toronto Transportation Commission's substations, the original work, as carried out by the old Toronto Railway Company, has made possible the quick transfer of operators from one substation to another by having a standard arrangement so that in each substation all pieces of apparatus are placed in the same relative positions and carry the same numbering. This is a very great advantage; also, the furnishing of all the substations with identical equipment enables the maintenance to be kept up with a minimum of spare parts.

In order to get machines back into service in the least time possible when repairs are required, several interesting tools have been developed. One is a device for changing field coils without disturbing any portion of the machine. This device consists of a band with clamps attached, a plate and a suspending arm. The band is fastened around the field coil, the clamps holding the pole piece in place, the plate is drilled so the band can be bolted to it. No matter what angle the field may be at, the suspending arm attached to the plate will be vertical. The pole piece bolts are taken out, the whole section, weighing some 300 pounds, is swung out, lowered down, slipped out of the band, the new one slipped in, raised up in the crane, and, since the angle is kept by the plate fastening the new field, it can be swung into position and bolted in, the whole process taking some 30 minutes, as compared to 3 to 4 hours without this device.

Another interesting tool is a machine for slotting commutator sections. This tool is erected on the shaft with the armature in place in the machine. Two guides rest on the commutator while a slide bar passes across the face of it, a motor driving a shaft with three milling saws on it are pushed across, riding on the slide bar, thus milling the mica out of three slots at once. As there are 864 slots on each commutator, you can readily appreciate the saving in time over the one-saw slotters.

These devices and others have greatly reduced the out-of-service time of our rotaries and increased their utilization time.

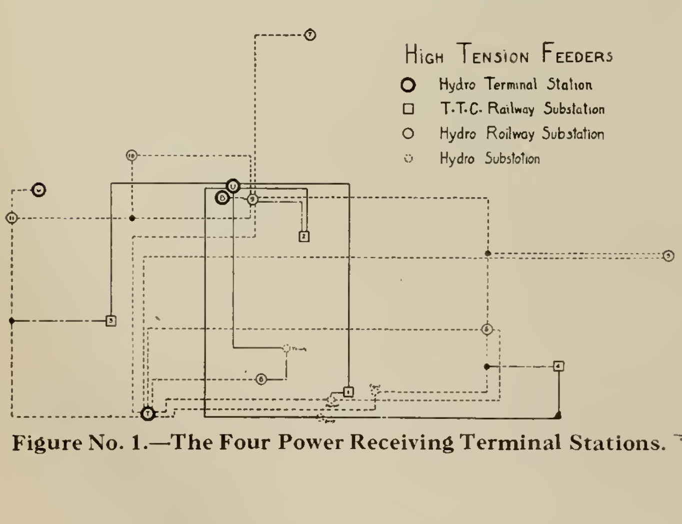

Figure No. 1.—The Four Power Receiving Terminal Stations.

Trolley Wire Sections and Feeder Arrangements

The trolley wire is divided into 119 sections, each section being fed by its own feeder. These sections are so divided that there will be a maximum load of about 1,500 amperes on each, thus giving a controllable load on each feeder panel which has its own control switch, ammeter and circuit-breaker. This division of sections also enables trouble, such as fires, falling wires, etc., to be isolated and made dead with the least traffic disturbances. The splitting-up of the system also enables the operators to build up their load very easily and safely after a total interruption.

Good judgment can be shown in the way the sections are laid out, having in mind the possibility of giving a service during a partial interruption or power shortage by having strategic intersections on tie feeders or on substations feeding downtown areas. In this way, if there is power downtown the cars can be run out for some distance and there will be turn-back points which will be alive.

It will be seen from the layout of the direct current feeders for Harrison Substation area, as shown in figure No. 2, that the outlying sections are all tie feeders. In this way, if any power is available, the downtown substation can be cut in and as good a service as possible operated out to turning-back points on the tie feeders, power can then be taken off the tie feeders at the dead substation end and fed out again on feeders which feed adjacent sections to the ties, and a skeleton service given to farther out points. These tie feeders have pilot lights on each end so that the operators can tell when other substations are alive.

All feeders are numbered. The numbering of the simple feeders shows the source of power; for instance, feeder 312 is number 12 feeder fed from number 3 substation. The numbers on the tie feeders are compound, and show which substations are tied; for instance, 116-616-316 indicates that substations 1, 6 and 3 are tied on number 16 feeder.

The negative feeder system, as shown in figure No. 3, is somewhat different, and serves a different purpose, as the whole of the negative network is tied together solidly. If there were only one large feeder run out from the negative bus there would be a very large concentration of current in the track return at this point, so feeders are fanned out so as to collect the current at different points, thus preventing excess flow of current in any track. At times it may be necessary to introduce resistances in the shorter feeders to force the current to take some other provided path home.

The point where the real trouble of the operating engineer begins is now reached. Figure No. 4 shows the 24-hour loads on the various substations, and the following considerations should be kept in mind:—

The Hydro-Electric Power Commission of Ontario has set a rate for the Toronto Hydro-Electric System to charge the Toronto Transportation Commission of $15 per horse power year for each highest monthly 10-minute peak demand

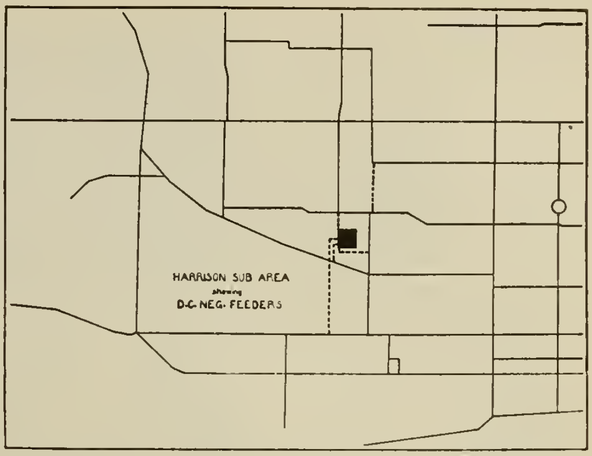

Figure No. 2.—Layout of Direct Current Feeders for Harrison Station.

metered at each Toronto Hydro-Electric substation, plus 0.9 cent per kilowatt hour consumption. This means that the loads on Duncan, Junction, High Level and Danforth substations are each separate individual sources of billing. These substations, of course, are owned and operated by the Toronto Hydro-Electric System. For Front street, Yonge, Harrison and Russell substations, which are owned and operated by the Toronto Transportation Commission, the rate set for the Toronto Hydro-Electric System to charge is $24 per horse power year for the highest 20-minute coincident peak each month.

The job before the electrical department of the Toronto Transportation Commission is to supply power to run the street cars at the lowest possible cost per mile, and, in trying to do this, some extraordinary conditions are encountered.

Referring now to figure No. 4, showing the character-

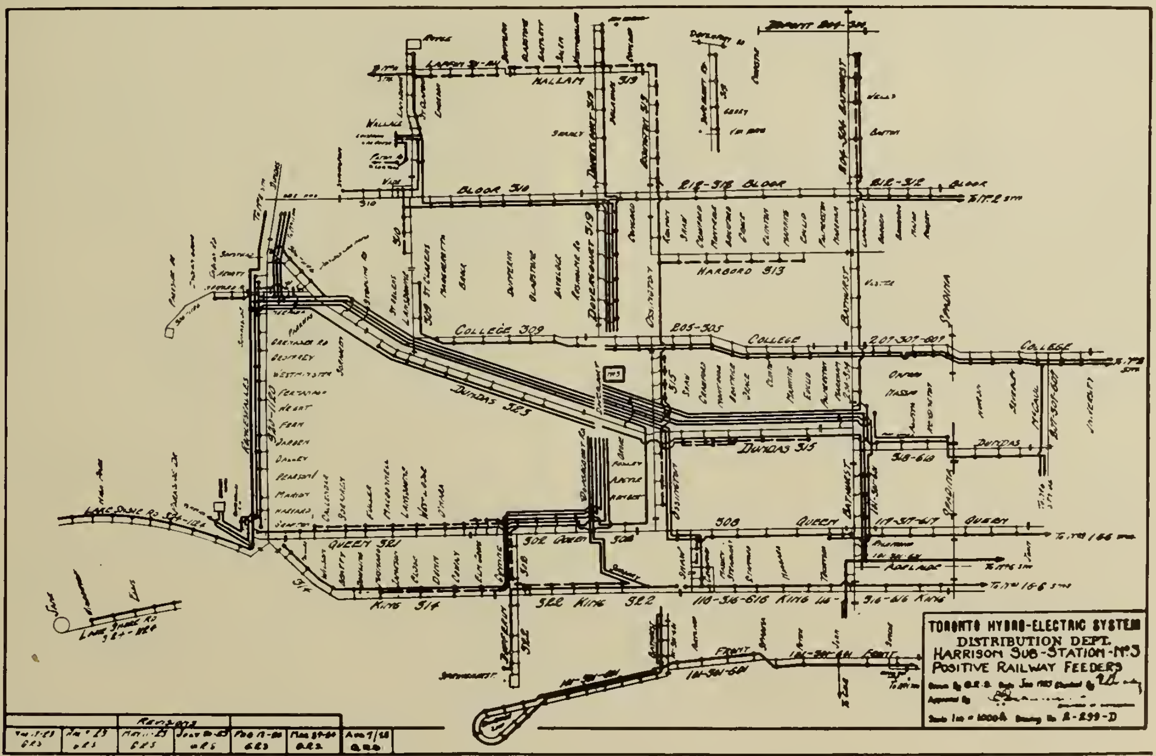

Figure No. 3.—Negative Feeder System, Harrison Station.

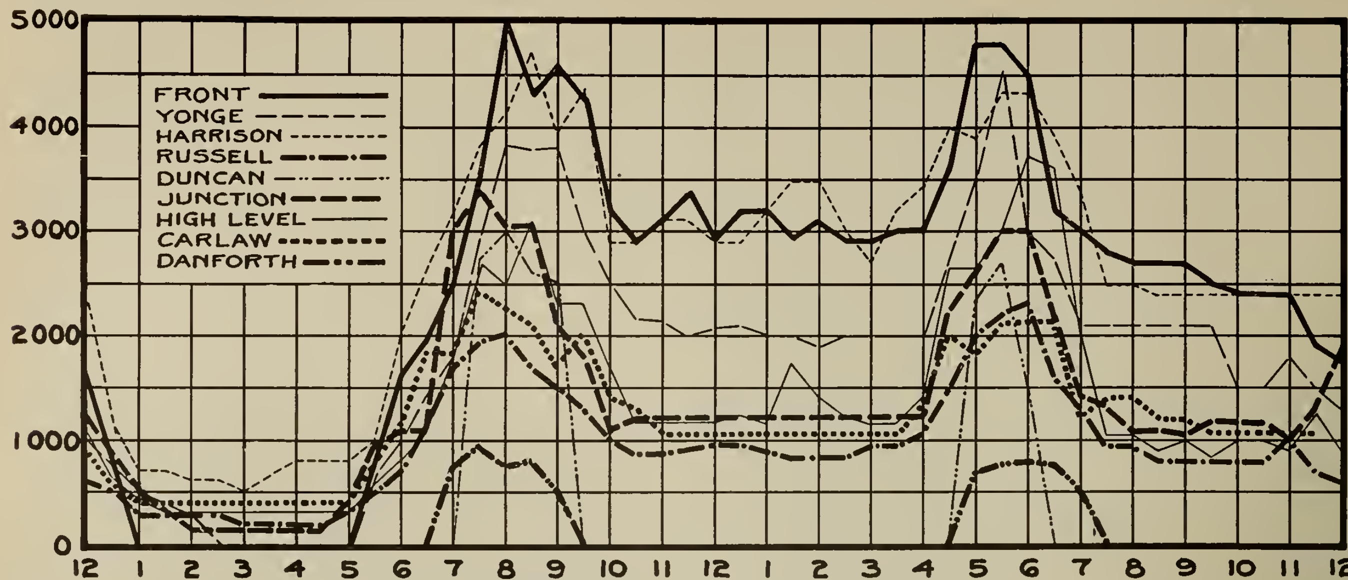

Figure No. 4.—Characteristic Loads for the Various Substations.

istic loads for the various substations, the prevailing low night valley will be noted, and in some instances the mid-day valley, but in practically every case we have sharp rising and falling peaks. You will also note there is very little time lag between the peaks.

Picture a long straight car route running across town, such as the Bloor route, passing through the areas of various substations. Suppose there is a traffic jam at the time of peak load caused by a fire in the west end. What happens? The peak goes up on Junction; the jam travels across town, then the peak goes up on Carlaw and on Danforth, and if it just so happens that it is passing through the centre of the city about 5.20 p.m. to 5.30 p.m., up goes the coincident peak on the centre group. Thus, while perfectly innocent in the matter, it is quite possible for the Toronto Transportation Commission to have to pay four times for one traffic jam, and the electrical department has to account for the increased cost of power.

It also sometimes happens, in the case of the coincident peak on the centre group of substations, that some peculiar traffic condition will advance or retard an individual peak by ten or fifteen minutes, thus eliminating the diversity between the various sections, and up goes the coincident peak. At $2 per horse power per month, plus additional charges, you can see that a changing condition can easily shoot up the bill by $1,000 to $1,500 for the month. The writer has known such a condition to mean over $4,000 in a month.

Certain other causes of an increase in load are shown on the curves of figure No. 5, which are the average of some five years' observation, and generally hold good for any property operating cars of approximately 26 tons.

The increase in load due to the greater traffic density, i.e., number of passengers per car mile, is simply a matter of having to move a heavier mass. An increase in schedule speed may also have a tendency to increase the peak unless the motormen are trained to coast their cars where possible. In both these points, it is practically a question of mass times velocity.

In the matter of the increase in power due to the lower average monthly temperature, there are several factors; one of the principal ones appears to be an increase in the friction at the gauge line, due to frozen particles causing a grinding action. This seems to be proven by what is noticed on a very dry day in summer when a sudden shower comes down, washing the rail, and a drop in load of sometimes as high as 15 per cent has been noticed.

In these days of heavy automobile traffic, the number of stops per mile has a very important bearing on the increased peaks that are carried, as every time a motorman has to stop and start his car there is a direct effect on the power demand, and, if he is not stopping for revenue passengers, there is a direct loss. It does not require any great imagination to see how the loads have been creeping up from the above-named causes.

It is in such cases that our tie feeders prove their value, as, by means of a variation on bus voltage, such conditions can be balanced in some measure.

Let us now consider this question from an entirely dif-

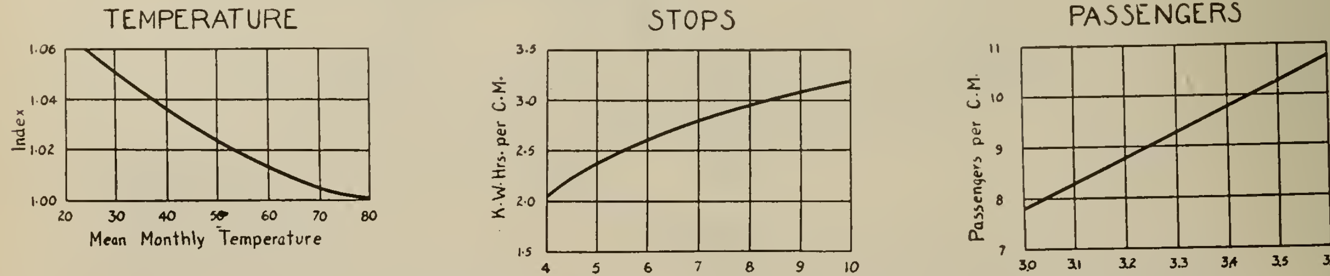

Figure No. 5.—Curves Showing Causes of Increase in Load.

ferent angle. Look at the characteristic totalized system load curve shown in figure No. 6, made up of the various substation loads as shown in figure No. 4. This represents the 24-hour day's work the plant has done. Note the long low valley at night, from the downward slide after 5.30 p.m., which falls sharply to 7.30 p.m., then more slowly until the theatre load is taken home at 11.00 p.m. After midnight the slump is rapid again until 1.00 a.m., then a sweeping dip, which rises to 5 a.m., and so on the whole story of the city's activities are clearly shown. Very pretty, indeed, but let us do some philosophising. Wellington, in his book "The Economic Theory of Railway Location," says this:—"It would be well if engineering were less generally thought of, or even defined, as the art of constructing. In a certain important sense it is the art of not constructing, or, to define it rudely but not inaptly, it is the art of doing that well with one dollar which any bungler can do with two after a fashion."

This definition of engineering is peculiarly applicable to power plant engineering for an electric railway system, where conditions are such that it is very easy for a man to sell himself the idea that he should carry an ample margin of capacity when a cold-blooded analysis of facts will cast doubt on the necessity or advisability of this. The tendency is to think too much in terms of peak loads, looking to installing such additional capacity of machines as to secure oneself against the day of the storm peak. This would be fine if we did not have such pessimistic people as comptrollers, who, immediately you purchase a piece of apparatus or install a new substation, take all the joy out of life by telling you that in twenty years it will all be junk and only fit for the scrap pile, and that you must proceed forthwith to pay so much per annum for the rest of its natural life for amortization, depreciation, etc.

The whole square of the utilization chart (figure No. 7)

Figure No. 6.—Characteristic Totalized System Load Curve.

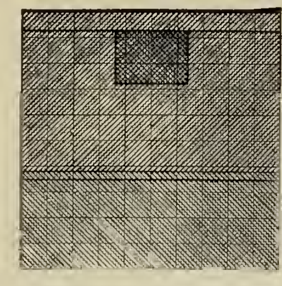

Figure No. 7.—Utilization Chart Showing Total Capital Charges on Plant for one Week-Day.

represents the total capital charges on the plant for one week-day. The block below the lines marked "base schedule demand" represents the utilization of plant actually used to operate your cars if there were no peak loads; over and above this there has to be some margin, so, based on experience, the writer has allowed up to the line marked "base schedule capacity." When you superimpose peaks, you must raise the ante up to your peak load demand, then on top of that put your peak load capacity margin, and, having done this, gaze on the little cross-hatched square in the centre, for that is all the use you get of your plant over your "base capacity." We purchase machines with a 150-per cent two-hour rating; why not take advantage of the excellence of the manufacturers' production, particularly when you have paid for it?

The more the utilization of plant on a street railway property is studied, the more is it apparent that Wellington expressed sound engineering philosophy for the street railway man to ponder over.

Trolley Wire

Let us now turn away with a sigh of relief from the very necessary self-suppression dictated by sheer economic necessity to a field where the same economic necessity compels the fullest factor of safety, the trolley wire. No one factor can cause a more widespread disturbance to traffic than a broken trolley wire, unless it be a power interruption, and these two brothers in iniquity are often closely associated.

The trolley wire used in Toronto is of round section, .365 inches in diameter, and is of two classes. One class is hard-drawn copper having a tensile strength of some 55,000 pounds per square inch, the other is an alloyed wire having a tensile strength of 70,000 pounds per square inch.

The city is divided into five sections for inspection purposes, with a foreman in charge who is responsible for the inspection and alignment of the wires and for making all the necessary repairs on the 40 odd miles in his district. The inspections are carried out systematically, and a progress report sent to the general manager each week. We find this regular re-alignment of the wire one of the greatest factors in saving wear, as it takes but very little off centre to cause a wire and the ears to wear very rapidly.

A daily report is sent in by each foreman, listing any renewals made; these are entered up in a record book, so that any cases of frogs, crossovers or curve wires which are having to be renewed too frequently stand out. The locations are then specially gone over to find out the reason for the excessive wear at that particular point. In this way, we have a continuous check on the whole of the overhead system.

At the present time, trolley wire is being renewed on a 7.5 per cent annual replacement. In order to eliminate any trouble due to excessive frost strains, we renew the worn

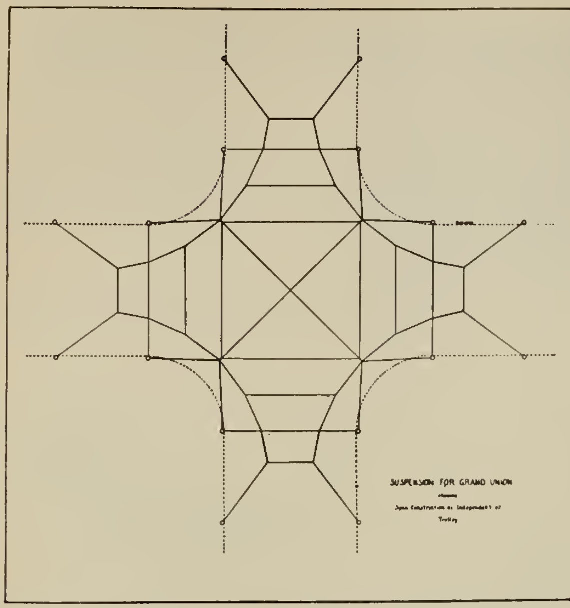

Figure No. 8.—Suspension for Grand Union showing Span Construction as Independent of Trolley.

wire during the winter time, taking care to leave the reels outside long enough to reach maximum contraction before stringing. We then pull the wire up as tightly as possible, leaving the sag in summer to take care of itself. The temperature in Toronto ranges from a probable 25 degrees below zero to a probable 100 degrees above zero.

Speaking of trolley wires, an interesting controversy is now going on between the trolley wire users and some of the United States manufacturers over the relative value of a " twist test " in trolley wire specifications. The trolley wire users claim to have found out by experience that a wire with a high twist test will wear longer than a wire with a low twist test, while the manufacturer contends that the twist test cannot altogether be controlled, and that as a general proposition it has no bearing on the wearing qualities of the wire.

The twist test is made by clamping a ten-inch piece of wire and twisting it not faster than 10 turns per minute. The American Electric Railway Engineering Association claims that a .365 hard-drawn trolley wire should stand 20 twists, while the American Society for Testing Materials will not concede more than 10 twists. For the present, the American Electric Railway Engineering Association are accepting the 10-twist test for the sake of a uniform specification, but a series of very elaborate tests are under way under actual service conditions in some of the large cities of the United States to determine this very interesting point. My experience in Toronto leads me to the opinion that the wear will vary almost directly with the number of twists the wire will stand, if the wire is otherwise apparently the same.

Intersection Suspension

After years of experimenting and experience in various methods of intersection suspension, we determined that the curve formation should be independent of the trolley wire itself, so that if a trolley wire should break there would be no sag in the structure to obstruct traffic.

The suspension is erected first, and, as will be seen from figure No. 8, the network of spans is self-contained. It is strong and easily erected, as it is based on straight lines; further, when the curve offset line is located it is not lost, as the backbone construction holds the pullovers in place, allowing a curve wire to be renewed without losing the alignment.

Along with this, we erect a device for permanently keeping the frog locations. This device is a clamp which is suspended on a cross-span and holds the trolley tangent wire and curve wire in place. The frog pan is then placed up against the clamp and fastened to the wire by the frog approaches. This device permits changing a frog pan in less than two minutes, which is a very valuable consideration. After the suspension is erected the tangent trolley wires are run into place, and the bridle wires pulled up, then the curves are put in.

This standard type of construction is adapted for the other intersections with lesser number of curves. Of course, it must be understood also that there are times when poles cannot be erected within a few feet of the desired locations, in which case the construction is varied to suit.

Overhead Emergency Calls

On any overhead system, the number of emergency calls per month for overhead troubles, compared to previous months, may be taken as a very fair indication of the condition of the system. Every emergency call is a potential source of traffic delay, and there are enough of such delays due to foreign causes without any internal department contributing to worries of the traffic men, consequently any reduction in the number of emergency calls must result in an improvement in the maintenance of the traffic schedule.

The effect of the system of inspection and the following-up of the records have had the result shown in figure No. 9. The rise in maintenance cost up to 1923 was caused by the increasing heavy maintenance which occurred on the lines purchased from the Toronto Railway Company. These lines could possibly have been rehabilitated as a capital charge, but the advisability of this was open to question, so the work was done on maintenance, and consequently we are now reaping the benefit in a falling average monthly cost. The 1926 cost will no doubt fall in about the same proportion as 1925.

By analyzing the number of emergency calls per year with reference to the hours of call over a period of years, some very interesting comparisons are obtained. Such an analysis is shown in figure No. 10. The great number of calls between 8 a.m. and 10 a.m. in 1923 were principally

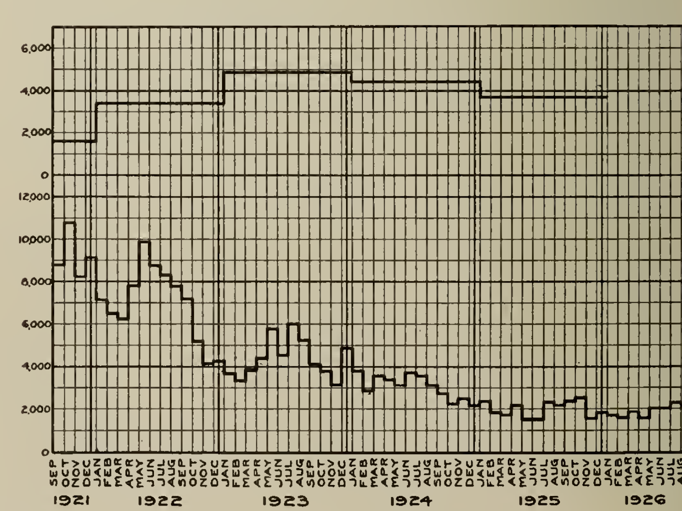

Figure No. 9.—Chart showing Average Monthly Cost per Year of Trolley Maintenance and Emergency Calls.

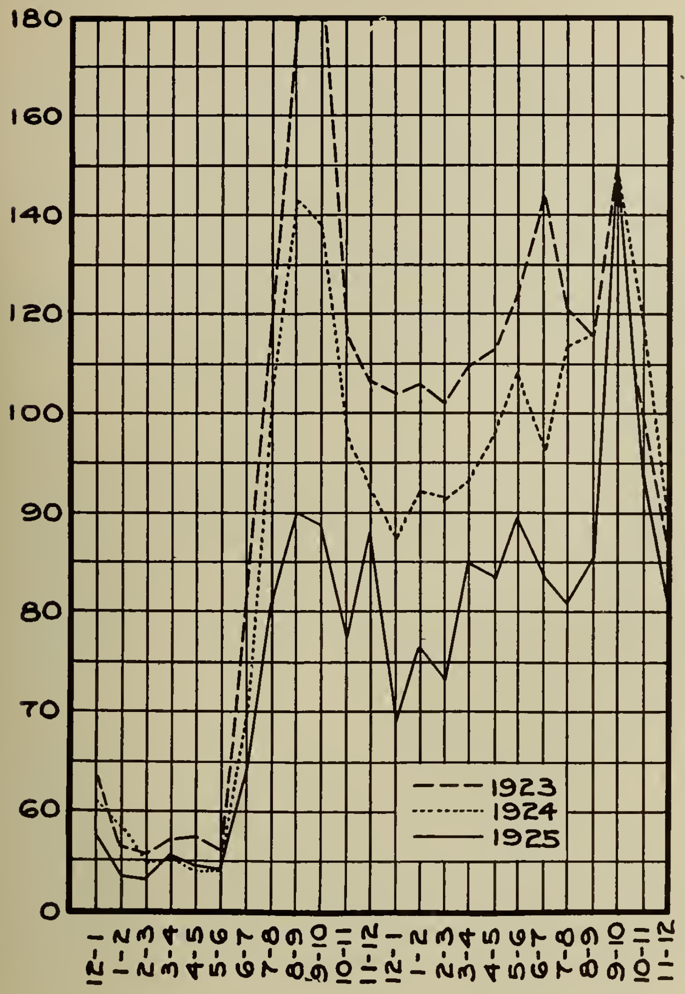

Figure No. 10.—Analysis of Number of Emergency Calls per Year.

due to broken spans and generally distorted intersections, due to high night car speeds, together with the fact that the morning inspectors were usually occupied with getting the cars out for the morning peak and had no time to report troubles until later. A determined attack was made upon the weak spots which caused these reports, with the result that by 1925 they were all well in hand. A peculiar fact appears to be that we cannot reduce the number of calls between 9 p.m. and 10 p.m., which have practically remained constant for the three years. This is partially explained by the fact that many of them are lights which are reported out, and are probably delayed until a slack time of the evening before reporting.

As an example of what constant attention to small things will do, we may take the matter of following-up broken trolley wires to determine the cause and to eliminate it. The fractured ends of all broken trolley wires must be sent to the head office, accompanied by a form giving details of the location, etc., of the break. If the circumstances do not appear to give the reason for the broken wire, an enlarged photograph of 20 times the diameter is made and studied. Such a photograph may show, for instance, the effect of a slight burn on top of the wire, setting up crystallization which finally caused a break. Many cases of crystallization may be traced to hard spots in the suspension, due to tight spans, or again it may be due to the shape of the trolley ear causing the wheel to pound the wire. This usually causes a wire to break about one to two inches in from the outer ends of the ear.

Electric Switches

Another interesting feature of the electrical department's work is the installation and maintenance of electric switches; a cut of a simplified circuit of which is shown in figure No. 11. The principle of operation is that the current limited by the resistance coil passes through the series, and operates the point for the straight, as soon as the trolley wheel bridges over from " B " to " C." If the motorman wishes to set the point for the curve, he puts his controller on the second or third notch and draws enough current to raise the plunger in the " circuit changer coil " from the straight track contact to the curve contact, with the result that the current flows through the other magnet in the track box and throws the point for the curve.

As the pull in the track box is a matter of some 400 pounds, some trouble has been experienced with the breaking of the connecting rod between the plunger and the point. This has been partially solved by the introduction of a damping spring. Investigations are still in progress, and we are looking to obtain a probable complete elimination of this trouble. We find the electric switch, when carefully maintained, a very efficient piece of apparatus, as our last twelve months' experience has shown approximately 81,500 operations for every trouble call. The actual economic value of the electric switch is very high with one-man-car operation, but they must be maintained, as one failure with a one-man-car operator during a peak load rush will probably cost more than a month's maintenance.

In 1885, what is claimed to be the first under-running trolley cars in the world was operated regularly between Strachan avenue and the Exhibition grounds, and after the passing of forty odd years, since that time, we are still searching after the factors which enter into the life of the trolley wire, and so it is in other phases of our work. To-day is witnessing one of those periods in the evolution of things where progress seems to leap ahead and development is very rapid. Traffic congestion such as was never known before is with us. Competition is keen, and all transportation systems are being tried in the economic balance, but the writer has no hesitation in saying that, with sound management and sane engineering, the trolley car will hold its own in the mass transportation field for many years to come.

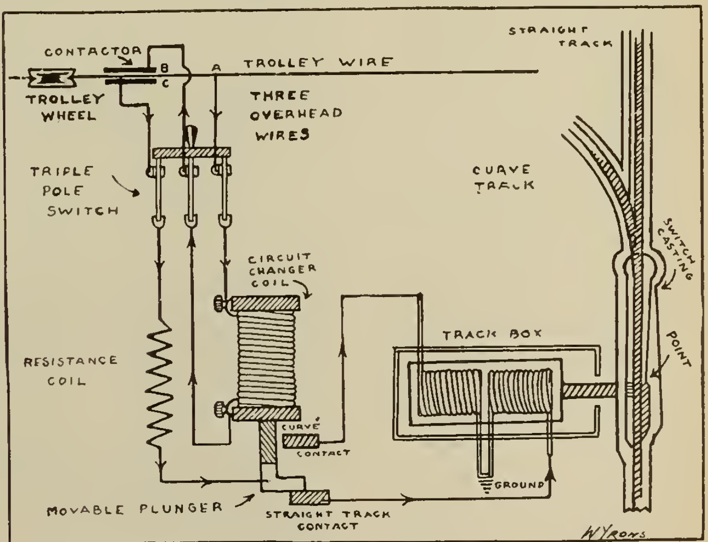

Figure No. 11.—Simplified Circuit of an Electric Switch.

THE

ENGINEERING JOURNAL

THE JOURNAL OF
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The Work of the Committee on Biographies

In view of the desirability of preserving some record, however brief, of the life and work of prominent Canadian Engineers, who are no longer with us, Council appointed the Committee on Biographies in 1922, under the Chairmanship of Professor P. Gillespie. As a result of that Committee's work, a number of sketches have been prepared which, for the first time, make such biographies available to members of the Engineering Institute of Canada.

They are prepared in each case by members having knowledge of the people of whom they write, and, as might be expected, vary greatly in length and method of treatment. Most of them, however, will be found to throw an interesting side light on the many difficulties encountered in carrying out engineering work in the old days.

It is intended to publish these papers from time to time in the columns of the Journal, and in the present issue will be found the first of the series, the life of Mr. Walter Shanly.

Meeting of Council

Meeting of November 16th, 1926

A meeting of Council was held at eight p.m. on Tuesday, November the 16th, 1926, Councillor J. H. Hunter in the Chair and four other members of Council being present.

The report of the Finance Committee with the financial statement to October 31st was approved, and a number of cases involving special consideration were dealt with.

The Secretary reported that in accordance with the directions of Council at the October meeting, the following letters had been forwarded to the Prime Minister and members of the Cabinet:—

October 22nd, 1926.

The Right Honourable W. L. Mackenzie King, C.M.G.,
Parliament Buildings,
Ottawa, Ont.

Sir:—

The Council of the Engineering Institute of Canada, as a result of suggestions received from a number of members of the Institute, has had under consideration statements which have recently appeared to the effect that the completion of the Hudson's Bay Railway, with harbour and other constructional works connected with it, is to be proceeded with at no distant date by the Dominion Government.

I have been directed to transmit to you, and to the members of the Cabinet, a copy of the resolution passed by my Council in June, 1924, and forwarded at that time to the Dominion Government, which reads as follows:

> "Resolved, that the Council of The Engineering Institute of Canada place itself on record in affirming that the proposed Hudson's Bay Railway be thoroughly investigated from the engineering, eonomic and national viewpoints, before any decision is made to construct, complete or operate the said railway."

It is believed that the above resolution embodies the considered opinion of the Engineering Profession in Canada.

In bringing the matter again to your notice, my Council is influenced by the fact that a number of important portfolios in the Dominion Government are now held by ministers who were not in office in 1924, and it is hoped that your new Government will accord favourable consideration to the suggestion now put forward.

I have the honour to be, Sir,
Your obedient servant,
R. J. DURLEY, Secretary.

October 23rd, 1926.

The Right Honourable W. L. Mackenzie King, C.M.G.,
Parliament Buildings,
Ottawa, Ont.

Sir:—

The attention of the Council of The Engineering Institute of Canada has been drawn from time to time to cases in which the design of important engineering works in Canada has been entrusted to engineers other than Canadians, and at the last Council meeting I was directed to bring this matter to your notice, and to say that in the case of public works in which the Dominion Government is interested, my Council would respectfully suggest that these be designed as well as executed by Canadian engineers.

It is felt that the necessity for the employment of foreign engineers in such cases no longer exists, since Canadians who have been responsible for the design and construction of important works in all principal branches of engineering are available for consultation and employment.

I have the honour to be, Sir,
Your obedient servant,
R. J. DURLEY, Secretary.

It was stated that these letters had been duly acknowledged, and in several cases Ministers had been good enough to express appreciation of the communications.

The views of all members of Council having been ascertained by correspondence with reference to the suggested removal of the age limit of thirty-three years for the class of Junior, it was reported that a considerable majority expressed the opinion that no change should be made in the present By-law, while a number of suggestions were made, including one that the By-law should be amended so as to empower Council to waive the limit in special cases. After discussion it was thought advisable to take no action in this matter at the present time.

The Secretary having reported that difficulty and delay had been experienced in completing the organization of the St. Maurice Valley Branch, Council approved the suggestion that a meeting of the members of this Branch should be called at an early date for the purpose of discussing the situation.

A report was submitted from Mr. A. G. Tapley and Dean H. M. MacKay, who attended the Annual Meeting of the Canadian Board of Trade at St. John, N.B., as representatives of The Engineering Institute of Canada. The Secretary was directed to draw the attention of the Executive Committees of the various branches of The Institute to the desirability of co-operation with local Boards of Trade in regard to matters involving engineering or technical considerations.

The design and inscription for the proposed tablet to be erected on the Fraser Canyon Highway by The Engineering Institute of Canada and the Association of Professional Engineers of British Columbia was submitted and approved; the inscription reading as follows:—"In commemoration of the engineering achievement of the two companies of Her Majesty's Royal Engineers who, in 1868, were responsible for the construction of the Cariboo Road. This tablet is erected by The Engineering Institute of Canada and the Association of Professional Engineers of British Columbia."

Action was taken in the cases of a number of Students from whom no communications have been received and who are over-age for the Student grade. Their names were removed from the membership list.

The following elections and transfers were effected:—

Elections	
Associate Members	1
Juniors	1
Affiliates	3
Students	23
Transfers	
Associate Member to Member	4
Student to Associate Member	2
Student to Junior	7

Fourteen applications for admission and transfer were scrutinized and classified for the ballot returnable December 14th, 1926.

Six special cases were considered in connection with applications for admission.

The Council rose at eleven-fifteen p.m.

Canadian War Memorials

In all periods of history, the natural impulse to commemorate warlike achievements and to honour those who sacrificed their lives in action has led to the erection of War or Battle Memorials. Some of these fitly enshrine the names of men from a particular locality or society, as in the case of The Institute's war memorial. Others are of larger outlook, national in their scope, like the series of Canadian war memorials now under construction in France and Belgium. These are not only landmarks, but records in enduring stone of the prowess of Canadian troops on important battlefields.

It seems fitting, on the eighth anniversary of Armistice Day, to give to the members of The Institute some account of what has been accomplished by the Canadian Battlefields' Memorial Commission to mark the scenes of the heroic encounters of 1915-1918. The scheme which the Commission is carrying out provides for a few important monuments rather than a number of minor ones, aims at the avoidance of triviality in design, and recalls the most striking episodes in which Canadians were engaged during the four years' conflict in the three-hundred-mile zone of desolation.

Saint Julien Memorial.

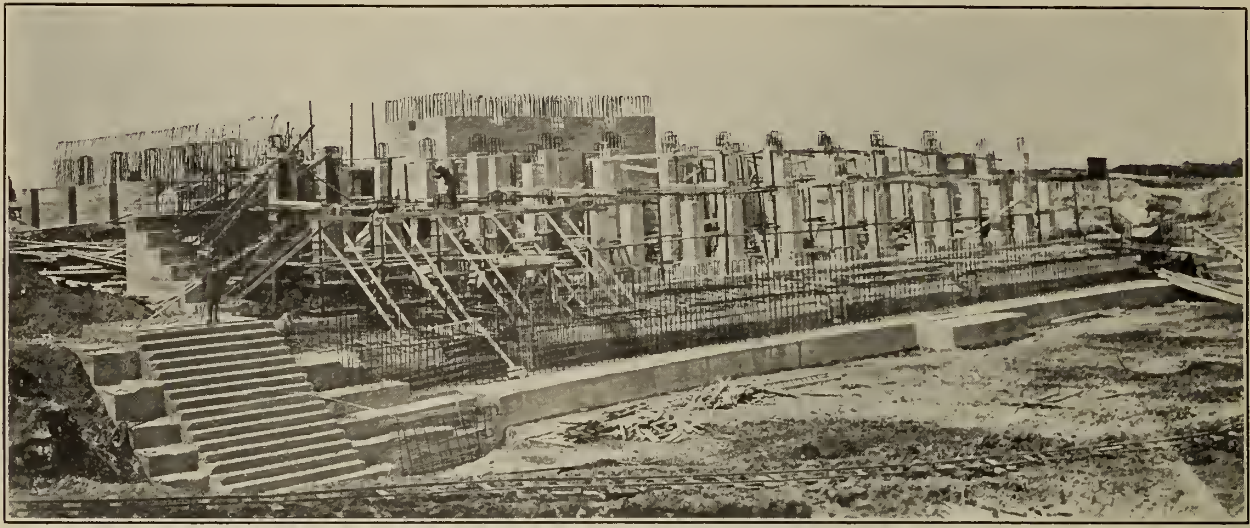
The general question of Allied War Memorials was first considered by a Battle Exploits Memorials Commission formed in February 1919, on which one of our own members, Brigadier-General H. T. Hughes, C.M.G., D.S.O., was appointed the Canadian representative. General Hughes subsequently proceeded to France and Belgium to secure eight sites which had previously been recommended at a meeting of senior Canadian officers. The necessary funds were appropriated by Parliament, and on September 2nd, 1920, the Canadian Battlefields Memorial Commission was appointed, by Order-in-Council, for the purpose of organizing and carrying out the work. This Commission has the following membership:—

- Major-General the Hon. S. C. Mewburn, C.M.G., K.C., M.P.;
- The Hon. Rodolphe Lemieux, K.C., M.P., (now chairman);
- Lt.-General Sir R. E. W. Turner, V.C., K.C.B.;
- Lt.-Colonel R. W. Leonard;
- The Hon. J. G. Turriff.

Colonel H. C. Osborne, C.M.G., is the Honorary Secretary; Professor P. E. Nobbs, R.C.A., is the Architectural Adviser, and Brigadier-General H. T. Hughes, A.M.E.I.C., who has been connected with the movement from its very inception, is the Chief Engineer of the organization in France, which comprises Lieut.-Col.-Ross, D.S.O., in charge of Landscape work, and Captain Simpson as Assistant Engineer.

The sites selected and the events commemorated are as follows:—

1. Saint Nazaire, land-

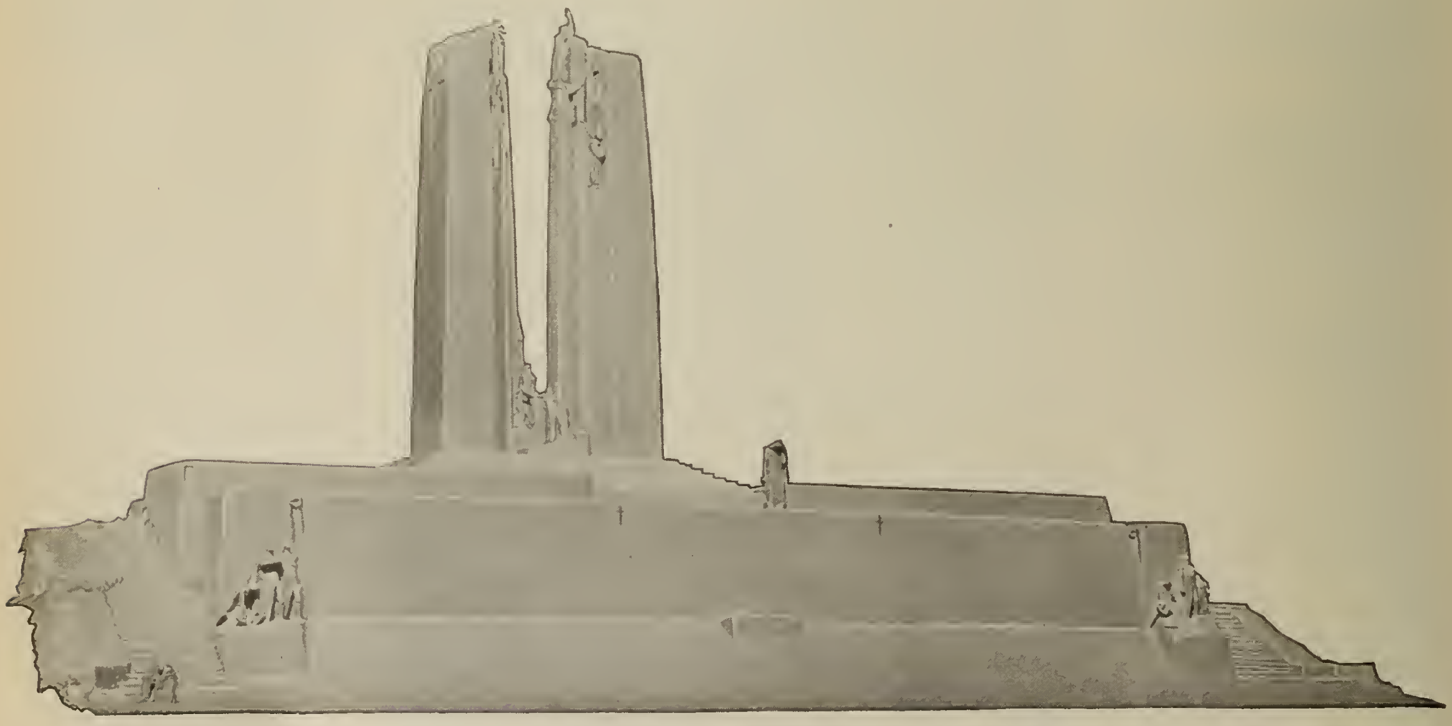


Sub-structure for Vimy Memorial.

ing of the First Canadian Division, February 12th, 1915.
2. Saint Julien, action of April 22nd-24th, 1915, when the Canadians on the British left withstood the first German gas attacks.
3. Hill 62—Battle of Mount Sorrel; Battle of Sanctuary Wood; April-August 1916.
4. Courcelette—Battles of the Somme, September-November 1916.
5. Vimy Ridge—April-May 1917.
6. Passchendaele—October-November 1917.
7. Le Quesnel—Eight-mile advance of the Canadian Corps. August 8th, 1918.
8. Dury—Battle of Arras, August 1918—breaking of the Queant-Drocourt switch of the Hindenburg line.
9. Bourlon Wood—forcing of the Canal du Nord, September 1918.
10. Mons—entry into this city of Canadian Troops on the last day of the War.

The memorial at St. Nazaire takes the form of a bronze tablet, designed by General Hughes, placed in the Town Hall, and bearing the following inscription:—

"Ici, le 12 fevrier, 1915, debarquèrent dix-huit mille soldats Canadiens, avant-garde d'une armée de trois cent trente-huit mille hommes; cette armée com-



Model of Vimy Memorial.

battit les Allemands pendant quatre ans; livra vingt-six batailles, et avec les Alliés victorieux marcha sur le Rhin."

"Here landed the First Canadian Division, eighteen thousand strong, on the 12th February, 1915. Three hundred and twenty thousand followed; throughout four years the Canadians fought the Germans; after engaging in twenty-six battles they marched in victory to the Rhine."

The inscription on the Mons tablet is as follows:—

"Mons was recaptured by the Canadian Corps on 11th November 1918; after fifty months of German occupation, freedom was restored to the city: Here was fired the last shot of the Great War."

The sites for the memorials at St. Julien, Sanctuary Wood and Passchendaele were given by the Belgian Government. The Bourlon Wood site was given by Comte de Francqueville, and later the Vimy site, two hundred and fifty acres in extent, was presented by the French Government. The three remaining sites were purchased.

Immediately after its formation, the Canadian Battlefields Memorials Commission organized a competition for designs, to be judged by three architectural assessors, from Canada, France and England respectively, and the successful designs were finally chosen from those submitted by over 160 competitors. The principal award was made in favour of Mr. W. S. Allward, R.C.A., of Toronto, whose design was recommended for erection at Vimy Ridge, while that of Mr. F. C. Clemesha, of Regina, was adopted for the Saint Julien site. There is considerable similarity of spirit and feeling between these two designs. They are, in fact, of the same school of thought, and have a distinctive character of their own; something romantic, imaginative, and unconventional.

The Vimy monument, when completed, will commemorate not only the taking of the Ridge and other engagements generally described as the Battle of Arras, but also the whole achievement of the Canadian troops in France during the Great War. It is situated on Hill 145—the King's Observation Post. From this point an extensive view is had over a wide valley towards Lens, Mericourt and, in the far distance, Douai.

In looking at a work of art, the observer often supplies his own symbolism. Mr. Allward's idea at the time his design was accepted is contained in the following paragraph:—

> At the base of the strong impregnable walls of defence are the Defenders, one group showing the breaking of the sword, the other the Sympathy of the Canadians for the Helpless. Above these are the mouths of guns covered with olive and laurels. On the wall stands an heroic figure of Canada brooding over the graves of her valiant dead; below is suggested a grave with a helmet, laurels, etc. Behind her stand two pylons symbolizing the two forces—Canadian and French—while between, at the base of these, is the Spirit of Sacrifice, who, giving all, throws the torch to his comrade. Looking up they see the figures of Peace, Justice, Truth and Knowledge, etc., for which they fought, chanting the hymn of Peace. Around these figures are the shields of Britain, Canada and France. On the outside of the pylons is the Cross.

In the case of the Saint Julien Memorial, which was unveiled by the Duke of Connaught on July 8th, 1923, the head and shoulders of a Canadian soldier surmount a great grey column. The hands are folded on a reversed rifle; the figure watches over those who sleep beneath. There is great power in this impressive monument.

BRIG.-GEN. H. T. HUGHES, C.M.G., D.S.O.

For the six sites other than Vimy and Saint Julien, one design has been used, a simple fifteen-ton block of Canadian granite from Stanstead being placed in the centre of the plot. The general scheme for these memorials shows a flight of terraced steps leading up to a stone platform in a small park with shrubs and flowers. At the present time, all the sites are complete, the sub-structure for the Vimy monument has been finished, the Saint Julien monument has been completed and dedicated, and the grading and landscape work on all the sites has been carried out.

The memorial parks and monuments in France and Belgium will be visited annually by an increasing number of pilgrims from this side of the Atlantic. No one who saw the war zone, even a year or two after the Armistice, can fail to recognize the magnitude of the task, and the difficulties which confronted the Commission, or to appreciate the imagination involved in the shaping of these parks from the torn and devastated fields.

Remember—

The FORTY-FIRST ANNUAL GENERAL *and* GENERAL PROFESSIONAL MEETING

Will be held at QUEBEC CITY

TUESDAY, WEDNESDAY *and* THURSDAY, FEBRUARY 15TH, 16TH *and* 17TH, 1927

Walter Shanly — A Biography

By M. J. Butler, M.E.I.C., and *J. S. Dennis, M.E.I.C.*

Walter Shanly was born at the Abbey, Stradbally, Queens County, Ireland, on the 11th of October 1817. He was the fifth son of the late James Shanly, Esq., a member of the Irish Bar, of the Abbey, Queens County, and Normans Grove, County Meath, Ireland, who came to Canada and settled at Thorndale, Middlesex County, Ontario, in the year 1836.

Walter Shanly was given his early education by private tuition. While living at Thorndale with his father, he was fortunate in becoming acquainted with the late Hamilton H. Killaly, who owned property in the neighbourhood. Shortly afterward Mr. Killaly was appointed to the position of Commissioner of Public Works for the recently united provinces of Upper and Lower Canada, and through him Mr. Shanly obtained an appointment in the Department. In the fall of 1840 he came to Montreal and was put in charge of the construction of a section of the turnpike roads on the island of Montreal. Subsequently, he was employed on the St. Ours lock on the Richelieu River canal and for a short time on the Cornwall canal, under the late Samuel Keefer. He was later transferred to the Beauharnois canal as resident engineer, where he remained until the completion of the work. From there he was moved to the Welland canal, where he held the position of assistant engineer and afterwards of chief engineer.

WALTER SHANLY

The railway era was just opening up about 1850, and Mr. Shanly felt that it was important to learn the work. He resigned from his position on the Welland canal and secured an appointment as resident engineer on the Ogdensburg and Lake Champlain Railway, (then known as the Northern New York Railway), and had charge of the work from Ogdensburg to Malone. On the completion of the railway, he returned to Canada and took charge, as chief engineer, of the Bytown and Prescott Railway, (now the Prescott branch of the Canadian Pacific Railway). On its completion, he removed to Toronto and was appointed chief engineer of the Toronto and Guelph Railway, which was soon merged into the Grand Trunk Railway, and, so known, was built under his supervision from Toronto to Sarnia. On the completion of this work, and the opening of the line from Sarnia to Montreal, he was appointed chief engineer and manager of the company. It may be said that Mr. Shanly was one of the moving spirits in the organization of the Grand Trunk Railway and of the building of the Victoria bridge across the St. Lawrence river at Montreal. He acted as general manager of the Grand Trunk Railway of Canada from 1858 to 1862.

In 1857, Mr. Shanly, at the request of the government, made an exploration of and reported upon the Georgian Bay canal, via the Ottawa and French rivers, a project that has been more or less in the public mind from that day to this. He ever afterwards took a great deal of interest in the scheme, was a firm believer in it and felt that a day would arrive when it would be an accomplished fact. In 1868, Mr. Shanly, having reached his fifty-first year, ripe in experience as an engineer on canal work, railway work and in management of the greatest railway then in Canada, and having had, as a Member of Parliament, another kind of training, decided, in partnership with his brother, the late Frank Shanly of Toronto, to enter the contracting field. At that date, and for some considerable time previously, there was under construction the largest and most difficult work on this continent. This was the Hoosac tunnel, a short history of which will, it is hoped, be found of interest, and with the successful completion of which the names of Walter and Frank Shanly are associated.

The building of a tunnel through Hoosac mountain, in the north-westerly corner or Massachusetts, was first suggested for canal purposes before the days of railroads.

In 1825, the state of Massachusetts appointed a board of commissioners to consider the practicability of building a canal from Boston to the Hudson river, its western terminus to be at the point where the then Great Erie canal, —the pride of the time,—emptied its waters into the river.

The commissioners recommended a route for the canal by way of the Deerfield and Hoosac rivers, piercing Hoosac mountain by a tunnel. Just as the commissioners' report began to be discussed, however, railroads began to be heard of, public attention was focused on rail transportation, and the labour and arguments of the canal commission were soon forgotten. The first railroad across Massachusetts through to the Hudson river was that now known as the Boston and Albany, which is leased to the New York Central, running from Boston, by way of Worcester, Springfield and Pittsfield, to Albany. A little later an east and west railroad across Massachusetts was begun following substantially the line of the proposed canal from Boston to the Hudson river.

Only six years after the Boston and Albany Railroad was completed, the farmers of Massachusetts began to denounce that road as a "grinding monopoly," and they sought the construction of another road through to the Hudson river.

Accordingly, the Troy and Greenfield Railroad was incorporated May 10th, 1848. To it was granted the right to build a railroad from near Greenfield, in the Connecticut valley, to the state line at Williamstown, there to connect with the railroad which would be built from Troy to that point. This project contemplated a tunnel through the Hoosac mountain, although the tunnel was not specifically mentioned in the charter.

The history of the Hoosac tunnel from the incorporation of the Troy and Greenfield Railroad in 1848 to July 1861 is that of a private enterprise backed by state aid. The location of the railway was not decided upon until 1850, and in the two years following the granting of the road's charter the enthusiasm of the people of the state for this new road as a competitor to the Boston and Albany

Railroad seems to have died out, and subscriptions to the capital stock of the Troy and Greenfield were very few.

The railway company met with great difficulty in securing funds. The first contract in 1855 was awarded to E. W. Sewell and Company, of Philadelphia, for the sum of $3,500,000, which sum was intended to cover the cost of building the tunnel through the Hoosac mountain, but was to build the entire road from Greenfield to the state line at Williamstown, a distance of approximately 45 miles. Some work was done under this contract, but a shortage of funds soon tied up the work. A second contract with the Sewell Company was made in January 1856, contingent upon the company securing additional funds to the extent of $100,000 by May 15th, 1856. This undertaking failed, and the Sewell contract was annulled.

The management of the railway, however, did not give up the contest. Shortly afterward the firm of Herman Haupt and Company, in July 1856, undertook for the sum of $3,800,000 to build the railway and the tunnel. Very little cash was provided, barely 10 per cent, the balance being in bonds of the state and in railroad securities. The firm actually started the construction of a small single-track tunnel at both the westerly and easterly sides of the mountain in 1856. Various difficulties arose, chiefly of finance, and the work dragged along slowly. In 1858 the old contract with Herman Haupt and Company was cancelled and a new one made, increasing the price for the road and tunnel to $4,000,000. Of this amount, $2,000,000 in state bonds were to be used exclusively for tunnelling. By August 1858, the Haupt concern had constructed 788 feet of tunnel at the easterly end and 240 feet at the westerly end. This, however, was a small bore, only large enough for a single track. Up to this time, all work had been done by hand drilling. A rock-cutting machine was then tried, but it proved to be a complete failure.

In 1859, the railroad again appeared before the legislature for a modification of the loan act of 1853, which was granted in a complicated act which made easy the terms of payment of the state's contribution and stipulated that the tunnel should be 14 feet wide and 18 feet high. Construction advanced very slowly, and in July 1861, the contractor having failed to do the prescribed amount of work on the tunnel, the state refused to make payments and the Troy and Greenfield Railroad gave up the project altogether.

From 1862 to 1868 the Hoosac tunnel project was carried on under state management, the work being done directly by a state commission.

In January 1863, the state commission on the tunnel, appointed under the Act of 1862, made a report to the legislature in which it recommended the building of a larger tunnel, 22 feet wide at grade line, 24 feet wide at its widest point and 21 feet in height, with a circular roof. The commission estimated the total cost at $5,179,330 and the time necessary for completion at 7½ years, provided the central shaft be constructed down from the top of the mountain, such that work could proceed simultaneously on four headings. The commission was unanimously of the opinion that the state should carry out the work alone.

When the state commission entered upon its work in 1863, it was found not only that little had been accomplished but that what had been done had been done wrong to a great extent. For example, the west shaft, which had pierced the mountain only a little way, was found to be 10 feet out of proper alignment. Work was begun by the state commission in December 1863 by the sinking of the central shaft, which it was hoped would be completed in time to be of much use in expediting the work of the tunnel as well as affording sufficient ventilation. Up to this time, all the actual work had been accomplished by hand power. The much-vaunted "boring machines" which were to run straight through the mountain had left their unpleasant memories behind them.

It was at this time, however, that the use of compressed air as a motive power was suggested. After much discussion, it was decided to dam the Deerfield river at a point about three-quarters of a mile from the eastern portal and to bring the water thence to the tunnel, the water power to be utilized in making compressed air. It was some time before this water power scheme was carried out. It was completed in 1866, and in June of that year rock drills operated by compressed air were first put to use in the easterly shaft of the tunnel. This marks the beginning of the use of the rock drill in tunnelling operations.

In this same year also, nitro-glycerine was first put to use in the westerly shaft. For the two succeeding years work on the tunnel appears to have been carried on under the state commission's direction, either by direct labour or by separate small contracts. In 1868, the legislature passed an act ending the work of tunnel construction by state commission and authorizing the making of a single contract to complete the entire tunnel, provided it could be done in 7 years at an expenditure of not more than $5,000,000. Of this sum, $250,000 was to be set aside for the payment of certain outstanding liabilities. Under the act, the contractor was to furnish satisfactory guarantees and at least $1,000,000 was to be held from the contract price until the enterprise was completed. The tunnel was to be built of sufficient size for two tracks, and one track was to be laid under the contract. When the bids were received by the Governor and Council in 1868 for the completion of the tunnel, it was found that twelve bids had been submitted, ranging in amount from $4,027,780 to $5,378,534.

Messrs. Walter and Francis Shanly, of Canada, made a bid at $4,623,069. Although this was next to the highest bid of those which came under consideration, the legislature had not required that the contract should be given to the lowest bidder, and in consideration of the deposit of public securities to the amount of $5,000,000 as a satisfactory guarantee, as well as in view of the long experience and excellent reputation of the firm, Governor Bullock gave the contract to the Messrs. Shanly, after long consultation with the Council. The contract was signed December 19th, 1868, and it provided that the tunnel should be completed March 1st, 1874. The work was carried on with the greatest possible energy and skill and to the satisfaction of all concerned.

The depth of the central shaft is 1,040 feet; the length from the shaft to the east portal is 12,837 feet, the length from the shaft to the western portal is 12,194 feet, making a total length of tunnel of 25,031 feet.

Mr. Shanly thereafter carried on a general practice as consulting engineer, and had for his clients both federal and provincial governments, the Grand Trunk Railway of Canada, the Canada Atlantic Railway and various other large corporations. His services were frequently sought as an arbitrator in disputes between companies, the government and contractors, and such was his reputation for honesty, ability and justice that his awards were seldom disputed by either party.

Mr. Shanly sat in the old Parliament of Canada from 1863 to the Union in 1867, and was the contemporary, colleague and friend of Sir John A. Macdonald, Sir George Cartier, Sir Alexander Galt and the Hon. T. D'Arcy McGee, and of the many other brilliant statesmen of the period.

When Confederation was accomplished, he sat in the House of Commons of Canada during the whole of the First Parliament of Canada, and subsequently during the greater portion of the Fifth and during the whole of the Sixth Parliament. A Conservative from conviction, he gave an unyielding support to Sir John A. Macdonald, both before and after the Union.

Mr. Shanly was a delegate to the Detroit Trade Convention, 1864, along with the late Hon. Joseph Howe, John Young and other representative men from the British Province. He was for some years president of the Mechanics' Bank. Mr. Shanly retired from public life at the General Election of 1891, and he died at Montreal on December 17th, 1899, and was buried at London, Ont.

OBITUARIES

John Rigney Barlow, M.E.I.C.

Sincere regret is expressed at the death of John Rigney Barlow, M.E.I.C., one of The Institute's oldest members, which occurred at his home in Montreal on October 29th, 1926.

The late Mr. Barlow had for many years been connected with the affairs of the city of Montreal in the capacity of city surveyor, which position he held until he retired in 1918. He was born at Stornoway, Isle of Lewis, Scotland, on July 29th, 1850, and came to Canada in 1855 with his father, who was for many years connected with the Geological Survey of Canada and was at one time with the Royal Engineers.

JOHN RIGNEY BARLOW, M.E.I.C.

Mr. Barlow received his education in this country and carried on his professional studies under his father. In 1872 he entered the Federal Government service on the staff of the Geological Survey of Canada, remaining on this work until 1875. He then spent one year on railway work in the United States, and upon his return to Canada joined the staff of the city of Montreal. He was for a short time chief assistant to Mr. J. A. W. Beaudry, on the construction of the St. Henry waterworks. In 1892 he received his appointment as deputy city surveyor, and in 1900 became city surveyor, retiring from active service eighteen years later.

The late Mr. Barlow joined The Institute in the days of the Canadian Society of Civil Engineers as Member on February 3rd, 1887, prior to its incorporation.

James Ewing, M.E.I.C.

James Ewing, M.E.I.C., president of the Town Planning Institute of Canada and senior member of the firm of Ewing and Tremblay, engineers, Montreal, died at his residence in Montreal on November 5th, 1926.

In the death of Mr. Ewing, the Town Planning movement in Canada has lost one of its strongest exponents.

JAMES EWING, M.E.I.C.

For some years past, Mr. Ewing had devoted his time and energy to the preparation of advocacy of a comprehensive plan for the development of the city and district of Montreal. Due to his splendid persistency by pen and voice, this movement has in recent months become a most active issue.

The late Mr. Ewing was born at Ardrossan, Scotland, on December 9th, 1859. He was educated at Greenock Academy and Greenock School of Science, passing the government examinations in various technical subjects. In July 1875 he became a pupil, and afterwards assistant, to Mr. James Wilson, superintendent of Greenock Waterworks, and was engaged on the construction of numerous waterworks and sewage disposal systems until October 1883. He came to Canada in December of that year, and his first position in this country was in the office of the harbour engineers in Montreal. In March 1884 he joined the engineering staff of the Canadian Pacific Railway Company. It was in the office of the chief engineer his services with this company were extended over a period of about twenty-nine years, during which time he occupied various positions, finally being appointed chief draughtsman in the construction department. Subsequently, he established the engineering firm of Ewing, Lovelace and Tremblay, which later become Ewing and Tremblay.

Mr. Ewing joined the Engineering Institute of Canada, then the Canadian Society of Civil Engineers, as Associate Member on November 11th, 1892 and was elected Member on October 24th, 1907.

PERSONALS

J. L. Bieler, S.E.I.C., is at present located in London, England, on the engineering staff of the Industrial Combustions Engineers, 31 Wybert street, London, N.W. 1.

Ralph C. Silver, S.E.I.C., Danville, Que., has been awarded the Jenkins Bros., Limited, scholarship for students entering the fourth year on engineering at McGill University.

Professor R. W. Angus, M.E.I.C., of the University of Toronto, has been elected secretary of the Toronto branch of the American Society of Mechanical Engineers.

T. L. Crossley, A.M.E.I.C., has been appointed special lecturer on pulp and paper in the department of chemical engineering at the University of Toronto.

Charles R. Stein, CAPTAIN R.C.E., A.M.E.I.C., who was for some time district engineer of Military District No. 10, Winnipeg, Man., is at present at the Royal Military Academy, Woolwich, S.E. 18.

F. L. Grindley, S.E.I.C., who graduated from the University of Alberta in 1926, is at present located at Arvida, Que., where he has received an appointment on the staff of the Aluminum Company of Canada, Limited.

W. R. Wonham, Jr.E.I.C., has resigned from the staff of the Montreal Tramways Company and has accepted a position with the Power Engineering Company in Montreal. Mr. Wonham graduated in electrical engineering from McGill University in 1922.

F. W. Townsend, A.M.E.I.C., who for the past six years has been located in Peru as chief engineer for the International Petroleum Company, Limited, has been transferred to Dartmouth, N.S., where he is chief engineer of the refinery of the Imperial Oil Limited.

Edward M. Velasco, S.E.I.C., who graduated from McGill University with the degree of B.Sc. in 1925, is with Messrs. Fraser, Brace Limited, and is located at Santiago, Antioquia, Colombia, S.A. Mr. Velasco was formerly with the woods department of the Wayagamack Pulp and Paper Company, Limited.

A. M. Toye, Jr.E.I.C., is with the John V. Gray Construction Company of Toronto, and is at present located in London, Ont., on the construction of a new hotel in that city. Mr. Toye is a graduate of the University of Toronto of the year 1925. He was until recently with Messrs. Chapman and Oxley, architects of Toronto, on the design of reinforced concrete work.

J. S. G. Shotwell, Jr.E.I.C., has been appointed to the staff of Price Brothers and Company, Limited, at their Riverbend mill, Riverbend, Que. Mr. Shotwell graduated from McGill University with the degree of B.Sc. in 1925, and has until recently been with the Forest Products Laboratories at Montreal. During the past year he was engaged on research work for the preparation of the thesis for which he was recently granted his degree of M.Sc. at McGill University.

F. T. Kaelin, M.E.I.C., chief engineer of the Shawinigan Water and Power Company, Montreal, who has been away for the past year, on account of his health, has returned, and it is gratifying to his many friends to learn that his health has been greatly improved. During his absence, Mr. Kaelin spent most of the time in his native land, Switzerland, and while there he represented the Canadian National Committee at the World Power Conference Meeting at Basle, Switzerland. Mr. Kaelin is a graduate of the Federal Technical University of Zurich, Switzerland. He joined the staff of the Shawinigan Water and Power Company in 1902, becoming assistant chief engineer in 1909 and chief engineer in 1919.

R. G. Johnstone, Jr.E.I.C., has joined the staff of the Harland Engineering Company of Canada, and is at present located at the plant of the Brompton Pulp and Paper Company, Bromptonville, Que., where he is engaged on the erection of a new paper machine for this mill. Mr. Johnstone was previously with the electrical department of the Newfoundland Power and Paper Company, Limited, Corner Brook, where he had charge of the electrical equipment for the new plant then under construction. He is a graduate of Nova Scotia Technical College, where he received his degree of B.Sc. in electrical engineering in 1924.

Louis Beaudry, A.M.E.I.C., secretary-treasurer of the Quebec Branch of The Institute, has joined Messrs. Wm. I. Bishop, Limited, on the construction of the Anglo-Canadian Pulp Company's mill at Limoilou, Que. Mr. Beaudry graduated from Ecole Polytechnique in 1921, at which time he received the degree of B.A.Sc. in civil engineering. During the summers of his college course he was engaged with the Department of Roads, Province of Quebec, with the exception of the last summer, when he was engaged with the engineering department of the city of Outremont. Following graduation he entered the construction field under the firm of Trepanier and Beaudry. In February 1923 he entered the Provincial Civil Service in the Department of Public Works of Quebec and was engaged on location, surveys, designing, estimating and inspecting of bridges.

M. A. Pooler, M.E.I.C., vice-president and general manager of the New Brunswick Power Company, Saint John, N.B., has been appointed general manager of the Tucson Gas, Electric Light and Power Company and the Tucson Rapid Transit Company, Tucson, Arizona. Mr. Pooler is a graduate of the Case School of Applied Science, where he received the degree of B.S. in 1904, and also of Perdue University, where he received his degree of E.E. in 1905. He was at one time superintendent of the New Castle Electric Company, New Castle, Pa., and later general manager of the Potomac Public Service Company, Hagerstown, Md. At the meeting of the directors of the New Brunswick Power Company on the occasion of Mr. Pooler's departure from Saint John, he was presented with a wrist watch on behalf of the board of directors.

Aerial Mapping in 1926

Aerial photography as an aid in economic mapping has steadily gone ahead in Canada since its inception five years ago. During the 1926 field season, operations extended into various parts of the Dominion, the major portion, however, being over lands where the need for maps was urgently felt in connection with the opening up of newly-discovered and newly-uncovered resources. Over such lands the lack of maps showing topographic features in an adequate manner was felt to be a severe handicap to development.

Thus, some of the most extensive operations included the new Rouyn mining district in the province of Quebec, and adjacent territory; a region in northwestern Ontario lying in general to the east of that covered by the 1925 season and extending from the Red lake area into the Woman lake and lake Nipigon districts, and an extensive territory in the vicinity of The Pas and Norway House in Manitoba. In the case of the new Rouyn mining district, the ground control was provided by the Geological Survey of Canada, and the survey section of the Quebec government.

In addition to this there were many smaller photographic operations, all with the ultimate object of providing data of value in the development of the natural resources of the country.

The value of the photographs taken is not alone confined to their actual use in mapping. Apart from this entirely they provide a most complete record of the features of the country, a record that may be called upon at any time when questions of any kind arise wherein the topography with its surface characteristics has a bearing. This is particularly true when used for geological, forestry, water power, road location, or other purposes.

The work of aerial mapping by the Dominion is carried on by the Topographical Survey, Department of the Interior, in co-operation with the Royal Canadian Air Force. The Topographical Survey has been made the central mapping organization for aerial photography of the Dominion Government service, and in their office, also, are carefully indexed and filed all photographs taken, thus providing for their use at any time in the future.

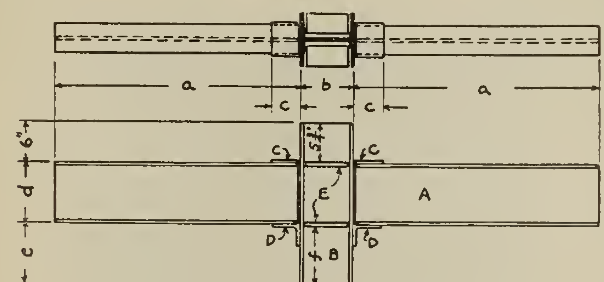
TESTS OF ARC WELDED STRUCTURAL STEEL

A. M. Candy, Welding Engineer,

and

G. D. Fish, Consulting Structural Steel Engineer,
Westinghouse Electric and Manufacturing Company

The series of test specimens which are described and discussed in this article were all welded with the various members located in the same position and manner as would be required if they were actually a part of a building structure. As a result, all of the welds made were executed from the same directions and were located in the same position as will be found in actual practice. For example, to weld the web of a beam to a column required welding along a vertical direction. To weld the under side of the top flange and the bottom face of the bottom flange of an I-beam to a column required the operator to execute overhead welds. For such operations as welding seat angles to columns and welding wed plates to the web and inside faces of the flanges of columns, the column sections were turned so as to permit the operator to make practically all such welds in the downward position due to the fact that in actual fabricating work these welds would be executed in the shop where it would be not only permissible but advisable to turn the material in such positions as to make the welding most easily executed by the operator, and thereby obtain welds which would be thoroughly dependable. All joints made with a single bead of metal were executed so as to make the bead of metal approximately 5/16-inch in thickness at the centre of the bead, and to extend out from the corner of the members so joined, a distance of approximately 5/16-inch.



Tests No. 1, 2, 3, 4, 5.

All specimens were loaded by means of rocker blocks 5 inches wide, 8 inches long, 10 inches high, finished on two faces to a radius of approximately 2 feet. Plates 1½ inches thick, 5 inches wide by 8 inches long were placed between the rocker blocks and the specimen so as to distribute the load through the rocker block over an area 5 inches wide across the specimen. Cantilever specimens, of course, were loaded at a point approximately 3 inches from the end, whereas simple beam specimens were supported by means of the rocker blocks on various spans, as indicated by the sketches, the load being applied at the centre of the specimen through a similar block 5 inches wide by 1½ inches thick.

The amount of weld metal used to make the various joints is unquestionably in excess of that actually required to produce joints of 100 per cent strength, but this was intentionally incorporated in the design of the test specimens so as to prove beyond the shadow of a doubt that structural members can be joined by arc welding, making joints which will not fail even up to rupturing loads on the members so joined.

In carrying out further tests in the future, determinations will be made as to the minimum amount of weld metal which can be used for such joints and still retain the requisite strength at the joints.

By perusal of the data which are given in this article it is manifest that the tests fully demonstrate the following facts:—

(*1*) That welded joints can be constructed in such manner as to develop fully the ultimate strength of the structural members connected.

(*2*) That beams and girders can be connected to columns so as to produce absolute fixation.

(*3*) That lines of beams or girders can be connected so as to provide complete continuity across the supports, whether the supports be girders or columns.

(*4*) That a steel I-beam of given section and length will sustain a far greater load if fixed at its ends by a suitably designed welded joint than if supported by standard rivetted connections consisting of top and bottom angles. A 9-inch standard I-beam framed between rigid upright columns 8 feet apart by means of specially designed welded connections sustained a load 25 per cent greater than a beam of the same size and length framed between columns by means of rivetted top and bottom angles of ½ inch thickness.

(*5*) That a plate girder assembled by welding and consisting of nothing but sheared plates, has a far greater bending strength than a rivetted plate-and-angle girder of the same weight, due to the better distribution of the steel in the cross-section. A 15-inch plate girder assembled by welding and simply supported on a 14-foot span developed more than 50 per cent greater strength than a rivetted plate-and-angle girder of the same depth and the same weight.

(*6*) A double angle tension member such as is used in trusses was connected at the ends by welding, and when tested to tension failure broke through the angles at a load 30 per cent greater than the load at which a hanger consisting of the same size angles with rivetted end connections failed.

The prevailing impression among the witnesses was that these tests demonstrated the superiority of welded connections to rivetted connections in every case where direct comparisons were made, and brought out two general facts:

(*1*) That complete continuity of lines of beams can be obtained in welded construction, whereas it is well known that this cannot be done in rivetted construction.

(*2*) That in a welded building it will be possible to make every joint develop full strength of the main members, whereas in a rivetted building many joints are weaker than the members due to the weakening effects of the rivet holes and the weakness of steel angles which have to be used for transmitting tension between two members at right angles to each other.

It was proved that a welded plate girder was 50 per cent stronger than the rivetted girder of relative depth, length and weight.

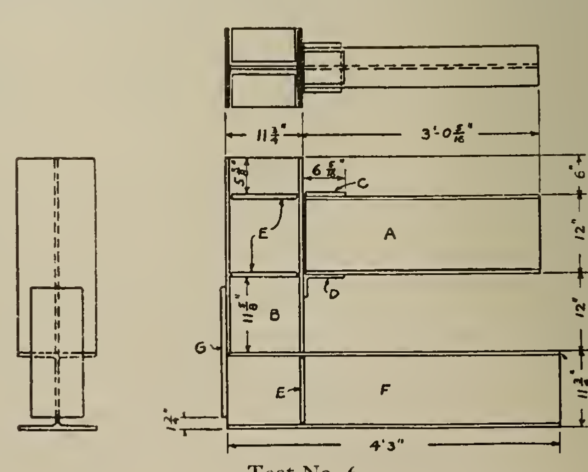
An Olsen testing machine, capable of applying 400,000 pounds, was used.

The tests proved the entire practicability of welding without any misgivings as to safety.

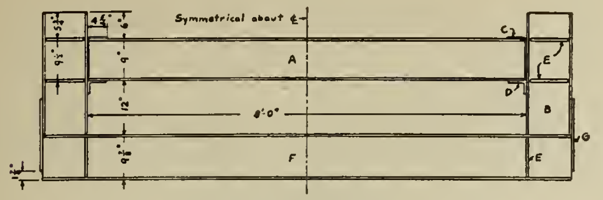
The joints that were demonstrated here are being used in the five-storey steel building 70 by 220 feet, and 80 feet high, now being fabricated and erected for the Sharon Works of the Westinghouse Electric and Manufacturing Company. The typical beam and girder connections are fully continuous connections thereby permitting large percentage of saving in the weight of the beams and girders to carry a given load. The same type of connection which develops continuity also effectively stiffens the building against wind. The equivalent cannot be obtained by any known rivetted joint.

Test No. 1

In test No. 1 a double cantilever specimen was used, comprising cantilever I-beams *A* weighing 21 8/10 pounds to the foot, 3 feet long, secured to the column *B* which is an 8-inch H-section weighing 32 pounds to the foot, 2 feet long. Seat angles *D* com-



Test No. 6.



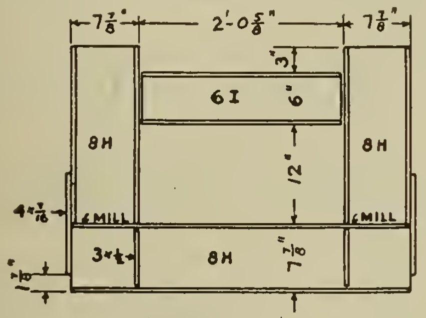
Tests Nos. 7, 8, 9.

prising 4 by 3 by ⅜-inch angles, 5 inches long, were welded to the column faces on which the beams *A* were landed, after which the entire end of the beams *A* were welded to the column faces. The edges of the bottom flanges of beams *A* were also welded to the seat angles *D*. After completing the weld between the top flanges of beams *A* to the column, plates *C*, 4 by 7/16 by 5 inches long were placed in position and welded to the column face. Due to the fact that plates *C* were wider than the top flanges of beams *A* it was necessary to make overhead welds along the edges of the top flanges to the under surfaces of plates *C*.

The web plates *E* are 3 by ⅝ by 6⅝ inches long, four of which were used; two on each side of the column as indicated. These web plates were cut so as to provide approximately 3/16 inch gap between their ends and the inside faces of the column flanges. These plates were securely welded at their ends to the inside faces of the column flanges and were located directly in line with the top and bottom flanges of beams *A*.

This test demonstrated several facts:—

First. That properly designed joints between beams and columns can be executed by arc welding so that the resulting joint is a great deal stronger than the members so joined. Such a joint is not only stronger but much more rigid than any similar joint



Test No. 10.

could be made by riveting practice, due principally to the use of web plates *E* which give the identical effect of the beams *A* being continuous through the column.

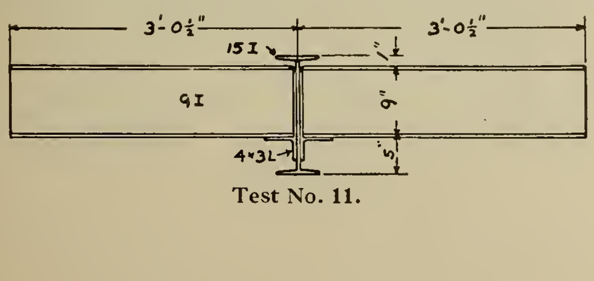
The total weight of the complete specimen was 224 pounds; 6 pounds of welding wire was required and the time to make the specimen was 4 hours. The span for loading this specimen was 6 feet 2¾ inches. The yield point of this specimen was 50,000 pounds and the ultimate load was 75,100 pounds. Failure was by web crippling of beams, and the ultimate bending moment at column face was 125,000 inch-pounds.

Test No. 2

The specimen in test No. 2 was similar to that in No. 1, the difference being that the beams *A* are 9-inch Bethlehem I-section, weighing 20½ pounds to the foot; plates *C* are 4 by ½ by 4½ inches; seat angles *D* are 6½ inches long. In this case the welding procedure was exactly the same as described for No. 1 with the single exception that the plates *C* being narrower than the top flanges of beams *A* it was possible to weld downward when securing the edges of plates *C* to the top face of the flanges of beams A.

This specimen demonstrated the same facts as pointed out for the first specimen.

The complete weight of this specimen was 214 pounds 8 ounces. The amount of welding wire used was 5 pounds 12 ounces



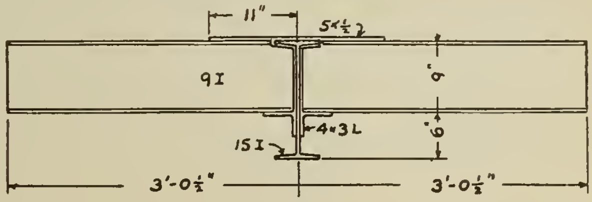
Test No. 11.

and the total time required to weld the specimen 2 hours 35 minutes. The span for loading this specimen was 6 feet 2½ inches. The yield point of this specimen was 57,000 pounds and the ultimate load was 70,000 pounds. Failure was by web crippling of beams, and the ultimate bending moment at column face 116,500 inch-pounds.

Test No. 3.

This test was very similar to the preceding specimen, the difference being that seat angles *D* and plates *C* were omitted; the beams *A* were welded directly to the column faces entirely around their ends without any means provided for landing or any reinforcement provided other than the weld metal itself.

This specimen weighs 198 pounds 8 ounces. The amount of welding wire used was 4 pounds 9 ounces, and the total welding time was 2 hours 20 minutes. The span for the loading on this specimen was 6 feet 1¾ inch. The yield point for this specimen was 50,000 pounds



Test No. 12.

and the ultimate load was 60,000 pounds. Failure was by web crippling of beams, and the ultimate bending moment at face of column 99,000 inch-pounds.

These loads are lower than the loads obtained on specimen Nos. 1 and 2 which is attributed to the fact that the omission of landing brackets *D* and the reinforcing plates *C* reduces the stiffening produced in the flanges of the beams *A*, which is obtained where these parts were used in specimen 1 and 2.

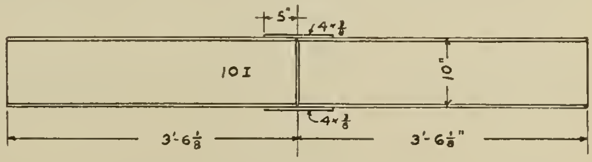
Test No. 4

This specimen is to be directly compared with specimen No. 2, the only and vital point of difference being that web plates *E* were omitted. The test on this specimen demonstrated very clearly the greatly increased strength and rigidity of specimen No. 2 which employed the use of the web plates *E*.

The total weight of this specimen is 199 pounds, there being 3 pounds 8 ounces of welding wire used. The time required for welding was 2 hours 15 minutes. The span for loading this specimen was 6 feet 2½ inches. The yield point for this specimen was 28,000 pounds, and the ultimate load was 50,000 pounds, which is to be compared with the yield point of 57,000 pounds and ultimate load of 70,000 pounds for test No. 2. Failure took place by buckling of web of column between beams in specimen No. 4. Ultimate bending moment at face of column 83,000 inch-pounds.

Test No. 5

Test No. 5 is also a double cantilever specimen made up of the following members: Two beams *A* comprising 8-inch H-beams

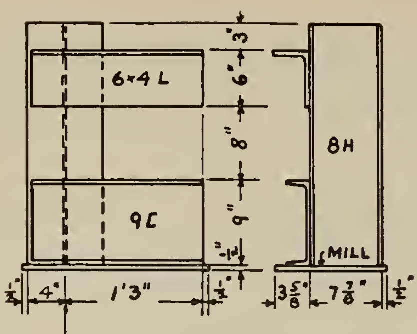


Test No. 13.

weighing 32.6 pounds to the foot, 4 feet long; one column *B* comprising a 10-inch H-section weighing 49½ pounds to the foot, 2 feet long; two plates *C* 7 by ½ by 7 inches and two seat angles *D* comprising 6 by 3½ by 7/16-inch angles, 9 inches long; four web plates *E* 4 by ¾ by 8¼ inches long. This specimen is to be compared directly with specimen Nos. 1 and 2. It demonstrates the same features as shown by them.

This specimen has a total weight of 442 pounds, there being 7 pounds 9 ounces of welding wire required to completely weld the specimen. The total welding time was 5 hours 5 minutes. The yield point of the specimen was 50,000 pounds, and the ultimate load 79,900 pounds. The span for loading this specimen was 8 feet 4 1/16 inches, and the bending moment at face of column 180,000 inch-pounds.

The ultimate failure for this specimen took place by rupture through the web and upper part of weld of one of the beams *A*. Upon investigating and removing the beam entirely from the column



Test No. 14.

we found that the overhead welds on the under side of the top flange of the beam were very poorly executed and furthermore that the main weld between the top flange of the beam *A* and the column and also between the plate *C* and the column was only fused 30 to 40 per cent of the total area. It is interesting to note that even under these conditions of poor welding the specimen carried load to the point of severe deformation of the beams and rupture of the beam web, which was far beyond that which could have been carried by any rivetted joint.

Test No. 6

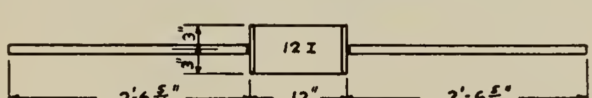
Specimen No. 6 is a single cantilever specimen comprising a 12-inch Bethlehem I-beam *A* weighing 28½ pounds to the foot, 3 feet long; one 12-inch., H-column *B* weighing 65½ pounds to the foot, 2 feet 6 inches long; a base member *F* comprising a 12-inch H-section weighing 65½ pounds to the foot, 4 feet 3 inches long; one seat angle *D* 6 by 3½ by 7/16 inch angles, 7½ inches long; one reinforcing plate *C* 5 by ⅝ by 6 inches long; 6 web plates *E* 5 by ¾ by 10 inches long; one reinforcing plate *G* 8 by ¾ by 20 inches long.

This specimen completed weighs 649 pounds, there being required a total of 12 pounds of welding wire. The time required was 6 hours 40 minutes to execute the welding. The span from centre of load to face of column was 2 feet 9 11/16 inches. The yield point was 35,000 pounds and the ultimate load 59,200 pounds. Ultimate bending moment at face of column 200,000 inch-pounds.

This specimen failed by web crippling of the cantilever beam *A*, there being no indication of any distress in any of the welded joints. Incidentally, considerable deformation was produced in the web of the base *F* to the left of the reinforcing plates *E* located in this base, in line with the right hand flange of column *B*.

Test No. 7

No. 7 is a typical example of a beam of reasonable length compared to the depth when secured to the faces of two rigid columns. The beam *A* is a 9-inch I-beam, weighing 21.8 pounds to the foot,



Test No. 16.

7 feet 11⅝ inches long. The columns *B* are 10-inch H-sections, weighing 49½ pounds to the foot, 2 feet 3 inches long. The base *F* is the same section as the column *B* but is 9 feet 7¾ inches long. The web plates *E* are 4 by ⅝ by 8¼ inches long. The seat angles *D* are 4 by 3 by ⅜-inch angles, 5 inches long. The re-enforcing plates *C* are 4 by 7/16 by 5 inches long.

The total weight of this specimen was 976 pounds 8 ounces. The total weight of welding wire used was 16 pounds 3 ounces, and the time required 12 hours 45 minutes. The span for loading this specimen was 7 feet 11⅝ inches. The yield point of this specimen was 50,000 pounds, and the ultimate load 73,500 pounds. Failure by web crippling and flange buckling of beam.

The sum of positive and negative bending moments was 1,760,000 inch-pounds. As the welds showed no distress and as the columns did not perceptibly deflect, the negative moment at either end must have been nearly as great as the positive moment at mid-span. For purposes of comparison with tests 8 and 9; assume this test a case of perfect fixed ends, positive and negative moments being each 880,000 inch-pounds. This corresponds to maximum fibre stress of 46,500 pounds per square inch.

Test No. 8

Specimen No. 8 is very similar to No. 7, the only difference being the omission of the landing angles *D* and the reinforcing plates *C*.

The total weight of this specimen is 967 pounds, the weight of welding wire required being 15 pounds. The total time to weld the specimen is 9 hours. The span for loading this specimen was 8 feet 3/16 inches. The yield point of the specimen being 50,000 pounds and the ultimate load 67,200 pounds. Failure by web crippling and flange buckling of beam.

It was interesting to note that the ultimate load on this specimen is appreciably less than that on specimen No. 7 which again demonstrates the additional restraint imposed on the beam where seat angles *D* and reinforcing plates *C* are provided.

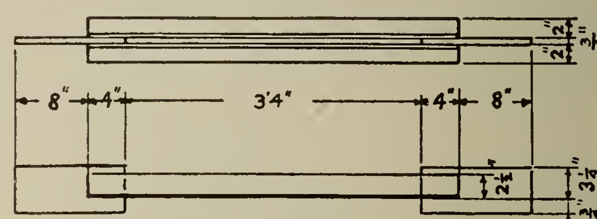
Sum of positive and negative bending moments was 1,618,000 inch-pounds. Assuming same ultimate positive bending moment as in test No. 7, the negative moment at column face would be 738,000 inch-pounds, indicating 84 per cent fixation.

Test No. 9

This specimen is made up so as to be directly comparable with specimen 7 and 8, the difference being that the beam *A* is secured to the column *B* by means of exceptionally rigid rivetted joints, using ½-inch top and bottom angles and a total of twenty ¾-inch diameter rivets in 13/16 diameter holes.

The span for loading this specimen was 8 feet 3/16 inches. The yield point for this specimen was 42,000 pounds and the ultimate load 58,700 pounds. Failure by web crippling and flange buckling and bending of connection angles.

It was interesting to observe in comparing these three specimens that specimen No. 7 making use of the seat angles and reinforcing plates shows 25 per cent greater ultimate strength than



Test No. 17.

specimen No. 9. Also, that specimen No. 8 in which only the beam ends are welded to the column without the landing brackets and the reinforcing plates shows 14 per cent greater ultimate strength than rivetted specimen No. 9.

Sum of positive and negative bending moments was 1,410,000 inch-pounds. Assuming same ultimate positive bending moment as in test no. 7, negative moment would be 530,000 inch-pounds, indicating 60 per cent fixation. Such a degree of fixation could not have been obtained with an ordinary type angle 5/16 inch or ⅜ inch thick.

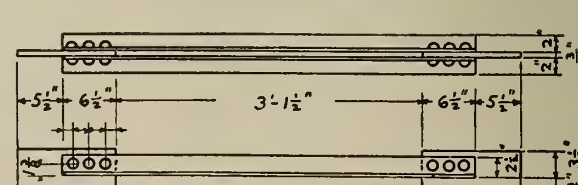
Test No. 10

This is to demonstrate principally a beam subject to shear load. This specimen comprises a 6-inch I-beam weighing 12½ pounds to the foot, 2 feet long secured between two 8-inch H-columns weighing 32 pounds to the foot, 1 foot 9 inches long each and one base member comprising a similar 8-inch H-section 3 feet 4⅜ inches long, using four web plates 3 by ½ by 6⅝ inches, located in the base member in line with the inside flanges of the columns. Also two stiffening plates 4 by 7/16 by 12 inches long each located as illustrated.

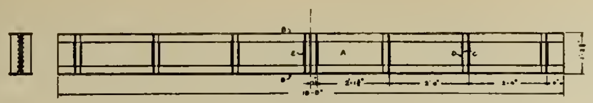
This specimen completed weighs 266 pounds, there being required 7 pounds 2 ounces welding wire. The total time for making the weld was 3 hours 40 minutes. The span for the load was 2 feet ⅜ inch. The yield point of this specimen being 50,000 pounds and the ultimate load 83,000 pounds. The load was applied at the centre of the specimen on a block 5 inches wide located on the top flange of the I-beam. Failure in this case took place by web crippling of the I-beam.

Test No. 11

This specimen is to illustrate two cantilever I-beams secured to the web of a larger I-beam representing a main girder of a



Test No. 18.



Test No. 19.

structure. The 9-inch I-beams weighing 21 8/10 pounds to the foot are 3 feet long. The 15-inch I-section weighs 42 9/10 pounds per foot and is one foot long. The two seat angles are each 4 by 3 by ⅜-inch angles, 5 inches long.

Owing to the very cramped and inaccessible space between the top face of the 9-inch I-beam flanges under the upper flange of the 15-inch I-section, it was next to impossible for an operator to make a good weld at this point where the tension stresses are concentrated. Therefore to assist in welding, wedge blocks were inserted so as to permit the operator to build up arc deposited metal over the end and edges of these wedge blocks thereby producing a tie between the flanges of the 15-inch I-section and the flanges of the 9-inch cantilever I-beams. This specimen complete weighs 187 pounds, there being required 4 pounds 2 ounces of welding wire and the total welding time required 2 hours 10 minutes.

The span for loading this specimen was 5 feet 7⅝ inches. The yield point of this specimen was 55,000 pounds and the ultimate load 64,000 pounds.

Test No. 12

Specimen No. 12 is similar to specimen No. 11 with the exception that the 9-inch I-beams are coped so as to throw the top face of the top flange in a plane with the top face of the top flange of the 15-inch I-beam. A reinforcing plate, 5 by ½ by 22 inches long, is provided across the specimen as illustrated. This reinforcing plate was wider than the flanges of the 9-inch I-beams which necessitated welding overhead in order to tie the edges of the top flanges to the under surface of the reinforcing plate. This design should be revised so as to make the reinforcing plate narrower than the I-beam flanges thereby providing for welding in the downward position.

The total weight of this specimen was 194 pounds, the welding wire required was 3 pounds 12 ounces and the total welding time 2 hours 15 minutes. The span for loading was 5 feet 4 15/16 inches. The yield point of this specimen was 65,000 pounds and the ultimate load 94,000 lbs. The ultimate failure taking place by progressive tearing of the overhead welded joint between the reinforcing plate and the top flange of one of the 9-inch I-beams. This specimen shows a very material increase in strength over that of specimen No. 11, namely, approximately 48 per cent.

Test No. 13

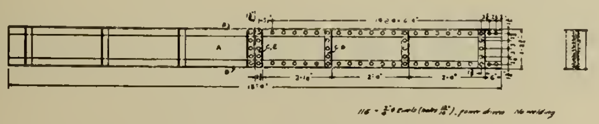
Specimen No. 13 represents a test of two spliced 10-inch Bethlehem I-beams, each weighing 23.5 pounds to the foot, 3 feet long, welded together at their abutting ends and reinforced by top and bottom cover plates, each of which is narrower than the flange of the beam so as to permit downward welding along the edge of the cover plate to the outer faces of the beam flanges. This particular specimen was considered a shop fabricating job, and therefore the beam was turned over so as to make all welding in the downward direction, whereas all of the preceding specimens were welded in the position shown to exactly duplicate regular building construction work.

Failure took place in this specimen by web crippling of the two joined 10-inch I-beams. The elastic limit of the specimen was approximately 65,000 pounds, and the ultimate load was 72,900 pounds. The loading span was 6 feet 6 1/16 inches, the load being concentrated at the centre on a loading block 5 inches wide. This gives a maximum bending moment of approximately 118,000 foot-pounds, and represents a fibre stress of approximately 58,200 pounds per square inch in the beams at the ultimate load.

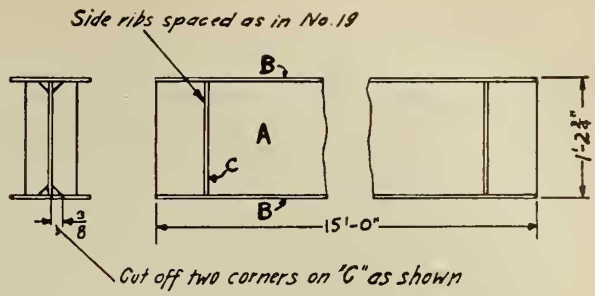
The weight of this specimen complete is 180 pounds 9 ounces, it being required to use one pound and 11 ounces of welding wire and the total actual welding time of 1 one and 15 minutes.

Test No. 14

This specimen is to represent a small bracket secured to a column, the bracket comprising a 6 by 4 by ½-inch angle, 1 foot 6½ inches long, welded across the end and the top and bottom



Test No. 20.



Test No. 21.

edges. The 8-inch H-column weighs 32 pounds to the foot and is 2 feet 2 inches high. Failure took place in this specimen by buckling of the column flange edge, midway between the bracket and the lower supporting channel welded to the column and to the base. The web of the column was also distorted at the same time. The yield point for this specimen was 25,000 pounds, and the ultimate load was 34,600 pounds. The span from the centre of the applied load to the edge of the column was 7½ inches. The maximum bending moment therefore is 21,700 foot-pounds, and the maximum fibre stress in the angle is 59,500 pounds per square inch.

The weight of this specimen is 148 pounds 8 ounces, and the amount of welding wire required is 3 pounds 3 ounces, and the total welding time is 1 hour 25 minutes.

Test No. 16

This specimen comprises a pair of 15/16-inch diameter hot rolled steel rods welded to the two faces of the 12-inch I-beam weighing 31.8 pounds to the foot, 6 inches long. It is to represent the construction where similar rods are to be attached to the bottom faces of the I-beams and girders for hangers to support balconies and mezzanines. Each rod was welded to the under face of the I-beam in an overhead position to exactly duplicate field construction work. The specimen failed by breaking the rod approximately 12 inches from one face of the I-beam section. The yield point was 23,200 pounds, and the ultimate load 35,000 pounds. The amount of welding wire required to weld both rods to the I-beam is 8 ounces, and the total welding time 45 minutes.

Test No. 17

This specimen comprises two 2½ by 2 by 3/16-inch angles 4 feet long, welded to two plates 5 by ¾ by 12 inches long, the 2½-inch leg of each angle being welded to the plates across the ends of the angle and along the heel and toe of the leg of the angle in contact with the plate. The specimen is for a tension test, the yield point being at 70,000 pounds, and the ultimate load being 94,000 pounds, the maximum elongation being 3 inches in the 40-inch length between shank plates. Failure took place by progressive failure through the 2½-inch legs of the angles, carrying on out through the 2-inch leg.

The complete specimen weighed 48 pounds 7 ounces, the amount of welding required was 8 ounces, and the actual welding time 20 minutes. All of the welding in this specimen was done in the downward direction, which shows the difference between overhead welding and downward welding by comparing with the amount of metal used and welding time for specimen No. 16. In the case of these two specimens, the amount of welding wire used was exactly the same and yet the welding time was 20 minutes in the case of No. 17 against 45 minutes in the case of No. 16. Mean tensile stress, ultimate, 58,000 pounds per square inch.

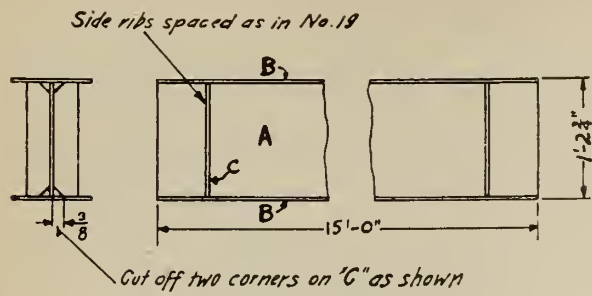
Test No. 18

This specimen is similar to specimen No. 17, the difference being that the angles were rivetted to the shank plates with ⅝-inch diameter rivets power driven in 11/16-inch diameter holes.

The elastic limit of this specimen was 60,000 pounds and the ultimate was 72,000 pounds, and the elongation was only 1.12 inch, failure taking place through the first rivet hole. The stress strain diagram curves of these two specimens make a very interesting comparison. Ultimate mean tensile stress on gross section 44,500 pounds per square inch; on net section 53,000 pounds per square inch.

Test No. 19

This specimen comprises a 15-foot by 14¾-inch deep girder employing one web plate, *A*, 14 by 5/16 inches by 15 feet long, four flange angles, *B*, 4 by 3 by 5/16-inch and 15 feet long; sixteen web stiffener angles 3 by 2 by ¼ inch and 13¾ inches long; twelve filler plates 2½ by 5/16 by 8⅝ inches long, and two filler plates 5 by 5/16



Test No. 21-A.

by 8⅝ inches long. The parts of this girder were assembled by welding. The top flange angles were welded to the web plate by intermittent welds 1 inch long on 3-inch centres along the toe of both the top angles. The backs of the angles were welded together and to the edge of the flange plate intermittently using 2-inch long welds on 3-inch centres. At each end the angles were welded solid to the web plate at both the heel and toe for a distance of 3 inches. The bottom flange angles were welded to the web plate solid for a distance of 6 inches at each end of the toe, the remainder of the weld along the toe of the angle being 2 inches on 5-inch centres. The heels of these angles were welded solid and also to the edge of the web plate for a distance of 6 inches. The remaining portion of this same joint was intermittently welded 2 inches on 5-inch centres. The filler plates were welded to the web plate by means of 2-inch long welds at the neutral axis and ½-inch welds at the ends of the filler plates along the web plate. The stiffener angles were completely welded around the entire periphery making contact with the flange angles, and also 2-inch welds at the heel and toe of these angles exactly in line with the 2-inch welds made at the edge of the filler plates to the web plate. The completed specimen weighed 785 pounds. The amount of welding wire required to complete the specimen was 27 pounds 8 ounces. The total time to complete the specimen was 14 hours and 10 minutes. The specimen was tested by centre loading on a block 5 inches wide, the span being 14 feet. The specimen failed by crippling of the top flange of the girder, the elastic limit being reached at 65,000 pounds, the ultimate load being 77,200 pounds, and the maximum bending moment being 270,000 foot-pounds. This gives a maximum fibre stress of 53,800 pounds per square inch based on the section modulus of 60.2.

Test No. 20

Specimen No. 20 is a 15-foot girder 14 15/16 inches deep, made up of duplicate parts used for specimen No. 19, except that all parts are rivetted together using ¾-inch diameter rivets power-driven in 13/16-inch diameter holes. The completed weight of this specimen was 798 pounds. This specimen was tested by centre loading on a block 5 inches wide, the span being 14 feet and ⅛ inch. Failure took place by buckling of the top flange, the yield point being 55,000 pounds, and the ultimate load being 68,900 pounds. A duplicate girder was also tested, the span being 14 feet 3/16 inch. The elastic limit was reached at 60,000 pounds, the ultimate load being 74,000 pounds, the depth of this girder being 14 15/16 inches. Maximum fibre stress, ultimate, for first specimen, 47,400; for second specimen, 51,000; section modulus for both specimens 61.1.

By comparing these figures with those for specimen No. 19 it is interesting to observe that although all parts joined were exactly the same, the welded specimen had a higher yield point than either of the rivetted specimens, and also an ultimate load carrying capacity appreciably above that of the rivetted specimens. Allowance should also be made for the fact that the depth of the welded specimen, namely No. 19, was less than either of the specimens No. 20, causing 1½ per cent less section modulus.

Test No. 21

Specimen No. 21 is a specimen designed strictly to take all advantage of the possibilities of joining structural steel members by the use of arc welding. In this respect it is entirely different from No. 19, which is simply a rivetted design welded.

The specimen comprises a web plate, *A*, 14 by 5/16-inch, and 15 feet long; two flange plates, *B*, 10 by ⅜ inch and 15 feet long; and sixteen web stiffener plates 3 by ¼ by 12 inches and 1¾ inch long. The top flange was welded to the web plate continuously along each side of the web plate. The bottom flange was welded to the web plate solid for a distance of 6 inches from each end and then intermittent welds 2 inches long on 4-inch centres the rest of the distance on each side of the web plate. The web stiffeners were welded solid to the flanges around the entire periphery at each end of each web stiffener. Each web stiffener was also welded 2 inches on each side at the neutral axis and at intermediate points 1 inch long at each side of each stiffener halfway between each stiffener and the flanges of the girder. This specimen was tested by centre loading on a block 5 inches wide, the span being 14 feet. Failure took place by buckling of the top flange. The elastic limit of the specimen was 65,000 pounds, and the ultimate load 78,000 pounds. This specimen had a total finished weight of 656 pounds, which is very materially less than that of the rivetted girder, namely approximately 18 per cent, and approximately 16½ per cent less than the weight of the rivetted design welded, namely specimen No. 19. A total of 30 pounds 2 ounces of welding wire was required, and the total welding time was 12 hours and 33 minutes. This shows the advantage of designing structures for welding, by placing the metal in the locations where the greatest strength can be developed with the amount of material used. It also demonstrates the fact that the parts to be joined need not be lapped as is required where rivets are to be used for securing the members. Maximum fibre stress 52,700 pounds per square inch section modulus 62.2.

Test No. 21-A

Specimen No. 21-A is similar to No. 21, except that the web stiffening plates are 4½ by ¼ by 12 inches, and 2 inches long, there being a total of twenty used and a top reinforcing plate 9 by 5/16 inch and 6 feet long was welded to the top flange. This plate was welded solid across each end and solid along each edge from the centre of the girder to a point 1 foot 2 inches from the centre of the girder. The remaining length of the edge of the plate was welded intermittently 2-inch welds on 4-inch centres. This girder had a completed weight of 795 pounds, and required 30 pounds 12 ounces of welding wire to complete the welding work. The total welding time was 16 hours and 50 minutes. This specimen failed ultimately by buckling of the top flange, the top cover plate blistering away from the flange at the centre where it was tied into the web plate. This blistering was approximately ½ inch in depth and did not result in the cracking of any of the welds. The elastic limit of this specimen was reached at 60,000 pounds and the ultimate load was 110,350 pounds. A very interesting feature developed in connection with this test, namely when the ultimate load was removed from the girder it sprung upward a distance of ¾ inch before coming to rest. Some very interesting comparisons can be made between this girder and the two preceding girders 19 and 20, which will show the very decided increase in strength which can be obtained by properly designing to take advantage of the possibilities of arc welded construction. The maximum bending moment in the case of this specimen is approximately 386,000 foot-pounds. The maximum fibre stress in tension would appear to be 69,300 pounds per square inch, based on a section modulus of 66.8; but the buckling of the top flange before ultimate load was reached would naturally lower the neutral axis below the calculated position, so that the figure given above for maximum tensile stress is undoubtedly much too high. At the elastic limit, the figure for tensile stress is 37,700 pounds per square inch.

Members of Institute doing Valuable Work in Forest Protection

That many members of the Engineering Institute are engaged in forest protection work and form part of an intensive organization which by efficient performance has been able to keep losses both of timber and valuable young growth at a surprisingly low figure during the past season, in spite of bad conditions, is the message brought back by D. Roy Cameron, M.E.I.C., associate director of the federal forest service, who made an extended trip through western Canada on general inspection work.

He found the forest fire season in Alberta and British Columbia was perhaps the most serious yet encountered in the history of forest fire protection, while suppression costs were high and the results achieved were strikingly good as indicated. Only those who have worked on the fire lines can realize the strain, both physical and mental, under which the personnel directing fire fighting operations on a large scale, labour, during a prolonged period of high fire hazard.

In the railway belt of British Columbia, which was the region hardest hit, the excellent system of fire detection by means of permanently occupied intervisible lookout stations equipped with telephones and special fire finders functioned perfectly. The elapsed time between start of fire and arrival of suppression forces was cut to the minimum, and no fire burned undiscovered for any appreciable period of time.

A feature of the fire season in the interior of British Columbia, particularly, was the occurrence of a series of heavy, dry electrical storms followed by high temperature and strong winds. An unusually high percentage of serious fires started by lightning resulted and enormously increased the difficulties of suppression.

ELECTIONS AND TRANSFERS

At the meeting of Council held on November 16th, 1926, the following elections and transfers were effected:—

Associate Member

NIKLASSON, Gunnar, Chem. Engr., (Chalmers Tech. Inst.), mill supt. Western Quebec Paper Mills, St. Andrews East, Que.

Junior

CULLWICK, Ernest Geoffrey, B.A. (Cambridge, Eng.), mech. dept. Can. Gen. Electric Co., Limited, Peterborough, Ont.

Affiliates

NELSON, Maxwell Stewart, B.Sc. (McGill Univ.), asst. mgr. and sec. treas., A. Faustin Ltd., Montreal, Que.

PARMELEE, Edward Henry, Eastern dist. mgr. Ferranti Meter and Trans. Mfg. Co., Montreal, Que.

QUIGLEY, Harry Stephen, contractor of aerial services, Montreal, Que.

Transferred from class of Associate Member to that of Member

DeCARTERET, Samuel Laurence, Ph.B. (Yale Univ.), Hammermill Paper Co., Quebec, Que.

MACNABB, Thomas Creighton, B.A. (Univ. of Man.), engr. of constrn. Western lines, C.P.R., Winnipeg, Man.

RIPLEY, Wilfred Jamieson, B.Sc. (McGill Univ.), designer and squad boss engrg. dept. and acting ch. dftsman, Dom. Coal Co., Sydney, N.S.

WILSON, Robert Starr Leigh, B.Sc. (McGill Univ.), prof. of civil and municipal engrg. Univ. of Alta., Edmonton, Alta.

Transferred from class of Student to that of Associate Member

PARKER, Walter J., B.A.Sc., (Univ. of Toronto), res. engr., Dept. of Northern Devel. Prov. of Ont., Preston, Ont.

VAUGHAN, Harold Wilfred, B.Sc. (McGill Univ.), asst. supt. light dept., City Hall, Montreal, Que.

Transferred from class of Student to that of Junior

BURCHILL, George Herbert, B.Sc. (N.S. Tech. Coll.), asst. engr., alternating current engrg., dept. Can. Gen. Elect. Co., Peterborough, Ont.

COULTER, Stanley L., B.A.Sc. (Univ. of Toronto), asst. to elect'l. engr., Aluminum Co. of Am., Massena, N.Y.

DYER, Joseph Wilson, B.A.Sc. (Univ. of Toronto), asst. to supervisor of bldgs. and vehicles, Bell Telephone Co., Toronto, Ont.

HAYES, St. Clair Joseph, B.S. (N.S. Tech. Coll.), B.A. (St. Mary's Coll.), D.C. Engrg., dept. Can. Gen. Elect. Co., Peterborough, Ont.

JENKINS, Thos. Harding, B.A.Sc. (Univ. of Toronto), structural dftsman, Can. Bridge Co., Walkerville, Ont.

JOHNSTON, Oswald Daniel, B.A.Sc. (Univ. of Toronto), asst. to gen'l mgr., D. M. Fraser, Ltd., Toronto, Ont.

SILLS, Herbert Ryerson, B.Sc. (Queen's Univ.), asst. engr. A. C. generator and synchronous motor engrg. dept. Can. Gen'l Elect. Co., Peterborough, Ont.

EMPLOYMENT BUREAU

Situation Wanted

CIVIL ENGINEER

Civil engineer, university graduate, age 26, three and one half years' experience in municipal engineering including the construction of concrete pavements, sanitary sewers, water supply systems, etc. Some business experience. At present employed. Address replies to Box 217-W, Engineering Journal.

Members' Exchange

For sale one Dumpy Level, three-screw, inverting, with special light tripod, Abney hand lever and clinometer. Apply Box No. 13-E, Engineering Journal.

ABSTRACT OF PAPER

Pigments

M. Doyle, Works Superintendent, British America Paint Corporation

Victoria Branch, October 6th, 1926

Beginning with the pigments, Mr. Doyle stated that white lead is the greatest standby of the paint trade, on account of its anti-corrosive and great covering qualities. Under present practice it is mostly made by pouring molten pig lead into water, when it is broken up into flakes; these are collected into a large holder, containing several tons, perhaps, and are then sprinkled with acetic acid, forming acetate of lead, which is a clear solution. Carbonic acid gas is passed through this liquid, the result being the formation of a fine white powder known as white lead. It is then washed free from acid, dried, and ground in oil.

The disadvantage of white lead is that it is an oxidizing agent, and gradually *burns*, as it were, the oil. The oil is the life of the paint, and consequently after a time the oil disappears and the white lead remains merely as a powder which can be easily rubbed off. Another disadvantage is that it can be attacked by sulphuretted hydrogen gas, given off perhaps from decomposing matter, and lead sulphide formed, the paint becoming grey.

Zinc oxide, a largely used white pigment, is formed by the burning of zinc ore. The fumes are carried through long tubes, and deposit on them a white dust; the finer in grain the further from the point of combustion. This is zinc oxide. Zinc oxide paint is largely used for interior painting, and on marine work and for boilers. In distinction from white lead, which dusts off when lifeless, zinc oxide comes off in flakes.

Lithopone, composed of zinc sulphide, and barium sulphate, finds a place among the white pigments, for interior flat wall paints, etc. Coming to black and coloured pigments, Mr. Doyle pointed out that those in the mineral class, such as oxide of iron and ochre, are lasting in colour, while the chemical colours, such as greens and chromes, are not so permanent.

OILS

Various oils are used, the chief being, of course, linseed oil, obtained by the crushing and treatment of flax seed. Whereas the Baltic linseed oil was for a long time considered the best, he believed that it has been superseded by the Canadian; climatic conditions under which the flax is grown in Canada having much to do with this. Linseed oil is the life of paint and varnish, it does not dry by evaporation, but by oxidization; in fact, it gains about ten per cent in weight in drying.

Wood oil, from China, obtained from a nut of that country, is found useful in the manufacture of waterproof varnishes, having decided advantage over linseed oil in this respect. Fish oil, which is now being manufactured in the fish reducing plants on the west coast of Vancouver Island, is looked upon by many as only an adulterant; as a matter of fact, it is far too expensive for such a use, even if such were sought. Its particular value is in cases where ordinary drying conditions are not encountered, such as baking enamel, and japan, where heat is used. Similarly in places where there was large variation in temperature and consequent contraction and expansion, such as smoke-stacks, a percentage of fish oil gave additional elasticity. Mineral oils should have no place in paint, as they have no drying action or wearing qualities.

VOLATILES

Turpentine is the volatile utilized in paint, this is practically all obtained from the Long Leaf Georgia pine; the sap heated in stills, gave off the turps, leaving behind rosin. The use of turps is merely to provide a mechanical means of spreading the paint; in a short time the turps evaporate, and in itself it has no action on the paint. It provided a volatile agent that takes long enough to evaporate to enable the paint to be properly spread. While a small amount of benzine might be used in some cases without much disadvantage, it is not advisable.

VARNISHES

Varnishes are a combination of gum, oil and turpentine, in which the gum provides the gloss, the oil the elasticity and the turps the mechanical means of spreading the others. There are some forty or fifty varieties of gum, the best being the Kauri gum from New Zealand. The reason for the large number of varnishes is the large variation of uses to which varnishes are put. For instance, a piano is not expected to stand the same exposure as a motor car. The difference between an inside and an outside varnish is largely in the percentage of oil; a rubbing varnish must contain much less oil.

For floor varnishes, China wood oil is largely used, as it dries much harder. Shellac varnish is made of shellac gum, a gum formed by an insect in India, dissolved in alcohol; it is not soluble in oil, and is turned white by contact with water.

General

Mr. Doyle claimed that reinforcing steel, either in the way of structural shapes or bars, should be painted before being encased in concrete; that if corrosion sets in beforehand the expansion of the oxide of iron formed has been known in cases to be sufficient to crack the concrete. A further advantage of the painting of the reinforcement is claimed to be the insulation from electrical currents, thus preventing electrolysis.

Though not connected with actual engineering work, the development of nitro-cellulose lacquers was mentioned by Mr. Doyle, who explained that, originally used for the treatment of aeroplane wings, a commercial market had been sought for them. Owing to the extremely volatile character of the solvent, such as amyl acetate, they had to be applied by spraying, and that while such lacquers are now produced for brushing on, they are rather in the experimental stage, there not having been enough time to prove their lasting qualities. The advantage of these lacquers is that a motor car, for instance, can be given several coats in a day compared to the length of time required to dry each coat otherwise.

Coming to the application of paint to wood, it was pointed out that new wood would absorb about 30 per cent of the oil in the paint, so that for the first or priming coat, about 25 per cent more oil should be used; for the second coat, less oil and some turps, in order to flatten down the surface, and for the third coat a larger percentage of oil, to give a durable finish. On iron or steel, however, there is no absorption, and therefore less oil is needed; the first coat should be of red lead, which is non-corrosive, and the hardest drying pigment known. For further coats, graphite paint is best, as it has no action on the oil.

He pointed out that they had been experimenting with various coloured paints in regard to the heat reflection for tanks, and found that the temperature with black paint rose to as much as 30° to 40° above that with a white paint, and that was the reason that oil tanks, for instance, should always be painted a light colour.

Mr. Doyle also dealt briefly with marine paints and other points of interest.

ANNOUNCEMENT OF MEETINGS

Information may be secured from the secretaries of the various Branches, whose addresses will be found under "Officers of Branches" on page 494 of the Journal.

MONTREAL BRANCH

Secretary-Treasurer, C. K. McLeod, A.M.E.I.C.

Dec. 9th: Symposium of Municipal Papers, by G. R. MacLeod, M.E.I.C., and P. E. Jarman, M.E.I.C.
Dec. 11th: Annual Meeting.

VANCOUVER BRANCH

Secretary-Treasurer, E. A. Wheatley, A.M.E.I.C.

Dec. 15th: Annual Meeting.
Jan. 5th: Address on "Engineering Education—The Development of an Engineer's Education," by E. E. Brydone-Jack, M.E.I.C.
Jan. 12th: Address on "The Mines of the Province," by J. D. Galloway, Esq.
Jan. 19th: Address on "Oscillographs," by Dr. H. Vickers.
Jan. 26th: Address on "Mountain Roads," by W. G. Swan, M.E.I.C.

OTTAWA BRANCH

Secretary-Treasurer, F. C. C. Lynch, A.M.E.I.C.

Dec. 9th: Address on "Thermit," by Prof. H. T. Barnes, M.E.I.C.
Dec. 16th: Luncheon.
Jan. 13th: Luncheon.
Jan. 13th: Annual Meeting.
Jan. 20th: Annual Ball.

The Coventry Company, Reg'd., have removed their Toronto Branch Office to the Otis-Fensom Building, at 170 Bay Street, where larger and more commodious quarters are provided. The telephone number, Elgin 4795, remains the same.

B. J. Coghlin Co., Limited, announce the enlargement of their plant in Montreal. The addition to their manufacturing plant, which will provide for double their present capacity, will be ready early in the new year.

BOOK REVIEWS

Elements of Heat-Power Engineering

Barnard, Ellenwood and Hirschfeld. Part I. John Wiley & Sons, Inc., New York, 1926. Cloth, 6 by 9½ in., 493 pp., diagrs. $4.50.

The new edition of the well-known text by Hirschfeld and Barnard is substantially a new book. The subject matter has been entirely re-written and expanded to two volumes, of which the first relates primarily to thermodynamics and the elementary principles of prime movers.

A brief summary will indicate the scope of Part 1.: Energy and its transformation, availability, reversibility, entropy; properties and thermodynamic processes of gases and vapors; compressed air; gas cycles; mechanical features, operation, power and performance of internal combustion engines; simple vapor cycles; reheating, regenerating and binary vapor cycles; steam engines and turbines. Numerous diagrams are employed and these are uniformly well executed and form a valuable feature.

The treatment is logical and sound and reflects the mature experience and broad viewpoint of the authors. In the opinion of the reviewer the book should take its place as a standard text-book and work of reference, useful alike to the student and practising engineer.

A. R. Roberts, A.M.E.I.C.

Metal-Plate Work

C. T. Millis, E. and F. N. Spon, London, 1926. Cloth, 5 x 7 in., 503 pp., diagrs. 7/6.

In this volume the geometrical constructions required in the laying-off of sheet-metal work are described and illustrated. They are arranged in the form of exercises carefully graded from the simplest to the most complex and include patterns for articles of equal and unequal taper and for miscellaneous articles such as elbows, mouldings, etc.

The ready solution of difficult problems in setting out patterns will be appreciated by all sheet-metal workers.

A. R. Roberts, A.M.E.I.C.

Coal and Ash Handling Plant

John D. Troup, Editor, 'Engineering and Boiler House Review,' Chapman & Hall, Limited, London. First Edition, 1926, 5¼" x 8½", 146 pages. 13/6.

A comprehensive review and general description of the different equipment used for handling coal, ashes and refuse in boiler plants. The book deals particularly with English practice and some of the apparatus, such as the coal car tipplers described, are of course not applicable to service on the American Continent.

A large number of excellent photographic illustrations are included and the subject is dealt with in a very interesting manner. The scope is indicated by the chapter headings:—

Handling Coal on Delivery
Automatic Coal Weighing
Coal Storage
Coal Conveyors
Ash Handling Plant
Aerial Ropeway Conveyors
Flue Dust Removal Plant
Recovering Unburnt Fuel.

Particular reference may be made to the chapter on Recovering Unburnt Fuel, the possibilities of which are dealt with.

F. A. Combe, M.E.I.C.

Draft and Capacity of Chimneys

J. G. Mingle, C.E., D. Van Nostrand Company, New York, 1925. First Edition, 5¼" x 7¾", 340 pages. $3.50.

The subject matter of this book was published serially in the technical periodical, "Combustion," during 1924 and 1925. The stated aim of the author has been to review the data available regarding the proportioning of chimneys for power plants and to deal with the matter more fully than has been done heretofore in view of the importance of proper design, especially in connection with large, modern steam stations.

The recognized chimney formulæ are given and developed in an elementary, theoretical manner with curves and tables to illustrate the effect of the different factors which enter into such calculations.

The subject is treated very fully, and the book may be of interest to those who wish to analyze any particular case or to become familiar with the general principles. At the same time, there are so many conditions which have to be assumed, and so many variables which affect the draft and capacity of chimneys under 'natural draft,' in addition to the importance of providing for change in fuel or method of burning, or for possible increased output from the boilers, that, in determining the most suitable diameter and height, one must allow a considerable 'factor of safety' or allowance over the sizes theoretically arrived at. Usually also, the question of cost is one which must be taken into consideration.

As a matter of fact, modern large boiler plants almost invariably include some heat recovery apparatus, such as economizers or air preheaters which necessitate the use of induced draft fans, which may be arranged to discharge through short stacks or into chimneys of sufficient height only to carry the gases above the point of nuisance. In such cases, an entirely different problem is presented, the fan then being designed to take care of the draft requirements, while the chimney is not working under natural gravity laws.

F. A. Combe, M.E.I.C.

Corrosion, Causes and Prevention, an Engineering Problem

Frank N. Speller. McGraw-Hill Book Co., New York, 1926. Cloth, 6 x 9½ in., 588 pp., illus., diags., $6.00.

To quote from the preface "the aim has been to combine in this volume a useful reference book for those who are interested in the many phases of this problem and a handbook for the engineer and architect who may desire only a practical knowledge of the developments in prevention of corrosion. The subject matter has been written with particular reference to the ferrous metals."

The book is divided into two parts. Part I—General Principles; Part II—Preventive Measures. The first part includes a chapter on the theories of corrosion in which the author justly and strongly favours the electrochemical theory. This chapter may be a little difficult for the engineer, although the subject is well presented.

The second part, Preventive Measures, should appeal strongly to anyone with a practical interest in corrosion. It includes among others, chapters on the Prevention of Corrosion in the atmosphere, under water, in the steam plant, and underground.

The book is well written, up to date and subject matter admirably presented. Many references are given for those requiring further information. There is a good index.

Any engineer with a corrosion problem to solve will find this book almost indispensable.

F. M. G. Johnson.

Recent Additions to the Library

Proceedings, Transactions, Etc.

Presented by the Societies:

- Transactions of the American Society of Civil Engineers, Volume 89, 1926.
- Transactions of the North East Coast Institution of Engineers and Shipbuilders, Volume 42, 1926.
- Yearbook of the Society of Naval Architects and Marine Engineers, 1926.

Reports, Etc.

Presented by the City Engineers of the City of Hamilton, Ont.:

Annual report, 1925.

Presented by the Division des Explosifs, Ministère des Mines, Canada:

Rapport Annuel, 1925.

Presented by the American Society of Mechanical Engineers:

Standard, codes, reports, etc.

Technical Books

Presented by Archives of Canada:

Northcliffe collection.

Presented by the British Engineering Standards Associations:

British standard glossary of terms used in electrical engineering.

Presented by the Canadian Gazeteer Publishing Co., Toronto:

Gazeteer of Canada, 1926.

Presented by Armand Colin:

- Les moteurs à combustion, par E. Marcotte.
- La transformation de l'énergie électrique—I, Transformateurs, par René Cartonet et Pierre Dumartin.

BRANCH NEWS

Calgary Branch

H. R. Carscallen, A.M.E.I.C., Secretary-Treasurer.
W. St. J. Miller, A.M.E.I.C., Branch News Editor.

Unfortunately, the opening meeting of the lecture season had to be postponed owing to the illness of the speaker, Mr. James W. Davidson, F.R.G.S., who was to have given a talk on "The Head Hunters of Formosa." This postponed meeting is now arranged for December 6th.

Some Problems of Water Power Development

On November 1st the first meeting of the season took place with J. H. Ross, A.M.E.I.C., in the chair. The secretary read the minutes and the report of the activities of the Branch since the annual meeting in the spring. F. J. Robertson, A.M.E.I.C., general superintendent of the Calgary Power Company, the speaker of the evening, gave a most interesting address on "Some Problems of Water Power Development and Operation." One pleasing feature was the manner in which the speaker explained in sequence the progressive steps of water power control and development.

He commenced by explaining the necessity of a careful survey of the conditions in connection with probable power markets; the nature of the expected power load; and fluctuations in load from season to season; continuing, he referred to the preliminary investigation necessary in the selection of a suitable site for a storage dam, together with alternative sites; the final selection of the most promising site, and the choice of the type of dam. He then referred to the investigation of probable cost of transmission lines, and whether one or more line would be necessary, and in the case of towns being supplied he advocated a minimum of two lines. In connection with the design of the power plant, he explained in detail the necessary investigation to determine the available head and the importance of long-time records of run-off on which to base the estimate of available water supply. He went on to state that the average minimum flow over low water periods should be averaged over a number of years. The question of possible storage reservoirs and pondage were also dealt with, and in referring particularly to the dam site investigations, he said that drill holes should be put down and cores carefully examined to determine whether any rock fissures or faults exist.

Referring to the construction of earth dams, he explained the necessity for a masonry spillway to take care of flood conditions, and also touched on such details as provision, ice and driftwood; design of flashboards; use of syphons; and the design of pipe lines, flumes, or headrace channels. A detailed explanation of the use of surge tanks was given, followed by a discussion of various types of hydraulic turbines and water wheels and the various electrical equipment of the plant. In connection with the electrical installation, the speaker explained the wonderful advances that had been made in recent years with the aid of relays to operate switches, pointing out that a modern plant can be practically automatic in operation.

In conclusion, Mr. Robertson related some of his experiences during his recent visit to San Salvador, Central America, in the interests of the Montreal Engineering Company. He gave an interesting résumé of conditions in that country, referring particularly to the ambitious road-making policy. He mentioned the golden opportunity that exists for Canadian manufacturers and financiers to create beneficial trade relationship. The impression gained throughout the address was that Mr. Robertson knew his subject from A to Z, and his audience listened to an address that was well worth while from every point of view.

A vote of thanks was very suitably phrased by A. G. Graves, Commissioner of Calgary, and seconded by A. L. Ford, M.E.I.C. Chairman J. H. Ross also voiced the thanks of those present in suitable terms.

Moncton Branch

V. C. Blackett, A.M.E.I.C., Secretary-Treasurer.

The opening meeting of the season was held on October 26th in the Y.M.C.A. banquet hall, and was marked by one of the most enthusiastic and largely attended gatherings since the formation of the branch. Following the supper the chairman, A. S. Gunn, A.M.E.I.C., introduced the speaker of the evening, K. L. Dawson, A.M.E.I.C., superintendent of the gas plant of the Nova Scotia Tramways and Power Company, Halifax, N.S., who gave a highly instructive address on "Coal and Other Fuels Derived Therefrom."

COAL AND OTHER FUELS DERIVED THEREFROM

Coal, declared Mr. Dawson, is, and for many years to come will continue to be, our principal source of fuel supply. Wood as a fuel is no longer used. Our oil reserves are being depleted with alarming rapidity. Even water power has its limitations. It is said that if manufacturing conditions in Ontario were normal, steam generating plants would have to be erected, or else the use of hydro would have to be curtailed.

The burning of bituminous coal is unfortunately accompanied by the smoke nuisance, due to failure to ignite the volatile gases which are given off. In the case of household use, this cannot be avoided. In the large centres, where bituminous coal is used, it is estimated that the annual additional cost of laundrying clothes is twenty dollars per person. Cities that can obtain coke and gas, (the two clean and smokeless fuels obtained from soft coal), are indeed lucky. It is interesting to note that the use of gas, in Halifax, has doubled within the past fifteen years, and that the Tramways Company has not the slightest difficulty in disposing of its coke.

The speaker described the manufacture of gas and coke, and illustrated the process by means of a miniature gas plant. This process consists in separating the coal into its two main constituents, gas and coke. The burning of these two constituents, as fuel, separately, is much more economical than burning them together in the original state as coal, for the reason that no fuel is wasted in smoke.

Mr. Dawson was not very optimistic as to the erection of coking plants in Montreal and other large cities unless a market could be found for the gas that is produced when coke is manufactured.

Another by-product of coke and gas manufacture may be mentioned, viz., tar, from which many useful substances are derived. Chief among these are oils used in driving gas and oil engines, ammonia, aniline dyes, and last but not least, the humble moth ball.

At the close of the address a vote of thanks was tendered Mr. Dawson by the chairman.

During the evening enjoyable vocal selections were rendered by Mr. Geo. C. Davidson, and clarinet solos by Dr. Fred E. Burden.

Hamilton Branch

W. F. McLaren, M.E.I.C., Secretary-Treasurer.
J. R. Dunbar, Jr.E.I.C., Branch News Editor.

The first meeting of the Hamilton Branch, for the season 1926-1927, was held on October 20th, 1926, in the Hamilton Chamber of Commerce Rooms, with an attendance of 24.

The following officers were elected for the ensuing season:—

Chairman	L. W. Gill, M.E.I.C.
Vice-Chairman	W. L. McFaul, M.E.I.C.
Secretary-Treasurer	W. F. McLaren, M.E.I.C.
Branch News Editor	J. R. Dunbar, JR.E.I.C.
Executive	H. A. Lumsden, M.E.I.C.
	G. R. Marston, A.M.E.I.C.
	F. P. Adams, A.M.E.I.C.
	A. H. Munson, A.M.E.I.C.
Members Emeriti	C. J. Nicholson, A.M.E.I.C.
	H. B. Stuart, A.M.E.I.C.

After routine business was transacted, J. J. MacKay, M.E.I.C., gave a very interesting talk on proposals for a scenic development of Hamilton and its surroundings, including harbour plans. Following this W. L. McFaul, M.E.I.C., presented a plan and explained the details of the proposed $567,000 extension of the Hamilton water works. He dealt also with the necessity for a considerable extension of the sewage system. Both talks were not only interesting but very instructive.

EXECUTIVE COMMITTEE MEETING, NOVEMBER 9TH, 1926

A meeting of the Executive Committee of the Hamilton Branch was held on November 9th, 1926, in the office of the chairman, L. W. Gill, M.E.I.C., in the Hamilton Technical Institute.

Besides the chairman, W. F. McLaren, M.E.I.C., secretary-treasurer, and four other members of the executive were present.

The following committees were appointed:—

Papers	H. A. Lumsden, M.E.I.C. (*Chairman*)
	E. H. Darling, M.E.I.C.
	J. A. McFarlane, M.E.I.C.
	H. S. Philips, M.E.I.C.
	F. P. Adams, A.M.E.I.C.
	D. W. Callander, Branch Affiliate.
Membership	H. B. Stuart, A.M.E.I.C. (*Chairman*)
	F. H. Midgly, A.M.E.I.C.
	H. G. Bertram, M.E.I.C.
	J. J. MacKay, M.E.I.C.
Entertainment	Arthur Munson, A.M.E.I.C. (*Chairman*)
	W. D. Black, A.M.E.I.C.
	A. R. Hannaford, A.M.E.I.C.
	A. M. Jackson, A.M.E.I.C.
	R. J. Clench, S.E.I.C.
	O. W. Titus, A.M.E.I.C.
Publicity	J. R. Dunbar, JR.E.I.C., (*Chairman*)
	F. I. Ker, A.M.E.I.C.
	E. M. Coles, A.M.E.I.C.

In each case the committee has power to add to its numbers and the chairman is to report to the executive for his committee.

Several excellent suggestions for papers were handed to the chairman of the Papers Committee. These included papers of all branches of engineering which are of interest to members of the Hamilton Branch.

Montreal Branch

C. K. McLeod, A.M.E.I.C., Secretary-Treasurer.
H. W. B. Swabey, M.E.I.C., Branch News Editor.

The fall programme of meetings was opened on Thursday, October 7th, when a paper was read by H. R. Wake, A.M.E.I.C., on the Arvida Townsite. Mr. Wake is the town manager in charge of this new town in the Lake St. John district, which is being developed in connection with the large works of the Aluminum Company of Canada, at present under construction. The townsite is planned for an ultimate population of thirty to forty thousand.

The description given in this paper illustrates how rapidly a modern townsite can be developed with up-to-date machinery, under proper engineering management and supervision.

ENGINEERING FEATURES IN BREAKING THE ALLEGHENY ICE GORGE

On October 14th an interesting description was given by Dr. H. T. Barnes, M.E.I.C., of the breaking up of the ice gorge in the Allegheny valley last spring. This great feat was carried out under the supervision of Dr. Barnes by the use of Thermit.

In the discussion on Dr. Barnes' paper, Dr. R. A. Ross, M.E.I.C., took part, and referred to the work accomplished by Dr. Barnes in the Allegheny valley as an outstanding performance by "an Eskimo from Canada in enlightened America."

Major Geo. A. Walkem, M.E.I.C., the president of the Institute, was present at this meeting, and was given a cordial welcome by the branch. Previous to Dr. Barnes' lecture, he gave a short address describing his recent tour across the Dominion, during which he visited most of the branches of the Institute.

A vote of thanks to the speaker of the evening was proposed by Major Walkem.

The hall was crowded for this meeting, which was under the chairmanship of C. J. Desbaillets, M.E.I.C.

MANUFACTURE OF CARBIDE

The branch was fortunate in having a most interesting lecture on this subject by R. A. Wetherspoon of the Canadian Carbide Company, on October 21st. A history of the industry was given, with a description of the most recent developments in electric furnaces for the manufacture of calcium carbide, illustrated by plans and sketches. Dr. A. Stansfield, M.E.I.C., was chairman at this meeting.

SPECIAL GENERAL MEETING

On October 28th, before the regular meeting, a special general meeting was held, with C. J. Desbaillets, M.E.I.C., in the chair, at which three members were appointed to the Nominating Committee for the nomination to the Executive Committee for 1927.

BEARING METAL BRONZES

After the special general meeting on October 28th, Mr. H. J. Roast, of the Society of Chemical Industry, read a paper on the subject of Bearing Metal Bronzes. This paper was under the joint authorship of Mr. Roast and F. Newell, M.E.I.C., chief mechanical engineer of the Dominion Bridge Company. The paper embodies the results of a great deal of research work by the authors, on bronzes for bearing purposes.

Eleven typical bronzes were discussed and illustrated by lantern slides taken from photo-micrographs of specimens under discussion, showing the structure of the metal before and after heat-treatment. Several microscopes were set up on a table in order to give those present the opportunity of examining the original specimens of bronze described in the paper.

Copies of a data-chart were distributed, giving particulars of the chemical and physical properties of the bronzes under discussion.

The American Railway Engineering Association and its Work

At a meeting on November 4th, under the chairmanship of D. Hillman, M.E.I.C., J. G. Armstrong, M.E.I.C., assistant engineer of the Canadian Pacific Railway, read a paper describing the work and giving a history of the A.R.E.A. from its inception in 1899. The author explained the workings and value of the association now recognized by all railways throughout the world. He described the wide range covered by the information given in the association's Manual, covering specifications for track material, to those for the grading of a railway; economics of the location of a railway to the economics of railway operation.

In 1900 the association had a membership of 280, which has risen to 2,300 at its 27th annual convention in the present year. The author described how the work of the association is carried on by twenty-three standing committees divided into sub-committees, handling special assignments.

During the discussion Mr. Gardener, assistant engineer of the Montreal Tramways, gave some information in regard to the operations of the American Electric Railway Engineering Association, which carries out very similar functions to the A.R.E.A. in connection with electric railways.

R. V. Look, AFFILIATE E.I.C., president of the Canada Creosoting Company, and O. C. Steinmayer, M.E.I.C., superintendent of treating for that company, were amongst those who took part in the discussion.

Manufacture of Kraft Pulp

A very creditable paper was read on November 11th by J. B. Phillips, fourth-year chemical engineering student of McGill University, on the manufacture of pulp for paper, with special reference to the kraft process.

The speaker gave a description of the process of manufacture of kraft pulp, dealing particularly with the sulphate method of cooking the wood. He mentioned that the word *kraft* is Swedish for *strong*, and that paper made by this process is brown in colour, as in the case of most wrapping papers. Fibre boards are also made from kraft pulp.

Mr. Phillips referred to the manufacture of paper from a variety of plants, such as flax, indian corn, pineapple leaves, straw, etc.

The paper was of a highly technical nature, involving a great deal of study and investigation into the methods of pulp-making.

Professor Goodwin of Queen's University, and E. P. Cameron, A.M.E.I.C., of the Forest Products Laboratory, were amongst those who took part in the discussion. H. L. Johnston, Jr. E.I.C., was chairman.

Niagara Peninsula Branch

R. W. Downie, A.M.E.I.C., Secretary-Treasurer.
C. G. Moon, A.M.E.I.C., Branch News Editor.

Engineering in Peru

In accordance with a policy suggested by Chairman Alex. Milne, A.M.E.I.C., whereby branch members are to present a series of papers on technical or semi-technical subjects, J. C. Street, M.E.I.C., of Welland, described an engineering jaunt to the interior of Peru for the Foundation Company of New York. A number of lantern slides were shown giving a good idea of the nature of the country, types of inhabitants, buildings and works of engineering interest.

Mr. Street reached the Port of Callao in June, 1920, via the Panama canal, and was almost immediately taken to police headquarters. (He explained that this was merely to have his papers examined and a photograph taken at the expense of the State.) However, upon his liberation, he departed hurriedly in an easterly direction for less civilized portions of the country.

The work upon which he was at first engaged was the Yanamayo hydro-electric project on the Oyon river, remarkable on account of the proposed head under which the power was to be developed. Twenty-five thousand horse-power were to be developed under a head of 1,200 feet, utilizing 245 c.f.s. of water and requiring a storage of 22,000 acre-feet.

This work was all at high altitudes, 13,000 to 16,000 feet above sea level, and breathing for the normal person was somewhat difficult. Doctors accompanied the trains which ran into the interior and attended to the many passengers who were overcome with mountain sickness. Some of these passengers were unable to stand the strain and had to be taken off the trains and returned to Lima.

The natives, although short of stature, have a tremendous chest and lung development and experienced little difficulty in breathing the rarefied air.

There is little or no rainfall in the coastal region of Peru visited by Mr. Street. Lima is practically without vegetation other than that grown by means of irrigations, and the uplands, or pampas, are little better, although grass grows and is excellent for sheep raising.

One of the main difficulties was the question of supplies. Most of these had to be packed in from the nearest railway station on the backs of small burros and the natives were not particularly honest. Kodak films appeared to be a great temptation and, whether by design or accident, very few reached the party.

Then before the preliminary surveys were fully complete the Yanamayo project was abandoned. Due to new mineral discoveries in another part of the world altogether, and to improved metallurgical treatments of vanadium ores it became commercially impracticable.

Mr. Street returned to Lima. This time he was unmolested and allowed to work in peace for the better part of a year on paving and street improvement contracts which the Foundation Company had secured. Lima is a wonderful city and the smells, fleas, open sewer troughs or gutters, etc., are fast becoming a thing of the past. It is noted for its old adobe buildings and churches; some of the latter dating back from two to four hundred years; together with their carved woodwork and interior decoration, existing in an almost perfect state of preservation, due to the dry state of the atmosphere.

The adobe construction, local mud, water-tamped into oblong forms about 10 by 20 by 24 inches, is still used extensively although a few concrete buildings are apparent. Adobe is a good non-conductor of heat and will last indefinitely under the local conditions.

Peruvian civil engineers are few in number and some are not very conversant with concrete design. One building foundation that Mr. Street noticed had a surplus of reinforcing steel embedded in the concrete,—1¼ inch round bars at about 12-inch centres both vertically and horizontally, but this steel had been placed in the compression side of the walls and consequently when the backfill was made the structure collapsed.

The supply of drinking water for the city of Lima is, and always has been a problem. The Rimac river rises in the foot hills of the Andes and is quite intermittent in flow. Combined with the fact that it also furnishes irrigation for some of the intervening country, by the time it reaches Lima the supply is not very satisfactory.

Attempts were made to cut parallel side ditches and tunnels with the idea that the water would filter through a glacial strata of lime cemented gravel and boulders, but this strata quickly clogged up with sediment and the flow gradually diminished. Now a new filtration plant is in process of construction and will undoubtedly do away with the epidemics of typhoid which were of such frequent occurrence.

This lecture was given on October 20th, 1926, at St. Catharines, after a dinner meeting at the Welland Inn, and following Mr. Street's remarks S. R. Frost, A.M.E.I.C., proposed a vote of thanks and this was heartily endorsed by the meeting.

Ottawa Branch

F. C. C. Lynch, A.M.E.I.C., Secretary-Treasurer.

There was a large attendance of the Ottawa Branch members at the first luncheon of the season, held in the Chateau Laurier on October 28th, when N. F. Parkinson, A.M.E.I.C., Deputy Minister of the Department of Soldiers' Civil Re-establishment, spoke on the subject of "Duralumin," with particular reference to the use of this metal by the Canadian Government in the manufacture of "all metal" artificial limbs.

Duralumin

If any members of the Institute entertained a thought that engineering skill did not enter largely into the manufacture of artificial limbs, such idea was rapidly dispelled as the speaker traced the research work on materials and the experiments which finally led to the fashioning of the present all-metal limbs which not only have brought comfort and happiness to hundreds of the unfortunate amputation cases resulting from the war, but have been an important factor in their complete re-establishment.

In speaking of the properties of duralumin as utilized in the construction of artificial limbs, Mr. Parkinson stated that it combined lightness, high tensile strength, high elastic limit and high resistance to shock. He outlined the features of the design of the all-metal limbs, comparing their practical utility and long life with wooden limbs, demonstrating the various points with samples which were passed among the members for inspection. The members marvelled at their lightness, less than half the weight of wood in some models; at the excellent design of the joints which permitted almost natural articulation, and at the care which was bestowed in modelling each limb to take care of the peculiarities of each individual case with a precision which could not be accomplished with wood. Duralumin could be readily beaten out to any desired shape. The speaker also dwelt at some length on the tests which had determined the exact proportions of aluminum and steel to give the alloy best suited to resist corrosion, and to have the requisite strength and malleability, resulting in the production of a highly polished and durable article which would provide a maximum of comfort and freedom from the inconvenience formerly necessary when the old wooden limbs had to be replaced, due to wearing out.

Mr. Parkinson disclosed the fact that the total number of amputation cases resulting from war service was 3,175, and remarked that the metal artificial limbs were being manufactured in Canada by ex-soldiers at the department's limb factory in Toronto. He paid high tribute to the sympathetic understanding of Hon. Dr. Beland, who, as former Minister, had greatly assisted the work of developing proper appliances.

J. D. Craig, M.E.I.C., chairman of the Ottawa Branch, presided, and at the conclusion of Mr. Parkinson's address conveyed the thanks of the Branch for his interesting talk on the use of duralumin in a highly important and humanitarian work.

Patents

On November 18th an Ottawa Branch member was the speaker at the luncheon held in the Chateau Laurier. Alex. E. MacRae, A.M.E.I.C., spoke on a subject of great interest to engineers—"Patents."

A patent grants a limited monopoly, Mr. MacRae said. In the reign of King James I. a statute was passed substantially prohibiting monopolies, which had been so prevalent at the time, but making an exception, which proved of incalculable importance, in granting a limited monopoly to " the true and first inventor " of " any manner of new manufacture within this realm."

The principle of patent law is to stimulate invention and encourage development of new industries. The American patent system has been held to be the greatest factor in the industrial development of the nation. Without patent protection progress in industry would be greatly retarded, for the industrialist could not afford to spend time and money in the development of a new enterprise or installation of new methods, knowing that his neighbour or competitor could immediately utilize his experience without restriction. Patents are thus essential to industrial development and are perhaps the most constructive force in our economic life. In the present day large industrial corporations maintain their own corps of inventors and their inventions are promptly patented.

To be patentable in Canada, Mr. MacRae said, a thing must be new the world over, and useful, and the result of invention. The requirement of utility usually needs little consideration as most, if not all, real inventions are useful to some degree. Applications for patent for perpetual motion machines, however, which are not altogether uncommon, usually fall before this requirement in the hands of the patent examiner. A theory or mere scientific principle is not patentable, but the process or means for applying the theory or principle to practical use is patentable. Many engineers, as well as lawyers and others, showed a lack of understanding in drawing up patent applications. Instead of details, what was required was a broad statement which would limit the use of the principle patented in its application in the arts and industries.

The speaker dwelt at some length on the provision embodied in the 1923 Patent Act relating to inventions made by persons in the public service. He maintained that the right of a public servant to patent his invention made in the course of his investigation or research resulted in great benefit to the public, as well as to the individual. The Commissioner of Patents has rights to grant license to use such invention on terms fixed by him, determining the amount payable to the government and to the inventor, but in no case shall the latter receive less than half of what would have been his had he not been a public servant. If the privilege of patenting the improvements in processes or machines developed in government research was not exercised there was great danger that patents covering the same would issue to outsiders, perhaps even citizens of foreign countries, and that Canadians would be called on to pay prohibitive prices to utilize the fruits of work carried on with public money.

A. F. Macallum, M.E.I.C., past chairman of the Ottawa Branch, presided in the absence of J. D. Craig, M.E.I.C., through indisposition, and conveyed the thanks of the meeting for an able address on a subject of great interest to engineers.

Peterborough Branch

W. E. Ross, A.M.E.I.C., Secretary.
B. Ottewell, A.M.E.I.C., Branch News Editor.

At the regular meeting of the Branch on October 28th, 1926, the speaker was Mr. W. Flavelle, of Lindsay, Ontario, whose subject was " The Life of Sir Wm. Van Horne and the Construction of the Canadian Pacific Railway." This was an historical and descriptive address of great interest, commencing with the original necessity for a transcontinental railway after Confederation, and dealing particularly with the tremendous difficulties in finance and engineering which had to be overcome.

The necessity for such a line of communication was emphasized when in 1870 the young Dominion found itself with the task of crushing the Riel rebellion, and the fact that it took 95 days to transport troops from Toronto to Winnipeg.

The incorporation of British Columbia into the Canadian Confederation in 1871 was on the express stipulation that the Dominion within two years would begin, and within ten years complete, a railway linking the new province with eastern Canada.

Reference was made throughout the address to the many illustrious engineers, financiers and politicians who took part in the work, —Sir John A. Macdonald, Sanford Fleming, George Stephens, R. B. Angus, Sir Charles Tupper, Sir Wm. Van Horne,—to mention only a few.

Of all these, the speaker singled out Sir Wm. Van Horne, the first general manager and president of the C. P. R., for the highest of praise and admiration for his great mental and physical power. When he was selected as general manager it was said of him that " He will take all the authority he gets, and more, so advise how much you want him to have."

Van Horne arrived in Winnipeg on December 31st, 1881, when the temperature was 40° below zero, and began his work in temporary quarters. His welcome had some of the chilliness of the Manitoba frost, but he was not the man to be deterred by this, and it was not long before he had won the admiration and co-operation of his fellow workers.

His proposition to build 500 miles of track in the season of 1882 was held to be ridiculous, but during that year 620 miles of line were located, 508 built, 807 miles of telegraph line, 30 station houses, and some score of other buildings erected.

Later on came the difficult Rocky Mountain section, and the north shore of lake Superior. As these engineering difficulties were overcome, the financial ones increased, and there were many critical stages for the company when only the strength and faith of such men as Van Horne pulled them through.

On November 7th, 1886, track layers met at a spot in Eagle Pass in the Selkirks, and here in the presence of Van Horne and many others of the company's officers and engineers, the last spike was driven, so linking Montreal with the Pacific, and adding a great imperial highway to the advantage and glory of the Empire.

Saint John Branch

W. J. Johnston, A.M.E.I.C., Secretary-Treasurer.

Coal and Other Fuels Derived From It

The members of the Saint John Branch, were addressed on October 27th, 1926, by K. L. Dawson, A.M.E.I.C., of Halifax, N.S., speaking on " Coal and Other Fuels Derived from It." An interesting feature of Mr. Dawson's talk was the demonstration with laboratory apparatus of the manufacture of coke and gas. Several samples of coal were experimented with and the advantages in coking properties obtaining in some fuels over others shown by actual demonstration.

Touching on the smoke nuisance in cities the speaker declared much of it, in addition to showing a waste of fuel owing to poor combustion conditions, was also unnecessary. Statistics were quoted from London and Glasgow showing the deposits of carbonaceous materials from smoke were heaviest in the residential and office-building sections of the cities, rather than the popularly-accepted belief that factory districts are the worst sections. The speaker explained that by the fact that more attention is paid to proper firing and burning of fuel in the factory where the enormous waste is realized. It is largely from the many small fires in private houses and business blocks that the smoke screen seen over any city originates.

The monetary loss from unnecessary smoke is realized when the cost of extra laundry work, paint to renovate smoked walls and woodwork, and for cleaning materials, is taken account of, without considering the matter of health. Most of the stoves and furnaces waste 60 to 70 per cent of the fuel; the average steam plant from 35 to 40 per cent, while the best steam plants waste about 20 per cent.

The waste in burning raw coal was plainly shown, and the advantage of coke explained with the possible recovery of so many valuable by-products. In making coke there is also obtained gas for domestic use and for further re-heating the coke, for domestic fuel and metallurgical purposes, tar, also valuable liquids, benzol, tuluol, creosote, carbolic acid, etc., which are necessary in dye and explosion industries and so important in pharmaceutical and photographic trades. Coal made into gas and coke is changed into products worth three times as much as in their raw state and in Canada provides work annually for 4,000 men receiving $6,000,000 annually in salaries, and represents an investment in plant of at least $50,000,000.

An interesting feature of the meeting was the discussion on this subject. Almost every one present wanted to relate his experiences in using some particular fuel in stove or furnace and tell how much it cost him, and then to ask what the matter was. Every one was interested in a matter affecting the pocket-book and asked Mr. Dawson many questions which he ably answered.

Geoffrey Stead, M.E.I.C., moved a vote of thanks, seconded by J. D. Garey, A.M.E.I.C., and this was tendered to Mr. Dawson by A. R. Crookshank, M.E.I.C., who acted as chairman of the meeting.

Survey of Civic Administration

The City of Saint John has contracted with the Citizens Research Institute of Canada under Dr. H. L. Brittain to make an examination of form of government, assessment, taxation, departmental organization, engineering services, and accounting systems at present in vogue. Assisting Dr. Brittain in this work will be an engineer, lawyer and accountant. William Storrie, M.E.I.C., of Gore, Nasmith and Storrie, consulting engineers, Toronto, is engaged on this work. The Mayor and Commissioners form of government is at present in operation in Saint John.

Saskatchewan Branch

R. W. E. Loucks, A.M.E.I.C., Secretary-Treasurer.

The October meeting of the Saskatchewan Branch was held at the C. P. R. banquet hall, Moose Jaw, on October 20th, 1926. A large number of the Regina members took advantage of the pleasant evening and the good roads and motored to Moose Jaw, where they were joined by members from Moose Jaw. Guests included Mr. S. P. Grosch of Regina, newly appointed chairman of the local government board of the province, and Mr. Fraser Stewart, city solicitor of the city of Regina. John G. Hall, A.M.E.I.C., representative of the Combustion Engineering Corporation, was also present and conveyed greetings from the Winnipeg Branch of the Institute.

A special committee composed of members from Moose Jaw had charge of the arrangements. The meeting opened with a sumptuous banquet, followed by the toast to The King. Mr. Jack Brooksbank and Mr. "Dutch" Macpherson delighted the audience with suitable songs.

Past-Chairman G. D. Mackie, M.E.I.C., and J. R. C. Macredie, M.E.I.C., both of the city of Moose Jaw, were presented with past-chairmen's badges, consisting of gold membership pins. R. N. Blackburn, M.E.I.C., also a past-chairman, spoke of the service which each of these members had rendered to the branch, in making the presentation. Mr. Mackie replied in a humorous vein and thanked the branch for the recognition thus taken of his service as chairman. While the past few years had been none too rosy for the engineers in this province, he prophesied a brighter outlook for the future. Engineers, he stated, should aim to assist in the development of agriculture, our dominating industry. Mr. Macredie suitably expressed his thanks to the Branch for the honour conferred upon him and stated that the year he had spent as chairman of the branch had been a most enjoyable one.

Sewer and Water Conditions in Saskatchewan

R. H. Murray, A.M.E.I.C., sanitary engineer for the province of Saskatchewan, read a paper on "Present Sewer and Water Conditions in Saskatchewan," in which he outlined briefly the work of the department with which he is connected. He spoke of the extension and development of sewer and water services in urban centres in the province and the costs of installations to date. He referred to recent changes in the Public Health Act empowering municipalities to enforce householders whose property is served by sewer and water mains to connect their houses thereto, and the action of the city of Saskatoon in enforcing the act in this connection.

The cities of Saskatoon and Prince Albert have no sewage disposal works and the sewage is discharged into the South Saskatchewan and the North Saskatchewan rivers respectively. Owing to the fact that there are no urban centres within the zone where the polluted river water reaches there has as yet been no urgent demand for the construction of these works, but it is anticipated that these will be required in the near future. The only new sewage disposal plants constructed in the province since the war are those at Gravelbourg and Shaunavon and the plant at Melfort, which has been entirely remodelled.

At Shaunavon and Melfort the activated sludge system of sewage disposal has been installed, and although these plants have been operating only a comparatively short time they are both giving very satisfactory effluents. Shaunavon enjoys the distinction of being the only municipality in the province which has a sewerage and sewage disposal system and yet has no watermains in the town. The explanation is that practically every householder has his own private well and there is no demand for water to be laid down for domestic purposes.

The discussion on Mr. Murray's paper was led by J. W. D. Farrell, superintendent of waterworks for the city of Regina, who quoted figures showing the number of services per mile of watermains in Saskatchewan cities as compared with cities in the United States. Regina has an average of 91, Saskatoon 70, Moose Jaw 76 and Prince Albert 36 services per mile, while the average in the American cities is about 100 per mile. Amongst the towns, Biggar has 88, Indian Head 60, Melfort 26, Melville 26, Swift Current 41, Weyburn 41 and Yorkton 63. In the three larger cities of the province the population per connected service is from 6 to 8. In the smaller towns the per capita consumption of water is from 8 to 11 gallons, and in the larger cities and towns as follows:—Moose Jaw 43, Prince Albert 87, Regina 68, Saskatoon 60, Swift Current 125, Estevan 173. In Regina the number of installed services in use compared with the total installed services increased from 59 per cent in 1919 to 70 per cent in 1926. In 1919 there were in Regina 69 services per mile of watermains and in 1926, 96 services per mile.

Mr. Mackie also discussed Mr. Murray's paper. He referred to the fact that the cities in Alberta use on an average 100 gallons per capita as against an average of 36 gallons per head in the cities in Saskatchewan, the larger amount used in the Alberta cities being no doubt due to the larger number of rivers as sources of water supply in that province. He stated that the cities in Saskatchewan must obtain their water supply from visible sources or they will not grow in population.

The Growth of Industrial Power in Saskatchewan

J. D. Peters, A.M.E.I.C., electrical superintendent of the city of Moose Jaw, gave an address on "The Growth of Industrial Power in Saskatchewan." He compared the increased consumption of electricity in five of the larger centres of the province, viz:—Regina, Saskatoon, Moose Jaw, Prince Albert and Weyburn, over the period 1915 to 1925. The total consumption of what might be termed industrial power in these five centres has increased in that period from 12,676,347 k.w. hrs. to 27,650,600 k.w. hrs., or an increase of 118 per cent. Including other cities and towns and private plants in the province using electrical energy for industrial purposes Mr. Peters computes the total consumption for this purpose in 1915 as 15,846,347 k.w. hrs., and in 1925 as 34,550,600 k.w. hrs., or an increase of 112 per cent. Assuming the annual load factor at 50 per cent of maximum load, the power required to serve the above load would be 4,820 h.p. in 1915, and 10,507 h.p. in 1925. Saskatchewan being an agricultural province the electrical energy used for industrial purposes is comparatively small, but the increase of over 100 per cent in a ten-year period leads one to believe that a much greater increase may be expected in the future. The total electrical output for the five centres above referred to for all purposes was 24,208,410 k.w. hrs. in 1915, and 56,495,446 k.w. hrs. in 1925, or an increase of 133.3 per cent. Taking the annual load factor at 40 per cent of maximum load, the power required to serve fully the five centres under discussion was 9,200 h.p. in 1915 and 21,500 h.p. in 1925. The development has been more along the lines of cooking and lighting rather than purely industrial lines. Considerable power, however, is used in lumber mills, brick plants, coal mines, etc. In fifteen years the power consumed in the Estevan mining field has increased about 2,000 per cent.

E. W. Bull, superintendent of the city of Regina power plant, led the discussion on Mr. Peters' paper. He exhibited a chart showing the increase in electrical energy distributed from the city of Regina power house over a number of years. He stated that the large increase in the number of electric ranges in Regina had been responsible for a large portion of the increase, and this increased demand will shortly require a new system of distribution to take care of the load.

Sault Ste. Marie Branch

A. H. Russell, A.M.E.I.C., Secretary-Treasurer.

A regular meeting was held at 8:00 p.m., October 29th, in the Y.W.C.A. rooms. C. H. Speer, M.E.I.C., chairman, called the meeting to order and disposed of the regular business.

Storm Swept Florida

An article was read by Mr. Speer from B. E. Barnhill, M.E.I.C., who is on construction work with Foley Brothers, Inc., in Florida. The article was entitled "Storm Swept Florida," and gave a most vivid description of the recent flood that swept from Jupiter inlet on the north to Key Largo on the south, a distance of 120 miles, and thence in a north westerly direction through the state and on into Alabama.

Wind velocities were estimated to have reached as high as 135 miles per hour thus exerting approximately 90 pounds per square foot pressure. This wind was accompanied by a downpour of rain estimated at four and one-half inches in two hours.

DIVERSION OF LAKE MICHIGAN WATER AT CHICAGO

Mr. Speer then called upon R. S. McCormick, M.E.I.C., general superintendent and chief engineer of the Algoma Central and Hudson Bay Railway Company of this city, who gave a most interesting paper on "The Diversion of Lake Michigan Water at Chicago." Mr. McCormick outlined extensively the historical and geographical aspect of the situation, clearly showing why the scheme of the Chicago drainage canal was initiated about forty years ago. He went through the early stages, through all the legal controversies and finished up by showing the extent to which this project has been developed and the possible results if allowed to be continued.

The members and visitors, including Mayor Irwin, entered actively into the discussion that followed. A hearty vote of thanks and appreciation was tendered to Mr. McCormick by J. W. LeB Ross, M.E.I.C., and Mayor Irwin, for his instructive address on a subject in which all residents of this district have such a deep interest.

The local paper, The Sault Daily Star, published Mr. McCormick's address verbatim, as they considered that the people of Algoma should get the facts that were so clearly outlined in this address.

Toronto Branch

J. W. Falkner, A.M.E.I.C., Secretary-Treasurer.

THE FUNCTIONING OF THE RIGHT-OF-WAY DEPARTMENT OF THE TORONTO TRANSPORTATION COMMISSION

The Toronto Branch held their first regular meeting of the season on October 28th, 1926, when the first of a series of three illustrated papers dealing with the Toronto Transportation Commission was given by H. W. Tate, A.M.E.I.C., engineer-of-way on the functioning of the rightof-way department of the Toronto Transportation Commission.

After briefly touching on the general history of the Commission, and giving a few figures comparing mileage of system when Commission took over the street railway with the mileage today, and the area of city served then with that served now, the average fare of 6.15 cents was then discussed, showing that out of this average fare 0.422 cents was spent on maintaining track work, overhead and structures.

The way department therefore had only a proportion of this 0.422 cents per passenger to carry out its work, and the object of this address was to show how this money was disbursed.

The general organization of the department by sections was taken up, first head office, then the roadmaster's, followed by the paving, the concreting and excavating, and the material yard sections.

The work of each section was taken up in detail, showing in the first place how the expenditures of the department were controlled by an annual budget, which budget before it could be put into effect had to be approved by the management.

The system of accounting was described, and the application of work orders and job orders for isolating various expenditures.

Coming to the roadmaster's section, which also includes the track equipment and bonding section, the division of the city system into four assistant roadmaster districts was taken next, and the daily duties of this important section throughout the twelve months of the year were outlined.

The work of the other sections was also described in detail, and finally the routine necessary before and during a construction job was carefully gone over.

A number of lantern slides were used, showing the organization of the Commission, and that of the way department, and also illustrating the various stages in construction work and the equipment used.

Slides of Rosedale loops and North Yonge street were shown to bring before the audience the improvements to a property or a district brought about by the construction of a loop or tracks.

There was a large attendance and those present showed their appreciation by the discussion at the close of the address.

POWER DISTRIBUTION PROBLEMS, TORONTO TRANSPORTATION COMMISSION

The second paper of the series was given on November 11th, 1926, when Mr. J. F. Neild gave an instructive and well illustrated paper on Power Distribution Problems of the Toronto Transportation Commission. Mr. Neild's paper appears in this issue of the Journal.

It was a pleasure to have General Secretary R. J. Durley, M.E.I.C., present with us at this meeting, and to have a few remarks from him regarding Institute affairs.

Vancouver Branch

E. A. Wheatley, A.M.E.I.C., Secretary-Treasurer.

During the month of October, four meetings of the branch were held. These included an address on Engineering Education by Professor W. E. Duckering, A.B., B.S., C.E., of the University of British Columbia. This meeting was well attended and proved of the very greatest interest. The discussion that followed the Professor's address showed the great thought which engineers at the moment are giving to this subject. Those leading the discussion were:—J. Porter, The Chairman W. H. Powell, M.E.I.C., and H. B. Muckleston, M.E.I.C.

The second meeting took the form of an address by Professor J. M. Turnbull, B.A.SC., Head of the Department of Mining Engineering of the University of British Columbia, who addressed the members on the subject of "Changing Aspects of Mining." This address was the first of a series of addresses by well-known mining engineers, and proved of great interest to the audience, which consisted, not only of mining engineers, but of engineers of all branches of the profession.

The third meeting held on October 20th in the nature of a discussion on the Professional Engineer Movement. The view was expressed by members present that this practice might well be repeated. It showed the very close connection between the Engineering Institute and the Professional Engineers' Association, and afforded an opportunity to those few members of the Institute who are not yet members of the Professional Engineers' Association, to understand and to learn how the absence from the rank of registered professional engineers injures the profession. The meeting was addressed by Frank Sawford and J. Muirhead, M.E.I.C., members of the council of the Association of Professional Engineers.

The final meeting of the month was addressed by Dr. H. W. Hill, M.B., M.D., D.P.H., L.M.C.C., in charge of the Pathological Laboratories of the General Hospital, Vancouver, B.C. Dr. Hill has been an authority for many years on the education of the medical student and was thus well qualified not only by his position, but by his delightful manner of public speaking, to address the members on such a subject. The engineers present remarked with interest that many points of control of the medical student's education by the medical profession, or by the members of the medical profession, was absent in the case of the engineering profession. Advanced copies of the Doctor's address were supplied to Prof. W. E. Duckering, H. B. Muckleston, M.E.I.C., and Mr. J. Porter, which resulted in a very keen and enjoyable discussion.

The Nominating Committee, consisting of J. Muirhead, M.E.I.C., W. O. Marble, M.E.I.C., and T. A. McElhanney, A.M.E.I.C., drew up the election ballot for the year. The committee recommended that written or printed by-laws be drawn up in order that future nominating committees be provided with a written guide.

During the month, the Vancouver Branch came very closely into touch with the Professional Engineers' Club, and with the Engineering Bureau of the Board of Trade of the City of Vancouver.

A number of very interesting addresses and discussions were held in connection with the Engineering Bureau of the Board of Trade, and representations were made to the Council of the Board of Trade, recommending that Canadian consulting engineers be employed before further steps were taken towards any decision to build the First Lions' bridge. This resolution was accepted by the council of the Board of Trade, and forwarded to the four municipalities concerned, and to the Minister of Public Works, Ottawa. The discussion is still continuing.

The Professional Engineers' Club enjoyed two splendid addresses by J. W. Allen on the subject of "The Amalgamation of Greater Vancouver" and an outstanding address given by J. W. de B. Farris on "The Canadian Constitution."

Victoria Branch

E. G. Marriott, A.M.E.I.C., Secretary-Treasurer.

On October 6th, Mr. M. Doyle, works superintendent of the British America Paint Company, of Victoria, addressed members of the Victoria Branch and members of the Professional Association of British Columbia on the subject of "Paints."

Mr. Doyle stated that in preparing to speak on this topic he had considered what would be of most use to the engineer, and had decided to leave out at this time description of the actual methods of manufacture, so as to deal rather with the materials used in the various classes of paint, and in mentioning at times the disadvantages of certain materials, he did not wish to be taken as condemning them, but only as emphasizing the conditions under which they gave the best service. An abstract of Mr. Doyle's paper appears on another page in this issue.

Mr. Doyle was subjected for the next quarter of an hour to a steady stream of questions, covering such things as Japan driers, enamels, flat finish paints, the use of boiled linseed oil, the painting of reinforcement, etc.

In conclusion Mr. Doyle stated that the company had a well-fitted laboratory, and a good library, and would be glad to be of assistance to engineers in any of their paint problems.

A hearty vote of thanks for such a clear description of many of the materials entering into paints, and their advantages and disadvantages, was offered Mr. Doyle by the branch chairman, J. N. Anderson, A.M.E.I.C., and unanimously endorsed by those present.

LUNCHEON TO HIS HONOUR LIEUT.-GOVERNOR R. R. BRUCE

On Tuesday, October 19th, a joint luncheon of the Victoria Branch and of local members of the Association of Professional Engineers of British Columbia was held, the guest being His Honour R. R. Bruce, Lieut.-Governor of the Province.

His Honour was introduced to the gathering by the branch chairman, J. N. Anderson, A.M.E.I.C., who pointed out that the engineers had been among the first, if not the first, to invite the Lieut.-Governor to address them, but owing to the numerous calls on his time, and the number of engineers who were away during the summer, it had not been possible to meet him before; however, it was with great pleasure that they now welcomed him.

Received with loud applause, and offering his congratulations to his fellow-engineers, His Honour expressed his great pleasure at meeting so large a gathering.

Referring to his early days with the C. P. R. as cheery days, though the work was rough and salaries modest, he remarked what a marvellous career the profession had had in Canada, and as one looked at the thousands of miles of railway, the large hydro-electric developments, the wonderful roads of the Dominion, and the rapid growth in mining development, one could not but be proud to belong to the engineering profession.

It was curious, he said, that engineers occupied so few public positions, or seats in the legislatures; it was noticeable that other professions were much more largely represented, and engineers should take steps to remedy this.

When he attended Glasgow University, it was the only university in Scotland granting a B.Sc. degree in engineering, but now a new generation of engineers has arisen who have received a thorough technical training in some university, almost a necessity for advancement at the present time.

The advantages of a technical training had been evident in very many ways, of which perhaps an outstanding local example was the development of methods of separation of metals at Trail, which had won world-wide reputation.

It had been suggested that there were too many engineers, but the resources of Canada were so vast that there was much room yet. In the province of British Columbia, mining, hydro-electric, and pulp and paper development were in their infancy, while in the commercial and industrial engineering fields such progress was made from day to day that opportunities were many for the young engineer. To be successful demands from them courage and persistence, and in concluding he would wish every one success, at the same time repeating his suggestion that engineers should take a more prominent part in public affairs.

P. Philip, M.E.I.C., Deputy Minister of Public Works, expressed the thanks of the membership for the encouraging and optimistic outlook for engineers that had been given them, and also for the exceptional pleasure it had given them to listen to His Honour as being Lieut.-Governor of the Province and also an engineer.

A wire was received from Major Geo. Walkem, M.E.I.C., president of the Institute, expressing his regrets at being unable to be present, also a letter from the registrar of the Association of Professional Engineers of British Columbia, asking Mr. Philip, in the unavoidable absence of the president and vice-president, to represent the council of the Association at the luncheon and to convey the respects of the council to His Honour.

Winnipeg Branch

James Quail, A.M.E.I.C., Secretary-Treasurer.

A regular meeting of the Winnipeg Branch was held on the evening of Thursday, October 7th. In addition to sending the announcements of the meeting to the members of the Institute, the secretary had been instructed to send them to the members of the Manitoba Association of Architects and to the Building Owners' Association of Winnipeg. The attendance was gratifyingly large.

Preceding the address of the speaker of the evening, reports and special business were considered. Some of the items under those heads are of general interest. They all indicate the activity of Winnipeg Branch.

The chairman, Prof. N. M. Hall, M.E.I.C., reported for the Executive Committee the visit to Winnipeg during the summer of the general secretary of the Institute, R. J. Durley, M.E.I.C. He drew the attention of the meeting to the coast to coast scope of the Institute and to the increasingly intimate part it was taking, through its branches, in the life of the communities in which the branches are located. The periodical visits of the general secretary tended toward the co-ordination of the activities of the branches.

J. G. Hall, A.M.E.I.C., reported the meeting that was held at Estevan, Sask., in July, when the Saskatchewan and the Winnipeg branches of the Institute met in convention with the Canadian Institute of Mining and Metallurgy and the Saskatchewan Branch of the American Institute of Electrical Engineers. He gave details of the papers presented and of the trips taken as part of the programme of the convention.

The convention held at Duluth, Minn., in August, was reported by C. H. Attwood, A.M.E.I.C., C. A. Clendening, A.M.E.I.C., R. W. Moffatt, A.M.E.I.C., D. L. McLean, A.M.E.I.C. This convention was held by the Minnesota Federation of Architectural and Engineering Societies, in conjunction with the Architectural and Engineering Fraternity of Manitoba. It will be remembered that Winnipeg was the meeting place of a similar convention in 1925, and noted that a convention has been arranged for Minneapolis and St. Paul in 1927.

Mr. Attwood, who had been chairman of the Arrangements Committee, from Winnipeg, told of how the interest of the Winnipeg engineers had been crystallized to produce a delegation to Duluth of some forty of the engineers and their wives. He told of the "wonderfully good time" the hosts in the United States city had provided for the visitors. He contrasted the wide newspaper and journalistic publicity given in the Duluth papers and the United States technical press with the small space devoted in Canadian publications last year. He quoted from newspaper editorials and displayed front page group photographs of interest.

Among the "papers" presented at the convention was one by N. M. Hall, M.E.I.C., chairman of Winnipeg Branch, in description of the Organization of the Engineering Fraternity in Canada.

Mr. Clendening, following Mr. Attwood, described with interesting detail the visits of parties of the convention to the various workings of the Iron Range in the vicinity of Duluth. Of interest is the production of ore,—from Eveleth 80,000,000 tons; from Virginia 70,000,000 tons; from Chisholm 60,000,000 tons; from Hibbing 225,000,000 tons. Substantial reserves of ore still exist at the centres mentioned.

Mr. Moffatt reported the visit to the Minnesota Steel Company works, and Mr. McLean reported the "Good Roads" activities in Minnesota and compared them with those of Manitoba.

FOUNDATIONS AND FOUNDATION PROBLEMS

A. W. Fosness, A.M.E.I.C., was introduced by the chairman as the speaker of the evening; his subject being Foundations and Foundation Problems. In his introduction, the chairman mentioned the fact of the speaker's broad experience in the design and construction of foundations.

Mr. Fosness addressed the meeting under four main heads,—(1) Types of Problem; (2) Types of Foundation; (3) Relative Costs of Foundations; (4) Settlement and Causes of Settlement. The various phases of foundation problems were treated both broadly and in detail, illustrated from the speaker's experience.

The paper is given in full elsewhere in this issue.

Among those taking part in the discussion were Messrs. W. G. Chace, M.E.I.C., J. N. Finlayson, M.E.I.C., C. T. Barnes, A.M.E.I.C., T. Kipp, Jr., M.E.I.C., H. W. McLeod, A.M.E.I.C., Mr. Chisholm, J. W. Porter, M.E.I.C., and D. A. Ross, M.E.I.C., closed the discussion and moved the vote of thanks.

Plan Now —

To attend the

ANNUAL MEETING

in QUEBEC CITY

FEBRUARY 15TH *to* 17TH, 1927

FULL DETAILS WILL APPEAR IN THE JANUARY ISSUE OF THE JOURNAL

Preliminary Notice

of Applications for Admission and for Transfer

October 19th, 1926.

The By-laws now provide that the Council of the Institute shall approve, classify and elect candidates to membership and transfer from one grade of membership to a higher.

It is also provided that there shall be issued to all corporate members a list of the new applicants for admission and for transfer, containing a concise statement of the record of each applicant and the names of his references.

In order that the Council may determine justly the eligibility of each candidate, every member is asked to read carefully the list submitted herewith and to report promptly to the Secretary any facts which may affect the classification and election of any of the candidates. In cases where the professional career of an applicant is known to any member, such member is specially invited to make a definite recommendation as to the proper classification of the candidate.*

If to your knowledge facts exist which are derogatory to the personal reputation of any applicant, they should be promptly communicated.

Communications relating to applicants are considered by the Council as strictly confidential.

The Council will consider the applications herein described in November, 1926.

R. J. Durley, Secretary.

*The professional requirements are as follows:—

A Member shall be at least thirty-five years of age, and shall have been engaged in some branch of engineering for at least twelve years, which period may include apprenticeship or pupilage in a qualified engineer's office, or a term of instruction in a school of engineering recognized by the council. The term of twelve years may, at the discretion of the council, be reduced to ten years in the case of a candidate for election who has graduated from a school of engineering recognized by the council. In every case the candidate shall have held a position in which he had responsible charge for at least five years as an engineer qualified to design, direct or report on engineering projects. The occupancy of a chair as a professor in a faculty of applied science or engineering, after the candidate has attained the age of thirty years, shall be considered as responsible charge.

An Associate Member shall be at least twenty-seven years of age, and shall have been engaged in some branch of engineering for at least six years, which period may include apprenticeship or pupilage in a qualified engineer's office or a term of instruction in a school of engineering recognized by the council. In every case a candidate for election shall have held a position of professional responsibility, in charge of work as principal or assistant, for at least two years. The occupancy of a chair as an assistant professor or associate professor in a faculty of applied science of engineering, after the candidate has attained the age of twenty-seven years, shall be considered as professional responsibility.

Every candidate who has not graduated from a school of engineering recognized by the council shall be required to pass an examination before a board of examiners appointed by the council. The candidate shall be examined on the theory and practice of engineering, with special reference to the branch of engineering in which he has been engaged, as set forth in Schedule C of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Sections 9 and 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard. Any or all of these examinations may be waived at the discretion of the council if the candidate has held a position of professional responsibility for five or more years.

A Junior shall be at least twenty-one years of age, and shall have been engaged in some branch of engineering for at least four years. This period may be reduced to one year, at the discretion of the council, if the candidate for election has graduated from a school of engineering recognized by the council. He shall not remain in the class of Junior after he has attained the age of thirty-three years.

Every candidate who has not graduated from a school of engineering recognized by the council, or has not passed the examinations of the third year in such a course, shall be required to pass an examination in engineering science as set forth in Schedule B of the Rules and Regulations relating to Examinations for Admission. He must also pass the examinations specified in Section 10, if not already passed, or else present evidence satisfactory to the examiners that he has attained an equivalent standard.

A Student shall be at least seventeen years of age, and shall present a certificate of having passed an examination equivalent to the final examination of a high school, or the matriculation of an arts or science course in a school of engineering recognized by the council.

He shall either be pursuing a course of instruction in a school of engineering recognized by the council, in which case he shall not remain in the class of Student for more than two years after graduation; or he shall be receiving a practical training in the profession, in which case he shall pass an examination in such of the subjects set forth in Schedule A of the Rules and Regulations relating to Examinations for Admission as were not included in the high school or matriculation examination which he has already passed; he shall not remain in the class of Student after he has attained the age of twenty-seven years.

An Affiliate shall be one who is not an engineer by profession but whose pursuits, scientific attainments or practical experience, qualify him to co-operate with engineers in the advancement of professional knowledge.

The fact that candidates give the names of certain members as reference does not necessarily mean that their applications are endorsed by such members.

FOR ADMISSION

BACKTEAROW—EVAN, of Toronto, Ont., Born at Eisk, Russia, May 5th, 1896; Educ., B.E., Prague Univ., 1925; 5 mos. inspector tunnels for ry. City of Mijava, Slovakia; at present with P. Lyall & Sons Constrn. Co. Ltd. on concrete constrn. Union Station, Toronto.

References: C. H. Mitchell, J. R. W. Ambrose, J. A. Knight, E. M. Proctor, J. H. Barber.

BRIDGLAND—MORRISON PARSONS, of Calgary, Alta., Born at Fairbank, Ont., Dec. 20th, 1878; Educ., B.A., Univ. of Toronto, 1901; 1905, obtained D.L.S. commission; 1902-09, asst. to A. O. Wheeler, Dept. of Int., engaged on topographical surveys in Rocky and Selkirk Mts. and examination of land in the ry. belt of B.C.; 1910-12 and 14, i/c triangulation survey of ry. belt of B.C.; 1913-25, i/c phototopographical surveys; 1925, topographical surveys, Calgary; at present, i/c Calgary office, Topographical Survey of Canada.

References: F. H. Peters, B. L. Thorne, A. L. Ford, G. B. Dodge, T. S. Nash, W. M. Dennis, E. H. Finlayson, K. Moodie, H. H. Moore.

GUEST—JOHN LAURENCE, of Arvida, Que., Born at Birmingham, Ala., Aug. 13th, 1898; Educ., B.Sc., Virginia Military Institute, 1918, C.E., Cornell Univ., 1921; 1918, training in U. S. army as 2nd lieut. field artillery; 1919-20, dftsman, instrumentman and inspector, Va. State Highway Comm'n; 1921-23, with Southern Canada Power Co., Charlotte, N.C., on design of two hydro-electric and two steam power plants, also preliminary work in connection with Isle Maligne power development; 1923-25, Quebec Devl. Co., Isle Maligne, i/c preparation of all plans for constrn. of plant; 1925 to date, office engr., Aluminum Co. of Canada Ltd., Arvida, Que., i/c dfting room, preparing plans for plant at Arvida and works for Roberval and Saguenay Ry.

References: W. S. Lee, F. H. Cothran, A. A. Bowman, W. G. Mitchell, B. Pelletier, H. G. Cochrane.

JEFFS—ARTHUR JOSEPH, of Montreal, Que., Born at Watford, England, July 3rd, 1890; Educ., Watford Collegiate School, evening tech. classes, I.C.S. course elect'l engrg.; 1905-09, apptce. to Watford Engrg. Co. and A. H. Inns; 1910-15, elect'l and air brake engr., London Electric Ry.; 1915-16, engr. i/c Spring Grove Laundry, gov't. work; 1916-19, C.Q.M.S. Ry. operating div. Royal Engrs., engr. i/c air brake and elect'l depts. at various points in Belgium and France; 1922-24, Eng. Elect. Co., ch. super. engr. on receiving, erecting and placing in service elect. locos. on Arthurs Pass mainline N. Z. gov't. rys., also instructor to staff and ch. asst. to res. engr. for mtce. period on turbo-gen. sets; 1924 to present time, ch. representative engr., Eng. Electric Co., similar work in Canada and England.

References: F. Newell, E. Blair, T. W. Harvie, J. A. Shaw, J. W. Anderson, G. R. Dalkin, R. G. Gage, H. W. McMillan.

NOYES—DONALD FRANKLIN, of Isle Maligne, Que., Born at Bellport, N.Y., Mch. 9th, 1888; Educ., B.S., Clarkson College of Technology, Potsdam, N.Y., 1912; 1910 (summer) and 1911 (summer), chainman, N.Y. State highway; 1912 (summer), rodman, N.Y. State highway; 1912-14, transitman, topographer and party ch. for Aluminum Co. of Am. on hydro-electric devel. N.C. and East Tenn.; 1914 (summer), designing dept., Hazen & Whipple, New York, N.Y.; 1914-15, res. engr. i/c design and constrn. paving programme for town of Graham, N.C., for J. N. Ambler, consulting engr.; Jan. to May 1915, topographer for Southern Power Co., Charlotte, N.C.; 1915-16, ch. of party on preliminary survey and layout work for hydro-electric devel. in N. and S. Carolina for Southern Power Co.; 1916-18, res. engr. i/c constrn. of Paddy Creek Dam of Bridgewater devel.; 1919-21, res. engr. i/c completion of constrn. of Linville dam and power house; 1921-23, general mgr., Bolton Constrn. Co., Marion, N.C., excavation, bridge work, paving, sewers, etc.; 1923 to date, supt. of constrn. for Quebec Devel. Co., Duke-Price Power Co. and Alma & Jonquiere Ry., Isle Maligne, Que.

References: F. H. Cothran, H. G. Cochrane, W. S. Lee, C. E. Legris, W. G. Mitchell, A. A. Bowman.

PARKS—RALPH E., of Arvida, Que., Born at Saugatuck, Mich., Apr. 4th, 1890; Educ., B.S., Purdue Univ., 1913; 1913-14, with Aluminum Co. of America, plant control and research work at Niagara Falls, N.Y., and Alcoa, Tenn.; 1914-15, control and laboratory, Alcoa, Tenn.; 1915-18, i/c of plant operations under gen'l. supt.; 1918-22, i/c plant operations, furnace rooms, electrical factory, etc., Badin, N.C.; 1922-23, training al. plant supt., Tyssada, Norway; 1923-24, research work, Badin, N.C.; 1924-26, design work connected with Arvida plant; at present, general supt., Arvida works.

References: H. R. Wake, W. G. Mitchell, A. A. MacDiarmid, W. S. Lee.

PATTERSON—ELMER GOODWIN, of Gatineau, Que., Born at Toronto, Ont., Apl. 16th, 1900; Educ., B.Sc., Queen's Univ., 1924; 1917 (summer), rodman, constrn. Wpg. aqueduct; May to Dec. 1918, jr. dftsman, Can. Northern Ry. shops, Wpg.; Jan. to Mch. 1919, field dftsman, C.P.R., location survey; Apl. to Oct., field dftsman, C.N.R., location survey; May to Sept. 1920, instrumentman and dftsman, C.P.R., irrigation block, Brooks, Alta.; May to Nov. 1921, leveller, Can. Gov't., irrigation survey, Alta. and Sask.; 1922-23, instrumentman and dftsman, C.P.R., irrigation block, Brooks, Alta.; 1924, dftsman, St. Lawrence Paper Mills Ltd., Three Rivers; 1925 to present, instrumentman and later asst. to res. engr., Can. Int. Paper Co., Gatineau, Que.

References: A. I. Cunningham, W. P. Wilgar, R. P. Freeman, F. O. White, A. Macphail, D. S. Ellis.

VINCENT—ROCH ARTHUR, of Longueuil, Que., Born at Longueuil, Mch. 15th, 1897; Educ., B.A.Sc., Laval Univ., 1918; 1915-16, chain surveys, dfting, Sewer Dept., City of Montreal; 1917-18, junior dftsman, Armstrong Whitworth of Can. Ltd.; 1919-20, dftsman, electricity and mechanics; 1920, dftsman and assisting in supervision of constrn., Wayagamack Pulp & Paper Co.; 1921, asst. engr. tech. service, City of Montreal; 1922, sec. to local mill mgr. field engrg. for execution of concrete substructures, Rolland Paper Co. Ltd.; 1923, acting city engr., asst. city engr., city engr. pro tem with City of Longueuil; 1923-24, dftsman, constrn. with G. F. Hardy, consulting engr., New York; 1925-26, engr. dftsman, structural steel, reinforced concrete, machy. erection, bldg. constrn. with Wayagamack Pulp & Paper Co.; at present, general engrg. architecture, surveying, etc., with Mr. Arthur Vincent, Montreal.

References: G. R. MacLeod, F. C. Laberge, C. Leluau, J. W. Bain, L. E. F. Fusey, A. Vincent.

WEBSTER—JAMES CLARENCE, of Toronto, Ont., Born at Cleveland, Ohio, June 16th, 1892; Educ., A.B., Western Reserve Univ., 1912, Chem.E., Columbia Univ., 1915; 1915-17, chem. engr., Research and Devel. Labs., Nat. Carbon Co. Inc., Cleveland; 1917-19, 1st lieut. 30th Engrs., A.E.F.; 1919-22, engr., Res. and Devel. Labs., Nat. Carbon Co.; 1922 to date, sales engr., Can. Nat. Carbon Co. and Prest-O-Lite Co. of Can. Ltd., Toronto, Ont.

References: B. Ottewell, A. B. Gates, V. S. Foster, R. A. Campbell, W. S. Wilson, T. R. Loudon.

FOR TRANSFER FROM CLASS OF ASSOCIATE MEMBER TO MEMBER

FOSNESS—ARTHUR WILLIAMS, of Winnipeg, Man., Born at Winnetago, Minn., Nov. 19th, 1890; Educ., E.M., Univ. of Minn., June 1911; 1911-13, dftsman, designer, estimator for C. A. P. Turner Co., mainly reinforced concrete design work; 1913-19, i/c of Can. branches for C. A. P. Turner Co. doing all design on their Can. work independent of the American office; 1920 to date, chief engr. for Carter-Halls-Aldinger Co. of Winnipeg, doing all reinforced concrete design, also constrn. plant design and layout, estimating, etc.

References: J. G. Sullivan, T. Kipp, H. B. Henderson, D. A. Ross, J. Woodman, J. Quail.

McNAUGHTON—ANDREW GEORGE LATTA, of Ottawa, Ont., Born at Moosomin, Sask., Feb. 25th, 1887; Educ., B.Sc. 1910, M.Sc. 1912, McGill Univ.; 1910-14, staff dept. of elect'l engrg., McGill Univ.; 1914, engrg. practice, Montreal, carried numerous investigations on subjects connected with elect'l engrg., member Can. Gov't. Committee on St. Lawrence Waterways; 1921 to date, Deputy Chief of the General Staff, Canada.

References: E. G. Burr, D. W. McLachlan, A. M. Harraway, J. L. Rannie, C. H. Mitchell, O. S. Finnie.

PRATT—FOREST MILLEN, of Ottawa, Ont., Born at Ottawa, Mch. 21st, 1891; Educ., B.A.Sc., Univ. of Toronto, 19'2; 1912-13, res. engr. on constrn. of ground wood mill and power plant for E. B. Eddy Co. Ltd., Hull; 1914-15, res. engr. on design and carrying out of alterations, etc., to machinery and bldgs. with same Co.; 19 6-19, overseas with 7th Field Co. Can. Engrs. as captain; 1920 to present, with E. B. Eddy Co. as, 1920-24, constrn. engr. i/c design and constrn. of alterations and additions to machinery and bldgs., 1925 to date, ch. engr. i/c plant improvements and mtce.

References: C. S. L. Hertzberg, T. R. Loudon, A. R. Harkness, G. G. Gale. J. B. McRae.

WEST—FRANK LESLIE, of Sackville, N.B., Born at Cole's Island, N.B., May 24th, 1891; Educ., B.Sc. McGill Univ. 1916, B.A. 1912, M.A. 1914, Mt. Allison Univ.; Sept. to Jan. 1914, rodman, James Bay & Eastern Ry.; C.N.R. System; May to Oct. 1916, asst. to A. V. Anrep on investigation and mapping of peat bogs near Farnham, Que.; Oct. 1916 to Dec. 1917, testing engr., Imperial Munitions Bd. in plants in and about Montreal; 1918-19, lieut. Can. Engrs. C.E.F.; 1919-20, instrumentman, C.N.R. Mtl. Div.; June to Sept. 1920, transitman, C.N.R. survey of Halifax and Southwestern branch; 1920 to date, professor of engrg., Mt. Allison Univ., Sackville, N.B.

References: H. W. McKiel, F. R. Faulkner, W. P. Copp, C. S. G. Rogers, A. S. Gunn.

YUILL—ALEXANDER CLAUDE ROY, of Vancouver, B.C., Born at White Lake, Ont., May 25th, 1880; Educ., private tuition and self-study; 1899-1900, power house operator, Valleyfield Elect. Co. and Mtl. Cotton Co.; 1900-08, constrn. work, C. G. E. Co. and Mtl. L. H. & P. Co.; 1908-15, consulting and contracting engr. under name of Mather Yuill & Co. Ltd., Vancouver; 1915-19, consulting engr.; 1919-22, designed and supervised constrn. of dams, hydro-electric plant and irrigation systems, and reports on various hydro-electric developments and irrigation systems; 1922-23, preliminary plans and report on Wigwam Pulp & Paper Co. paper mill, Elko, B.C.; 1924, design and supervision of installation of hydro power development for Gilley Bros. Ltd., Pitt River, B.C., investigation and report Cowichan River and Oil Engine development for City of Duncan, B.C.; 1925, investigation and report on Cheakamus River, B.C., and City of Prince Rupert hydro power systems, design and supervision of elect'l services for Univ. of B.C. buildings; 1926, extension to City of Merritt steam plant and water works, incldg. reinforced concrete reservoir, layout hydro-electric power house for Engr. Gold Mines Ltd.

References: G. A. Walkem, F. P. Shearwood, E. A. Cleveland, P. E. Doncaster, J. F. Frew, J. C. MacDonald.

FOR TRANSFER FROM CLASS OF JUNIOR TO A HIGHER GRADE

BOWMAN—NELSON, of Baden, Ont., Born at Washington, Ont., Dec. 29th, 1894; Educ., B.A.Sc., Univ. of Toronto, 1921; 1918-19 and 1920 (summer), dftsman for Can. Aeroplanes, Toronto, Dominion Tire Co., Kitchener, and Ames-Holden Tire Co.; 1920 to date, ch. engr., Dom. Linseed Oil Co. at Baden, Ont., and Montreal i/c design and erection of grain elevators and warehouses, development of mfg. processes of special character, and sole charge of equipment of all new bldgs.

References: C. R. Young, P. Gillespie, C. K. MacLeod, H. Holgate, S. G. Talman, W. I. Bishop.

ELMSLIE—GORDON ALEXANDER, of Sarnia, Ont., Born at Boston, Mass., Feb. 21st, 1897; Educ., private tuition in engrg. Military Academy, Oxford and Denham, England, Alexander Hamilton business course; 1912-13, jr. dftsman and estimating, Dom. Bridge Co.; 1913-15, dftsman and template maker, St. Lawrence Bridge Co. Ltd.; 1916-17, war service in France; July to Dec. 1917, Military Academy, Oxford and Denham; Jan. to Sept. 1918, flight commander, R.F.C.; 1918-19, Captain on staff of the R.F.C.; 1919-22, plant engrg. with Dom. Bridge Co. and Dom. Engrg. Works Ltd.; 1922-23, i/c dept. for H. & R. contracts, Dom. Bridge Co.; 1923-25, asst. ch. inspector for same Co.; 1925 to present time, sales engr. for Sarnia Bridge Co. Ltd.

References: C. J. Madgett, A. Jackson, A. Peden, LeR. Wilson, D. C. Tennant.

ROOT—STEPHEN EASTMAN, of Beaupre, Que., Born at Rochester, N.H., on Jan. 3rd, 1898; Educ., 3 yrs. at McGill Univ., Faculty of Applied Sci., one year Mass. Inst. of Technology; May to Sept. 1922, rodman and inspector for St. Lawrence Paper Mills Ltd., 1922-23, field engr. for St. Lawrence Paper Mills i/c layout; April to Dec. 1923, asst. supt. of constrn. for Donnacona Paper Co.; 1924-25, cnstrn. supt. and res. engr. for Can. Explosives Ltd.; Mch. to Oct. 1925, asst. to ch. engr., St. Lawrence Paper Mills Ltd., Oct. 1925 to Mch. 1926, with Int. Paper Co. i/c of layout of Gatineau millsite, and on ry. location at Chelsea; Mch. to Aug. 1926, res. engr. for W. I. Bishop Ltd. on Belgo-Can. Paper Co.'s mill at Shawinigan; at present, with same Co. at Beaupre on Ste. Anne Power Co. work.

References: A. B. McEwen, L. deB. McCrady, J. J. O'Sullivan, C. A. Buchanan, Geo. Claxton, H. S. Taylor.

FOR TRANSFER FROM CLASS OF STUDENT TO A HIGHER GRADE

CALDWELL—CHARLES EDWARD, of Rochester, N.Y., Born at New Harbour, Nfld., Feb. 8th, 1896; Educ., B.Sc., McGill Univ., 1923; 1914-19, overseas with Royal Nfld. Regiment, sergeant; 1920 (summer), air compressor attendant, Can. Vickers, Ltd.; 1921 (summer), coal mining, Dom. Coal Co.; 1922 (summer), asst. foreman, scaffolding gang, Thos. Starret Co., Mt. Royal Hotel, Mtl.; 1923 to date, with Taylor Instrument Companies, Rochester, N.Y., as, 1923-24, machine shop inspector, machine shop comprises automatic and hand-screw machines, turret lathes, milling and drilling machines and punch presses; 1925 to present, time study engr. installing the Bedaux system in machine shop.

References: J. B. Porter, E. Brown, C. M. McKergow, A. J. Kelly, H. M. MacKay.

FENWICK—JAMES REID, of Montreal, Que., Born at Toronto, Mar. 4th, 1897; Educ., B.Sc., Univ. of Toronto, 1922; 1916-18, wireless operator i/c ship station for Marconi Co. of Canada; 1920 (summer), surveying for Hydro-Electric Comm'n. at Chippawa; 1922-23, responsible operating charge of broadcasting station for Northern Electric Co.; 1923 to date, responsible charge of design work on radio receiving equipment for Northern Electric Co.

References: W. C. Adams, H. J. Vennes, N. E. D. Sheppard, W. B. Cartmel, W. S. Vipond.

HULBURD—WILLIAM CHAUNCEY, of Montreal, Que., Born at Cowansville, Que., Aug. 23rd, 1896; Educ., B.Sc., McGill Univ., 1922; 1915 (summer), Q. S. Comm. on survey party in Lake St. John district; May to Sept. 19-6, inspn. at Can. Ingersoll Rand Co.; 1916-17, manufacture of munitions at plant of Mtl. Tramways Co.; 1923-24, asst. ch. dftsman for Harland Engineer Co.; 1924 to date, mech. engr and ch. dftsman for same Co.

References: C. M. McKergow, R. N. Norris, C. U. Vessot, A. Roberts, G. Wallace.

LANGSTROTH—CECIL CRAVEN, of Hampton, N.B., Born at Hampton, N.B., May 2nd, 1896; Educ., B.Sc., McGill Univ., 1921; 1919 (summer), in machine shop N.S. Tramways Co., Halifax; 1920 (summer), asst. bridge inspector with Grand Trunk Administration Bd.; 1921-22, inspector of sprinkler risks with Can. Bd. of Fire Underwriters; 1923-24, asst. engr. under Mr. E. G. Cameron on installation of boilers, turbines and auxiliaries at power house of St. John Drydock and Shipbuilding Co.; 1924 to date, asst. engr. on plant operation and mtce. at Atlantic Sugar Refinery, St. John, N.B.

References: E. G. Cameron, C. M. McKergow, W. R. Pearce, F. W. Taylor-Bailey, F. P. Vaughan.

VALLIERES—IRENEE A., of Montreal, Que., Born at Montreal, Apr. 10th, 1884; Educ., B.Sc., Ecole Polytechnique, 1907; 1907-09, asst. engr. with Water Works Dept., City of Mtl.; 19.0, i/c laying of steel pipes in St. Lawrence River for intake of Montreal aqueduct; 1910-13, on first enlargement of canal, Mtl. aqueduct; 1913-17, on second enlargement of canal, Mtl. aqueduct, i/c estimate, also design of plain and reinforced concrete retaining walls, culverts, bridges, etc., on constrn. of La Salle bridge and Church st. bridge; 1918, preparation of tech. data, plans, profiles, diagrams, etc., re arbitration Cook. Constrn. Co. vs. City of Mtl. and Sullivan vs. the City; 1919, with R. S. and W. S. Lea, studies, designs and estimates in connection with report on Montreal aqueduct; 1920, with Mtl. Water Board, engr. i/c expropriation for aqueduct blvds.; 1921-26, private business; at present, asst. engr. grade 1 with tech. service, City of Mtl.

References: W. S. Lea, F. C. Laberge, G. R. MacLeod, C. J. Desbaillets, J. G. Caron, T. W. Lesage, F. Y. Dorrance, F. E. Field, M. Dickson, A. Leroux, A. Jette, E. O'Sullivan.

VELASCO—EDWARD M., of Montreal, Que., Born at Barcelona, Spain, Nov. 7th, 1899; Educ., B.Sc., McGill Univ., 1925; 1925 to present, C.P.R. shop work inspection, C.N.R. material inspection, Peacock Bros. mech. dfting; Wayagamack Pulp & Paper Co., civil engrg.; with Fraser Brace on engineering work at La Quiebra, Colombia, S.A.

References: C. M. McKergow, R. deL. French, A. A. Wickenden, A. Kelly, A. R. Roberts.

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A

AIR PUMPS

Ejector. The Ejector Air Pump, D. G. McNair. Power Engr., vol. 20, no. 235, Oct. 1925, pp. 367-370, 3 figs. Practical considerations on installation and efficient operation of steam-jet ejector air pumps.

AIRPLANE ENGINES

Development. Some Aspects of Aircraft-Engine Development, G. J. Mead. Soc. Automotive Engrs.—Jl., vol. 17, no. 5, Nov. 1925, pp. 496-507, 19 figs. Discusses requirements and limiting factors of dependability, size, speeds, and power-plant weight and cost; relation of thrust to weight of power plant; various engines in vogue are classified into groups according to their horsepower; advantages of air-cooled and handicaps of water cooled engines.

AIRPLANE PROPELLERS

Airflow Around. The Airflow Round a Body as Affecting Airscrew Performance C. N. H. Lock, H. Bateman and H. C. H. Townend. Aeronautical Research Committee (Lond.), Reports and Memoranda, No. 956, Jan. 1925, 22 pp., 13 figs. on supp. plates. Experiments determined variation of thrust with radius by measurements of total head on three airscrews with one body, and actual velocity and direction of air-stream round one airscrew and front of one body by experiments with a yawmeter; results are presented in form of streamlines and of curves of axial component velocity. Airfoil element theory suggested which would apply to an airscrew working in front of a tractor body, involves a single empirical curve representing effect of body on axial inflow at each radius; same curve is assumed to apply to screws of any design or diameter relative to that body.

AIRPLANES

Aileron Tests. Full Scale Tests of Different Ailerons on Bristol Fighter Aeroplane, H. M. Garner and E. T. Jones. Aeronautical Research Committee (Lond.), Reports and Memoranda, No. 966, Jan. 1925, 7 pp., 10 figs. on supp. plates. Three different types of ailerons, standard F. 2B, Handley Page balanced and Bristol "Frise" were fitted in turn to a Bristol Fighter airplane; for each type flights were made with and without loads on wing tips; airplane was flown straight with no bank, engine being switched off, and measurements were made of aileron angle, rudder angle, and lateral force on control column, from which calculations were made of rolling moment, yawing moment, and hinge moment coefficients for three types of ailerons. Effect on hinge moment coefficient caused by setting ailerons up or down also discussed.

Inspection. Some Aspects of Airplane Inspection, J. J. Feeley. Soc. Automotive Engrs.—Jl., vol. 17, no. 5, Nov. 1925, pp. 441-447, 9 figs. Following description of airplane structure, author discusses structural requirements and outlines main features of properly co-ordination engineering and manufacturing activities; states that no inspection is worth name or money spent on it that does not include constructive work and knowledge at all times that intentions of designers are being carried out so that safety of craft is assured; outline of inspection procedures.

Lateral Controls. Full Scale Tests of a New Slot-and-Aileron Lateral Control, H. L. Stevens. Aeronautical Research Committee (Lond.), Reports and Memoranda, No. 968, Mar. 1925, 3 pp., 4 figs. on supp. plate. Describes a modified form of lateral control for airplanes, designed to reduce danger of an accidental stall; discusses desirable characteristics of such a control; extracts from reports of model tests on this form of control showing that it should possess such features; summarizes flying experience obtained on an Avro, 504K airplane fitted with this control.

Pitching and Yawing Moments. Pitching and Yawing Moments With Sideslip on a Model Aeroplane With Zero Stagger, F. B. Bradfield. Aeronautical Research Committee (Lond.), Reports and Memoranda, No. 965, Jan. 1925, 14 pp., 15 figs. on supp. plates. Describes tests made on a model of an airplane with zero stagger, fairly small gap-chord ratio, and a round section fuselage, and wind channel tests of pitching and yawing moments with sideslip made with a view to finding any reasons why it should be difficult to bring an airplane of this type out of a spin.

Wind-Tunnel Tests. Wind Tunnel Tests of Fuselages and Windshields, E. P. Warner. Nat. Advisory Committee of Aeronautics—Tech. Notes, no. 226, Sept. 1925, 6 pp., 4 figs. on supp. plates. Results of tests made in 1918 in old 4-ft. wind tunnel at Mass. Inst. of Technology, for purpose of securing data on effect of windshield form on total resistance of fuselage of good streamline shape.

Wings. Determination and Classification of the Aerodynamic Properties of Wing Sections, M. M. Munk. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 227, Sept. 1925, 22 pp. Remarks on possible improvement of experimental determination of aerodynamic properties of wing sections; shows how errors of observation can subsequently be partially eliminated, and how computation of maxima or minima of aerodynamic characteristics can be much improved.

Preliminary Wing Model Tests in the Variable Density Wind Tunnel of the National Advisory Committee for Aeronautics, M. M. Munk. Nat. Advisory Committee for Aeronautics—Report, no. 217, 1925, 15 pp., 23 figs. Results of series of tests with 3-wing models, made to obtain general information on air forces on wing sections at high Reynolds Number and in particular to make sure that Reynolds Number is really important factor.

Wing Spar Stress Charts and Wing Truss Proportions, E. P. Warner. Nat. Advisory Committee for Aeronautics—Report, no. 214, 1925, 18 pp., 24 figs. In order to simplify calculation of beams continuous over three supports, series of charts have been calculated giving bending moments at all critical points and reactions at all supports for such members; using these charts as basis, calculations of equivalent bending moments, representing total stresses acting in two bay-wing trusses of proportions varying over wide range, have been determined, both with and without allowance for column effect.

AIRSHIPS

Commercial Value. The Airship and Its Place in Commerce, H. H. Blee. Mech. Eng., vol. 47, no. 11a, Mid-November, 1925, pp. 961-972, 19 figs. General survey of development of airship and discussion of its commercial possibilities: author predicts that within a few years this type of airship, especially when using helium as lifting medium, will be classed as safe, reliable, time-saving, comfortable craft, admirably adapted to carrying heavy loads of passengers, mail and express on profitable commercial service over long non-stop flights.

ALIGNMENT CHARTS

Construction and Use. Graphical Methods of Calculation, H. L. Seward. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1019-1033, 38 figs. Construction of Cartesian diagrams and alignment charts for use in rapid determination of values of unknown quantities in mathematical expressions.

ALLOY STEELS

Special-Purpose. Steels for Special Purposes. Metal Industry (Lond.), vol. 27, no. 17, Oct. 23, 1925, pp. 391-392. Gives examples of steels made for special purposes, such as for drawing and extrusion dies, stamping and press tools, drawing mandrils, etc.

ALLOYS

Aluminum. *See Aluminum Alloys.*

Brass. *See Brass.*

Inner Structure. The Inner Structure of Alloys, W. Rosenhain. Roy. Soc. Arts—Jl., vol. 73, nos. 3803, 3804 and 3805, Oct. 9, 16 and 23, 1925, pp. 1000-1021, 1022-1037 and 1039-1052, 31 figs. Oct. 9: Discussion of atomic structure of alloys. Oct. 16: Deals with question of interaction of different kinds of atoms when they are brought together in single crystal. Oct. 23 Considers question of conduction of electricity through metals.

Tests. Comparative Slow Bend and Impact Notched Bar Tests on Some Metals, S. N. Petrenko. U. S. Bur. Standards, Technologic Papers, No. 289, June 27, 1925, pp. 315-346, 25 figs. partly on supp. plates. Describes parallel impact and slow-bend tests made by Bur. of Standards on some materials, mostly non-ferrous alloys, to determine whether a slow-bend test may be used as a substitute for an impact test or as a valuable addition to it, and to determine also its practicability; results obtained; interpretation of a slow-bend diagram. Bibliography.

ALUMINUM ALLOYS

Aging of. The Effect of Artificial Ageing upon Age-Hardened Aluminum Alloys, K. L. Meissner. Metal Industry (Lond.), vol. 27, no. 15, Oct. 9, 1925, pp. 333-338, 10 figs. Author replies to criticisms advanced by Dr. Marie Gayler in same journal, July 10, 1925, of certain statements, in his article under above head in this Journal, June 26, 1925. He does not dispute small aging at room temperatures of aluminum copper alloys, but such aging is of negligible practical mportance; disagreement as to what is understood by age-hardening; fundamental differences in aging temperatures; Gayler's researches under different conditions; author points out that Gayler's results are inconsistent proof of age-hardening influence of $MgZn_2$.

Castings, Improving Aluminium Alloy Castings. Machy. (Lond.), vol. 27, no. 679, Oct. 1, 1925, p. 7. Review of report published by Engineering Co-ordinating Research Board, describing experiments, by S. L. Archbutt, with object of improving soundness and mechanical properties of aluminum-alloy castings.

Castings, Permanent-Mold. Permanent Mold Aluminum Castings and Their Field of Usefulness, J. B. Chaffe, Jr. Am. Foundrymen's Assn.—advance paper, no. 478, for mtg. Oct. 5-9, 1925, 15 pp., 8 figs. Greatest difficulty encountered is that caused by crystallization shrinkage which is shrinkage in volume on freezing, and amounts to from 7 to 5 per cent of volume of molten metal; to get solid casting this shrinkage must be fed with hot metal and molds are therefore designed so that there is progressive freezing from points furthest from gates to metal in gates and sprues; venting of mold and thermal expansion must also be considered; compares sand-casting with permanent-mold method; many points of former are not applicable to latter; shows important differences between pressure die castings and permanent-mold castings. See also Am. Mach., vol. 63, no. 19, Nov. 5, 1925, pp. 743-744.

Castings, X-Ray Examination. X-Ray Examination of Aluminum-Alloy Castings for Internal Defects, Rob. J. Anderson. Am. Foundrymen's Assn.—advance paper, no. 459, for mtg. Oct. 5-9, 1925, 19 pp., 15 figs. Discusses application of X-ray examination and presents results of experimental work; advantages are stated to be: (1) inspection may be made without cutting or otherwise damaging parts; (2) dangerous flaws can be detected before parts are put in service; (3) flaws which might be uncovered in machining can be located before expensive machine work is done; (4) correlation of nature, amount, and distribution of internal defects in castings may be made with method of gating or some other factor, thus permitting use of smaller sections and lower factor of safety with simultaneous decrease in cost; apparatus and equipment for radiography and method of making exposures.

AMMONIA COMPRESSORS

CYLINDER LUBRICATION. Lubrication of Ammonia Compressor Cylinders, R. J. Nadherny. Power Plant Eng., vol. 29, no. 18, Sept. 15, 1925, pp. 964-965, 3 figs. Discussion of lubricants and lubricating methods used on modern types of open and closed ammonia compressors.

AUTOMOBILE FUELS

DEVELOPMENTS AND RESEARCH. Motor Fuels, J. S. S. Brame. Roy. Soc. Arts.—Jl., vol. 73, nos. 3797, 3798 and 3799, Aug. 28, Sept. 4 and 11, 1925, pp. 920-929, 930-940 and 942-954, 4 figs. Considers ways in which greatly increased demands for motor fuel have been met hitherto, and prospects of meeting still greater demands of near future by alternative or supplementary fuels; knowledge of relative merits of different components of various types of fuels, which can be applied to their improvement and production of blends which impart best characters to mixtures; light shed upon question of more efficient utilization of automobile fuels. Three Howard lectures.

AUTOMOBILES

CHARCOAL GAS PRODUCERS FOR. The Malbay Charcoal-Gas-Engine Plant with Producer (Neue Entwicklungswege beim Sauggasgenerator). Wirtschaftsmotor vol. 7, no. 7, July 25, 1925, pp. 8-9, 2 figs. About 50 per cent thermal efficiency is calculated for this plant developed by French firm, R. Malbay; to attain which use is made of heat of producer gases themselves and heat of exhaust; hot gases are guided around retorts and preheat charcoal that is contained therein; exhaust gas is carried into producer itself.

HEADLIGHTING. Motor-Vehicle Headlighting. U. S. Bur. Standards, Circular No 276, Aug. 5, 1925, 28 pp., 20 figs., partly on supp. plate. Requirements for good road lighting are discussed and construction and operation of present-day types of electric head lamps explained; latest specifications for gas head lamps as approved by Soc. Automotive Engrs. are given; gas head lamps are used on trucks; methods used at Bur. of Standards for making laboratory tests on electric headlighting devices briefly described; state laws and regulations are discussed and suggested paragraphs for a state law presented. Appendix containing specifications under which tests for approval of types of devices by state officials are made. Bibliography.

SHIMMYING. Prevention of Shimmy by Hydraulic Steering-Control, J. W. White. Soc. Automotive Engrs.—Jl., vol. 17, no. 5, Nov. 1925; pp. 490-493, 7 figs. Experiments with hydraulic steering control with object of preventing or reducing shimmying and tramping were made by author, who asserts that elimination of backlash by doing away with mechanical joints and by holding front wheels as rigid as rear wheels has been amply proved by results to be long step in right direction; front and rear end differences that cause shimmying; how hydraulic steering is accomplished; main cylinder and master pump.

TRANSMISSION NOMENCLATURE. Parts Nomenclature for Three-Speed Transmission. Am. Mach., vol. 63, no. 18, Oct. 29, 1925, p. 687, 1 fig. Standardized terms suggested by committee of Am. Gear Mfrs.' Assn.

AVIATION

HIGH SPEEDS. The Attainment of High Speeds. Aviation, vol. 19, no. 18, Nov. 2, 1925, p. 633. Discusses engineering achievements which render high speeds a possibility.

RADIO SIGNAL. Air Mail Radio Signal Developed. Aviation, vol. 19, no. 20, Nov. 16, 1925, pp. 720-721. Invisible beacon, which guides pilots by day, night or in thick fog successfully tested by Air Mail Service.

RELIABILITY IN TRANSPORTATION. Reliability As a Factor in Air-Transportation Efficiency, J. P. Van Zandt. Soc. Automotive Engrs.—Jl., vol. 17, no. 5, Nov. 1925, pp. 433-436, 6 figs. On-time records of passenger trains compared with Air-Mail Service; how prevailing winds affect regularity; planes are said to be more reliable than trains.

B

BEARINGS

SLEEVE. Results Obtained Through the Use of an Improved Type of Sleeve Bearing, J. S. Murray. Indus. Engr., vol. 83, no. 10, Oct. 1925, pp. 473-475, 5 figs. Details of operating conditions that were encountered before and after making several installations in a large steel plant.

BOILER FEEDWATER

PURIFICATION. Boiler-Feedwater Purification, A. S. Behrman. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 909-910. Inquiry into present status of art, and into fundamental considerations responsible therefor. (Abridged.)

BOILER FURNACES

AIR PREHEATERS. Air Preheaters in the Power Plant. Power Plant Eng., vol. 29, no. 18, Sept. 15, 1925, pp. 940-943, 6 figs. Description of types in general use and summary of results which may be expected from their use.

BOILER AND CHAIN-GRATE OPERATION. Practical Points on Boiler and Chain Grate Operation, J. T. Ruddick. Elec. Times, vol. 68, no. 1773, Oct. 8, 1925, pp. 400-401. Air and its calorific values; simple formula for flue-gas losses; effect of arch design on combustion rate, trouble with brickwork and bad furnace-wall design; highest CO_2 not necessarily best operating point; cases of growth of cast-iron links; etc.

HEAT LOSSES FROM WALLS. Heat Losses from Boiler Furnace Walls, L. B. McMillan. Power Plant Eng., vol. 29, no. 18, Sept. 15, 1925, pp. 944-946, 4 figs. Radiation and convection losses determined by air velocity as well as temperature difference

PULVERIZED FUEL. Boiler Furnace Design for Pulverized Fuel, J. G. Coutant. Combustion, vol. 13, no. 5, Nov. 1925, pp. 278-279, 4 figs. Changes in boiler-furnace design to meet conditions imposed by use of pulverized fuel, with particular reference to Ashley Street Station of Union Elec. Light & Power Co.

Radiant Heat Absorption in Pulverized Coal Furnaces, W. Lulofs. Elec. Times, vol. 68, no. 1773, Oct. 8, 1925, pp. 397-398, 1 fig. Author's views on theory developed by E. G. Ritchie, in Elec. Times of Aug. 27, as to effect of waterscreen and water-cooled sidewalls on radiant heat absorption in pulverized-fuel furnaces, in which he concluded by indicating that there was still ample efficiency to be won if boiler heat-absorbing surface were so disposed as completely to surround combustion chamber. Claims that theory is bound to lead to wrong results.

BOILERS

EDGE MOOR SINGLE-PASS. A New Boiler Design. Combustion, vol. 13, no. 5 Nov. 1925, pp. 284-285, 1 fig. Discussion of new Single Pass Boiler developed by Edge Moor Iron Co.

HIGH-PRESSURE. The Atmos High-Pressure Boiler. Engineering, vol. 120, no. 3122, Oct. 30, 1925, pp. 538-540, 10 figs. Principal feature of design is that steam is generated in rapidly revolving tubes, which are so arranged that they may expand freely without setting up internal stresses.

BRAKES

OPERATION AND MAINTENANCE. Loss, Damage and Discomfort Due to Improper Handling of Locomotive and Air Brakes. Ry. & Locomotive Eng., vol. 38, no. 10, Oct. 1925, pp. 284-287, 4 figs. Points out that best way to reduce damage to equipment and lading is for engineer to set brakes while slack is stretched, then gradually close throttle until train comes to rest with no steam in cylinders; fundamental enemies of modern air brake are uneven piston travel and leaks. Report presented to Travelling Engrs.' Assn.

BRASS

HIGH-STRENGTH. High Strength Brasses, M. Thibaud. Metal Industry (Lond.), vol. 27, no. 19, Nov. 6, 1925, pp. 434-435, 1 fig. General notes on composition and resulting strengths of high-strength brasses, as well as on methods of mixing, melting, casting, etc., on which special emphasis is laid. Abridged translation of paper presented before Franco-Belgian Foundry Congress.

NICKEL. Special Nickel Brasses, O. Smalley. Am. Inst. Min. & Met. Engrs.—Trans., no. 1508-E, Oct. 1925, 35 pp., 12 figs. Physical tests on nickel brass, tin brass, iron brass, nickel-aluminum brasses, iron-aluminum brass, nickel-iron-aluminum brasses and nickel-aluminum-tin brass, as cast or forged; impurities; problems of manufacture, crucible melting, electric furnace, casting, etc.

BRICK

PAVING. Progress Report on Research of Paving Brick from Iowa Shales, D. A. Moulton. Am. Ceramic Soc.—Jl., vol. 8, no. 11, Nov. 1925, pp. 694-701, 3 figs. Test on full-size pavers made from 11 shales showed that 5 would make excellent paving material and others had possibilities of making block that would give service; various processes were tried as soft-mud, roller expression machine, dry-press, and new belt machine, also additions of magnesium and colloidal materials; gives results.

BRIDGES

EAST YORK-LEASIDE, CANADA. Proposed East York-Leaside Bridge, F. Barber. Can. Engr., vol. 49, no. 16, Oct. 20, 1925, pp. 473-476, 3 figs. Discussion of its economic effect on city of Toronto; would form vital link in new North-east highway entrance project. Address delivered before Toronto Bldg. Owners and Mgrs. Assn.

BRIDGES, CONCRETE

CONTINUOUS-GIRDER. Continuous-Girder Bridges of Concrete, J. F. Seiler. Eng. News-Rec., vol. 95, no. 18, Oct. 29, 1925, pp. 722-725, 12 figs. Increasing use of type; graphical analysis by simple method adapted to variable moment of inertia; adjustment of supports and span length of 3-span girder.

THROUGH-ARCH. Concrete Arch Bridge of Unusual Form and Details, W. H. Rabe. Eng. News-Rec., vol. 95, no. 19, Nov. 5, 1925, pp. 750-751, 3 figs. Through-arch crossing being built at Piqua over Miami River; reinforced-concrete hangers have hinge joints.

BRIDGES, LIFT

BASCULE. Double-Leaf Bascule Bridge Over Canal at Seattle. Eng. News-Rec., vol. 95, no. 21, Nov. 19, 1925, pp. 826-829, 5 figs. New form of trunnion support; bridge designed for 12-year-old foundations; anchored against sliding; novel center lock.

BRIDGES, STEEL

WEIGHTS. Steel Bridge Weights, W. H. Thorpe. Engineering, vol. 120, no. 3122, Oct. 30, 1925, pp. 534-538, 11 figs. partly on supp. plate. Attempt is made to furnish, by use of diagrams based upon actual cases, means of determining probable steel weights in bridges of various types, down to, but not including, bearings, by reference to live load carried by bridge.

BRIQUETTING

SAWDUST AND WOOD SHAVINGS. The Briquetting of Sawdust and Wood Shavings, J. Petipas. Engineer, vol. 140, no. 3645, Nov. 6, 1925, pp. 483-484. Account of investigations and discoveries made in connection with agglomeration or briquetting of sawdust and wood shavings. Translated abstract of paper presented to Société des Ingénieurs Civils de France.

BUILDINGS

COLLAPSE. Concrete Hotel Building Collapses After Cold Weather. Eng. News-Rec., vol. 95, no. 20, Nov. 12, 1925, pp. 800-801, 2 figs. 12 bays of 4-story structure fall when forms are stripped; tarpaulins and salamanders absent.

BUSBARS

SPECIFICATIONS. British Standard Specification for Bus-Bars and Connections Constructed of Bare Copper or Aluminium. Brit. Eng. Standards Assn., no. 159, Mar. 1925, 7 pp. Specification covering quality of metal, manufacture, temperature rise and current density, joints and connections, and recommended sizes of flat and round bars. Appendix giving International standards of resistance for copper.

C

CAMS

RADIAL OR ROTARY-ENGINE. Radial and Rotary Engine Cams, P. Cormack. Automobile Engr., vol. 15, no. 207, Oct. 1925, p. 322, 2 figs. In notes referring to multilobe cam disk of radial or rotary engine, principle of operation is dealt with in manner which brings to light new possible cam arrangements of interest to designer.

CANADIAN GAS WORKS. Coke Ovens in a Canadian Gas Works, J. Stephenson. Gas Age-Rec., vol. 56, no. 16, Oct. 17, 1925, pp. 563-566 and 574, 6 figs. Notes on practices at plant of Hamilton By-Products Coke Ovens, Ltd., Ontario; coke oven plant flexibility. See also, Gas Wld., vol. 83, no. 2150, Oct. 3, 1925, pp. 12-15.

CANALS

SHIP, SEA WATER FLOWING INTO. The Control of Sea Water Flowing into the Lake Washington Ship Canal, E. Victor Smith and Thos. G. Thompson. Indus. & Eng. Chem., vol. 17, no. 10, Oct. 1925, pp. 1084-1087, 4 figs. Results of investigations by authors of invasion of sea water into Lake Union; lock control of sea water; methods of sampling and analysis; salinity variation in locks; flow of sea water into canal and lakes; conclusions.

CARBURETORS

CALIBRATING JETS. Method of Calibrating Carbureter Jets Standardized in England. Automotive Industries, vol. 53, no. 20, Nov. 12, 1925, pp. 820-822, 4 figs. Engineering Standards Assn.'s plan provides for use of master jets at National Laboratory, and reference jets for regular work, latter calibrated from master jets with benzol.

CARGO HANDLING

SLIPWAY FOR. Ships Unloaded by Barges Operating on Slipway Structure. Eng. News-Rec., vol. 95, no. 18, Oct. 29, 1925, pp. 707-708, 1 fig. Method used where construction of piers is impracticable because of distance of deep water from shore; describes structure erected on west coast of Guatemala.

CAST IRON

Graphitization. One of the Causes of Variations in Rates of Graphitization of White Cast Iron, A. Hayes and H. E. Flanders. Am. Foundrymen's Assn. —advance paper, no. 481, for mtg. Oct. 5-9, 1925, pp. 2-5, 4 figs.; also (abstract) in Foundry Trade Jl., vol. 32, no. 478, Oct. 15, 1925, p. 329, 4 figs. Study made as part of program for purpose of making feasible commercial use of greatly shortened annealing cycle; use of greatly reduced annealing period necessitates rather precise knowledge of factors that cause variations in rates of graphitizations of white cast irons of normal chemical composition; authors conclude that sulphur has great influence on rates of graphitization of white cast irons and difference in this case can be completely corrected by addition of small amount of manganese.

The Catalysis of the Graphitization of White Cast Iron by the Use of Carbon Monoxide Carbon Dioxide Mixtures When Applied Under Pressure, A. Hayes and G. C. Scott. Am. Foundrymen's Assn.—advance paper, no. 480, for Mtg. Oct. 5-9, 1925, 21 pp., 12 figs. Conclusions reached from results of investigation are: (1) at temperature of 920 deg. cent. CO-CO_2 mixtures increase their rate of absorption of free iron carbide nearly 100 per cent; (2) during cooling at rates varying from 3½ deg. cent. per hr. to 400 deg. per hr. it inhibits almost completely graphitization in critical range; (3) action of gas mixture offers very convenient method of obtaining pearlitic matrix in present graphitization of white cast iron.

Gray, Effect of Heat Treatment. The Effect of Heat Treatment on the Properties and Microstructures of Gray Cast Iron and Semi-Steel, O. W. Potter. Am. Foundrymen's Assn.—advance paper, no. 462, for mtg. Oct. 5-9, 1925, 50 pp., 22 figs. Series of investigations dealing with effects on 10 different heat treatments, details of which are included; it is concluded that proper heat treatment can greatly improve general properties of gray cast iron and semi-steel; one important result is uniform hardness and elimination of massive cementite under annealing; to properly heat treat, correct critical temperature must be located and obtained in heat treatment; properties of gray cast iron and semi-steel can be greatly varied by heat treatment.

Nickel and Nickel Chromium in. Nickel and Nickel-Chromium in Cast Iron, T. H. Wickenden and J. S. Vanick. Am. Foundrymen's Assn.—advance paper, no. 486, for mtg. Oct. 5-9, 1925, 60 pp., 13 figs. Discusses results of investigation of effects on properties of gray iron of nickel and nickel-chromium additions, and commercial applications of nickel and nickel-chromium cast iron; tests were made also on cast iron of high alloy content—up to 30 per cent nickel.

Oxygen Content. The Oxygen Content of Coke and Charcoal Cast Irons, J. R. Eckman, L. Jordan and W. E. Jominy. Am. Foundrymen's Assn.—advance paper, no. 479, for mtg. Oct. 5-9, 1925, 12 pp., 1 fig. General tendency of charcoal cast iron to exhibit greater strength and contain finer and more nodular form of graphitic carbon than coke cast iron of similar composition, melted and cast under identical conditions, has been attributed to higher oxygen in stronger irons; careful analyses of 12 charcoal and 8 coke irons failed to show that stronger irons contained more oxygen than weaker irons; values for oxygen in both stronger and weaker cast irons were very much lower than general range of values reported by Oberhoffer and Johnson; vacuum fusion method of analysis is more accurate than methods employed in previous investigations.

Perlit Process. A Description of the Perlit Process, H. J. Young. Foundry Trade Jl., vol. 32, no. 477, Oct. 8, 1925, pp. 294-295. Describes new method of production of gray iron castings under new conditions; process, in author's opinion, represents first distinct and definite advance in ordinary iron-foundry practice. See also (discussion) in no. 478, Oct. 15, 1925, pp. 331-332.

Phosphorus, Effect of. The Influence of Phosphorus on the Total Carbon Content of Cast Iron, J. T. MacKensie. Am. Foundrymen's Assn.—advance paper, no. 493, for mtg. Oct. 5-9, 1925, 24 pp., 8 figs. Investigation undertaken to see how small an increment of phosphorus would really affect total carbon enough to count in ordinary foundry processes, and how much would net effect be on fluidity and life of molten iron, and on strength, deflection and impact resistance of test bars.

Synthetic. Synthetic Cast Iron and Its Possibilities for the Seattle District, G. S. Schaller. Am. Foundrymen's Assn.—advance paper, no. 484, for mtg. Oct. 5-9, 1925, 28 pp. Discusses factors entering into production of synthetic cast iron and pig, and shows possibilities of this process as applied to Seattle district, from which application can be made to other districts; historical review of development of process and discussion of types of furnaces erected and causes for development; present problems and materials used in process; application to Seattle district, taking up factors of material, supplies, labour, costs and markets.

CASTINGS

Hydraulic Cleaning. Cleaning Castings Hydraulically Proves Economical, E. C. Barringer. Iron Trade Rev., vol. 77, no. 21, Nov. 19, 1925, pp. 1267-1269 and 1318. Compared with old hand method, cleaning of castings by hydraulic pressure at Allis-Chalmers Mfg. Co., Milwaukee, is matter of minutes to hours; castings up to largest size of turbines, motors and heavy machinery of every sort, are swung by travelling crane into concrete chamber and deposited on turntable. See also article by R. A. Fiske, in Iron Age, vol. 116, no. 21, Nov. 19, 1925, pp. 1383-1385, 5 figs.

CEMENT, PORTLAND

Manufacture. Producing High Grade Portland Cement From Unusual Raw Materials, E. D. Roberts. Pit & Quarry, vol. 11, no. 3, Nov. 1, 1925, pp. 49-58, 12 figs. Describes operations of Pacific Portland Cement Co., especially Redwood City (California) plant.

CENTRAL STATIONS

Lighting Service Department. A Lighting Service Department, D. J. Finn. Elec. World, vol. 86, no. 19, Nov. 7, 1925, pp. 943-945. What it is and what it can accomplish for central station; how it can increase revenue and improve public relations; suggested organization for utilities.

Maintenance and Changes. Keeping a Modern Station Up to Date, Jas. F. Brown. Elec. World, vol. 86, no. 17, Oct. 24, 1925, pp. 839-842, 3 figs. How, in period of five years, changes were made in Tulsa generating station from time to time to meet changing operating conditions and keep it up to desired standard of reliability of service, economy of operation and simplicity.

Prime Movers for, Design of. Tendencies in the Present Design of Prime Movers for Central Stations, A. M. Greene, Jr. Engrs. & Eng., vol. 42, no. 9, Sept. 1925, pp. 246-249. Discusses early accomplishments, influence of travelling cranes, low-temperature exhaust, influence of steam turbine, bucket conveyor, mercury turbine, and regenerative cycles.

CHEMICAL PLANTS

Layout and Design. Layout and Design of Chemical Plants on a Philosophical Basis, C. Field. Chem. & Met. Eng., vol. 32, no. 16, Oct. 1925, pp. 794-799, 15 figs. Notes on method of developing plants in rational manner which results in nearest possible approach to ideal.

COAL

Sulphur Compounds in. The Powell and Parr Method for the Determination of Sulphur Compounds in Coal, T. G. Woolhouse. Fuel, vol. 4, no. 10, Oct. 1925, pp. 454-456. Results of investigations show that dilute nitric acid employed appears to be complete solvent for iron compounds found in coal samples used, since residues after nitric acid extraction did not contain iron; method is fairly accurate, but it seems desirable always to estimate iron values together with sulphur values, so that some idea of probable error involved can be arrived at.

COAL BREAKERS

Synchronous-Motor-Driven. Synchronous Motors with Magnetic Clutches Are Successfully Applied to Breaker Machinery, E. J. Gealy. Coal Age, vol. 28, no. 15, Oct. 8, 1925, pp. 488-490, 4 figs. Describes installation of breaker with synchronous motors by Geo. F. Lee Coal Co., near Avondale, Pa.; motors start heavy loads without shock or strain; power factor is improved and peak demands reduced so that penalty charges on bill are avoided.

COAL HANDLING

Power Plants. Coal and Ash Handling Plant at East Greenwich Power Station, G. F. Zimmer. Indus. Mgt. (Lond.), vol. 17, nos. 9 and 10, Sept. and Oct. 1925, pp. 431-433 and 467-470, 6 figs. Two hundred tons of coal are hourly converted at this power plant, situated on south bank of Thames river, into power which gives life to tramway system of London County Council; how necessary coal is unloaded from river craft, and brought to boilers and reserve stocks of power house; describes conveying installation.

High Speed Coal Towers at Brooklyn Edison Company's Hudson Avenue Station. Indus. Mgt. (Lond.), vol. 12, no. 10, Oct. 1925, pp. 470-473, 4 figs. Description of coal handling plant having capacity of 500 tons per hour.

COAL MINES

Blasting. Air-Cushioned Blasting. Colliery Eng., vol. 2, no. 19, Sept. 1925, p. 397. Refers to alleged merits of various special ways and means of arranging explosive and tamping in shot holes; from experience available air cushioning seems to be most rational and promising method to employ, but there is clearly room for further investigation of tamping methods in general.

Reconditioning. Reconditioning Cuts Valier Mine Costs, F. H. Kneeland. Coal Age, vol. 28, no. 19, Nov. 5, 1925, pp. 623-627, 9 figs. Labour and power saved and safety increased by program of changes that already has made total reductions estimated at 20 cents a ton.

COAL MINING

Blasting. Method of Increasing Lump-Coal Production, With Especial Reference to Southern Illinois, J. E. Tiffany and J. J. McKitterick. U. S. Bur. Mines, Reports of Investigations, Serial No. 2697, Aug. 1925, 7 pp., 7 figs. Results of study of blasting methods conducted through an arrangement made by Supt. of Central District Experiment Station of Bur. Mines with a coal company operating mines in Southern Illinois, in one of their mines, by authors.

Scraper Loaders. Scraper Loaders Cut Cost in Two Hazard Mines, A. Brosky. Coal Age, vol. 28, no. 18, Oct. 29, 1925, pp. 589-593, 10 figs. Two mining companies in southeastern Kentucky are proving that in thin beds of clean coal, scraper loader fitted to system of rather long faces produces considerably larger output per man-shift than is obtained by hand loading in conventional system.

COMPRESSED AIR

Cooling and Drying. Cooling and Drying Compressed Air, J. B. Leonard. Ry. Mech. Engr., vol. 99, no. 11, Nov. 1925, pp. 721-722, 1 fig. Describes installation, at one of car shops of Mich. Cent., Detroit, Mich., of system for cooling and drying compressed air.

CONDENSERS, STEAM

Tube Failures. Causes of Condenser Tube Failures. Power Plant Eng., vol. 29, no. 22, Nov. 15, 1925, pp. 1143-1144, 3 figs. Mechanical and chemical actions, latter due in part to crystal arrangement of metals employed, may cause tube to fail.

COILS

Magnetic Blowout. Action of Relays and Starting Boxes, Chas. G. Green. Power Plant Eng., vol. 29, no. 22, Nov. 15, 1925, pp. 1147-1149, 4 figs. Principle of magnetic blowout and use of protective equipment are explained.

Concrete. Method of Casting and Setting Concrete Posts. Eng. & Contracting (Gen. Contracting), vol. 64, no. 4, Oct. 21, 1925, pp. 896-899, 1 fig. How a contractor handled a 23.3-mile fencing job for Board of Water Supply of New York City.

CONCRETE

Deterioration. The Deterioration of Concrete in Sea and Alkali Water, O. L. Grover. Concrete, vol. 27, no. 4, Oct. 1925, pp. 17-18, 2 figs. Notes on the subject, with list of requirements for concrete in order to compare favourably in durability with other materials.

Deterioration in Alkali Soils. Concrete Deterioration in Alkali Soils, C. J. Mackenzie. Eng. Jl., vol. 8, no. 11, Nov. 1925, pp. 462-464. Review of first chemical paper published by Dr. Thorvaldson and assistants, in connection with investigation initiated by Eng. Inst. Committee into disintegration of concrete by alkali waters.

Disintegration. The Fundamental Cause of the Disintegration of Concrete, A. H. White. Mun. & Cty. Eng., vol. 69, no. 1, July 1925, pp. 27-33, 2 figs. Discusses permanence and hardening of portland cement, expansion of cement in water, contraction of cement products in air, alternate expansion and contraction of cement structures with change in moisture, secondary causes of destruction of concrete, conditions for usefulness and long life of concrete, and factors affecting strength. Paper read at Highway Engineering conference.

Laitance in. Cause and Remedy for Laitance in Concrete, R. M. Miller. Eng. & Contracting (Gen. Contracting), vol. 64, no. 4, Oct. 21, 1925, pp. 887-892, 2 figs. Practical suggestions based on experiences on railway construction job. Paper presented at Am. Concrete Inst. convention.

Water-Cement Ratio. Furnishing Concrete by a Strength Specification. Eng. News-Rec., vol. 95, no. 17, Oct. 22, 1925, pp. 674-677, 3 figs. Practical application of water-cement ratio theory with aid of new scale-weighing device which fixes that ratio for each batch. Contains following articles: Water-Cement Theory as a Fact in Field Control of Concrete, J. G. Ahlers; Scale-Weighing Device Applies Water-Cement Ratio Theory, describing regulator devised by Ahlers.

CONCRETE CONSTRUCTION

Sliding Forms. A Manual for Building and Operating Sliding Forms, R. F. Egelhoff. Eng. News-Rec., vol. 95, no. 20, Nov. 12, 1925, pp. 786-792, 14 figs. Fabrication, placing, filling, jacking, swelling, leveling; bending and placing steel; crew organization; plant, aggregates, and mix; practice in structures with columns and floors.

CONCRETE MIXERS

Central Plants. Central Mixing Plants for the Manufacture of Pre-mixed Concrete, W. E. Hart. Contractors' & Engrs.' Monthly, vol. 11, no. 4, Oct. 1925, pp. 51-54, 2 figs. Advantages and disadvantages of central plant; established plants; location of plant. Published by permission of Am. Concrete Inst. from its Proceedings, vol. 21, 1925.

Standardization. Benefits of Mixer Standardization, P. A. Koehring. Contract Rec., vol. 39, no. 41, Oct. 14, 1925, pp. 1002-1004. Economic waste involved in an unnecessary variety of types and sizes; what happens when manufacturers disregard standards determined upon.

CONDENSERS, ELECTRIC

Rotary Variable. "The Straight-Line Frequency" Variable Condenser, H. C. Forbes. Inst. Radio Engrs.—Proc., vol. 13, no. 4, Aug. 1925, pp. 507-508. Equation for shape of rotary plates in rotary variable condenser is developed so that frequency—angular setting characteristic is a straight line; equation for capacity of this condenser at any angular setting is also given.

CONDUITS

Penstock Breaks. Further Data on Mocassin Creek Penstock Breaks. Eng. News-Rec., vol. 95, no. 17, Oct. 22, 1925, pp. 666-667, 3 figs. Defective welds give way when operator's mistake in opening hydraulic valve causes severe water hammer.

CONVERTERS

ROTARY. On the Synchronization of Rotary Converters, Y. Takahashi. Inst. Elec. Engrs. Japan—Jl., no. 445, Aug. 1925, pp. 639-650, 24 figs. Discusses the various methods of correcting polarity, and instant of polarity reversals; explains switching in phenomena of converters after synchronism; concludes with best condition of switching in on high tension side taps of transformer, and makes remarks on polarity reversal, and operation of automatic synchronizing by polarized relay. (In Japanese, with English abstract.)

COOLING TOWERS

OPERATION. The Theory of Cooling-Tower Operation, D. K. Dean. Power, vol. 62, no. 20, Nov. 17, 1925, pp. 754-757, 6 figs. Presents relationships of various factors governing such operation.

COPPER

SAMPLING AND ASSAYING. Commercial Practice in Sampling and Assaying Copper, A. M. Smoot. Eng. & Min. Jl.—Press, vol. 120, no. 16, Oct. 17, 1925, pp. 605-611. How established customs in industry enter into transactions between producer, smelter, and refiner; weighing of ores, mattes, and bullion; metal sampling; gathering drillings; drying blister; settlement assays; etc.

CORES

CORE OILS. The Qualities of Commercial Core Oils, H. L. Campbell. Am. Foundrymen's Assn.—advance paper, no. 467, for mtg. Oct. 5-9, 1925, 12 pp., 5 figs. Study of properties of 23 commercial core oils; chemical and physical properties of core oils were obtained as well as physical properties of cores made with oils, in order to note any relationship in these characteristics; properties determined were specific gravity, refractive index, iodine number, and unsaponifiable matter; summary of conclusions reached.

COST ACCOUNTING

INVENTORY CONTROL. The Control of Inventory Through the Scientific Determination of Lot Sizes, H. S. Owen. Indus. Mgmt. (N.Y.), vol. 70, no. 5, Nov. 1925, pp. 289-295. Building charts for order-quantity determination.

PRICE CONTROL AND. Cost Accounting and Price Control, D. L. Moran. Indus. Mgmt. (Lond.), vol. 17, no. 19, Sept. 1925, pp. 445-447. Discusses selling policy, uniform methods of costing, method of stabilization, issue of stocking orders, etc. Paper read before Fourth Annual Costing Conference held in London.

CRANES

FOUNDRY. Dust-Proof Foundry Cranes. Foundry Trade Jl., vol. 32, no. 479, Oct. 22, 1925, pp. 347-349, 6 figs. Describes overhead electric travellin gcrane introduced by S. H. Heywood & Co., Reddish, specially designed for use in foundries and other places where dust and dirt are inevitable, with object of reducing to minimum breakdowns and stoppages associated with unprotected open-type overhead travellers used under such conditions.

Transport in Foundries. Foundry Trade Jl., vol. 32, no. 481, Nov. 5, 1925, pp. 385-386, 3 figs. Characteristics of type of crane introduced by Wellman Smith Owen Eng. Corp., London, which has been standardized by this firm; it is electric overhead travelling type designed primarily to meet requirements of iron and steel foundries.

CUPOLAS

FLAMES. Cupola Flames. Metal Industry (Lond.), vol. 27, no. 16, Oct. 16, 1925, pp. 367-368. Describes what appearance of flames above charge and in stack above charging door indicate; continuous flaming above charge; probable defects it indicates; color of flame in stack.

MELTING RATE AND TUYERE RATIOS. Cupola Melting Rate as Affected by Tuyere Ratios, J. Grennan. Am. Foundrymen's Assn.—advance paper, no. 477, for mtg. Oct. 5-9, 1925, 7 pp., 1 fig. Series of experimental heats were run to determine whether any differences could be noticed in cupola melting when tuyere area ratios were changed; observations were taken of air pressures in wind belt and cupola, together with temperature of iron at spout as determined by optical pyrometer; author concludes that there is nothing vital in size of tuyeres and that small tuyeres do not have marked influence on melting.

THERMAL CONTROL. The Regulation of Cupolas from Heat-Economical Standpoint (Die wärmewirtschaftliche Einstellung des Kuppelofens), E. Piwowarsky and F. Meyer. Stahl u. Eisen, vol. 45, no. 26, June 25, 1925, pp. 1017-1022, 7 figs. Description of cupola installation and experimental equipment charging; values obtained and experimental results.

CUTTING METALS

RESEARCH IN. Research in Metal Cutting, O. W. Boston. Am. Mach., vol. 63, no. 21, Nov. 19, 1925, pp. 805-806, 4 figs. Discovery of fundamental facts is aim rather than investigation dealing only with practical results.

CYLINDERS

HOLLOW, COLD WORKING. Effect of Cold Working on the Strength of Hollow Cylinders, F. C. Langenberg. Am. Soc. Steel Treating—Trans., vol. 8, no. 4, Oct. 1925, pp. 447-471 and (discussion) 471-473, 16 figs. Describes process of manufacture in which physical properties of large-size simple hollow cylinders may be greatly increased over usual properties obtained; discusses principles involved in computation of strength of gun tubes and jackets; apparatus employed in manufacture of gun tubes by cold-working progress; effect of annealing operations on elastic strength of cold-worked simple and compound cylinders, after different amounts of cold working had been applied.

D

DAMS

CONSTRUCTION. Wanaque Dam Construction. Pub. Wks., vol. 56, no. 10, Oct. 1925, pp. 349-352, 7 figs. Most extensive use of belt conveyors ever made for a construction project, about 13,000 ft. being used for transporting sand, gravel, cement, concrete and embankment materials; steel conveyor trestle built into concrete core wall.

HYDRAULIC REGULATING GATES. Hydraulic Regulating Gates, F. Newell. Eng. Jl., vol. 8, no. 11, Nov. 1925, pp. 439-450 and (discussion) 450-451, 18 figs. Field engineering and erection problems in connection with various types of hydraulic regulating gates.

MULTIPLE-ARCH. Large Multiple-Arch Dam Being Built in Italy, J. B. Lippincott. Eng. News-Rec., vol. 95, no. 18, Oct. 29, 1925, pp. 710-711, 4 figs. Tidone dam for irrigation and power 170 ft. high; cement plant with vertical kilns built especially for concrete.

STORAGE. Storage Dams at Lake Kenogami, Que., A. F. Dyer. Can. Engr., vol. 49, no. 17, Oct. 27, 1925, pp. 489-494, 8 figs. Construction of dams for Quebec Streams Commission for increasing water storage for industries in that district; main dams across Chicoutimi river at Portage des Roches and Pibrac; six other dams built.

DIESEL ENGINES

CENTRIFUGAL COMPRESSORS FOR. Centrifugal Compressors for Diesel Engines, S. A. Moss. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1075-1084, 12 figs. Installations of centrifugal compressors for scavenging and supercharging; centrifugal compressors for Diesel Engines; advantages of centrifugal compressors for 2-cycle scavenging; supercharging experiments; theory of supercharging Diesel engine; exhaust-gas turbine for scavenging and supercharging.

EFFICIENCY. The Diesel Engine and Its Overall Economy, C. B. Jahnke. New England Water Wks. Assn.—Jl., vol. 39, no. 2, June 1925, pp. 105-134, 16 figs. Discusses oil situation of United States; status of Diesel and steam-engine efficiency; estimated total cost of steam, motor, and oil-engine-driven plants; actual oil-engine-plant operating costs.

FORGE PLANTS. Diesel Engine Experience in a Modern Forge Plant, J. P. Harbeson, Jr. New England Water Wks. Assn.—Jl., vol. 39, no. 2, June 1925, pp. 138-140. Cities facts and figures that have occurred and are occurring in operation of two Diesel engine generator sets under author's supervision at Camden Forge Co., Camden, N. J., together with reasons for adopting this source of power, troubles encountered and how overcome, and results obtained.

DOCKS

EQUIPMENT. Modern Dock Equipment, H. J. Deane. Inst. Transport — Jl., vol. 6, no. 9, July 1925, pp. 503-514 and (discussion 515-522. Notes on hydraulic and electric capstans; hydraulic power pumps and impounding pumps; vehicular and freight elevators; heavy lift cranes; floating derricks and cranes; quay cranes; tractors; portable piling and stacking machines; warehouse gantry cranes; timber discharging; grain handling; discharging ore and coal; coal bunkering; etc.

E

EDUCATION, ENGINEERING

DANZIG. The Technical High School at Danzig (Die Technische Hochschule zu Danzig), Roessler. Elektrotechnische Zeit., vol. 46, no. 41, Sept. 3, 1925, pp. 1332-1337, 5 figs. Details of building and equipment, especially of electrotechnical and machinery laboratories, heating power plant in course of construction, welfare arrangements for students.

EJECTORS

PNEUMATIC. Pneumatic Ejectors, E. Johnstone-Taylor. Mech. Wld., vol. 78, no. 2020, Sept. 18, 1925, pp. 224-226, 6 figs. Description of pneumatic ejector as a means of raising liquids; is entirely automatic, and pumping medium is compressed air; working of ejectors; self-contained sets; ejectors in tandem; automatic engine equipment.

ELASTICITY

MODULUS AND LIMIT OF. Elastic Limit and Modulus of Elasticity (Limite d'élasticité et module d'élasticité), L. Guillet. Bul. Technique du Bureau Veritas. Vol. 7, no. 9, Sept. 1925, pp. 175-178, 2 figs. Reviews nature and methods of determination of elastic coefficients in general, and examines variations of elastic limit of various alloys; shows that this limit is always maximum for eutectoid alloy; discusses possible researches which may lead to improved elastic limits and moduli; more is to be expected from quarternary and ternary alloys than from binary.

ELECTRIC CURRENTS

SHORT-CIRCUITS. Short-Circuit Calculating Table, S. Murray Jones. Elec. World, vol. 86, no. 17, Oct. 24, 1925, pp. 847-850, 6 figs. New and interesting features incorporated in board built by Alabama Power Co.; arrangement of apparatus and details of use.

ELECTRIC DISTRIBUTION SYSTEMS

INCREASED VOLTAGES. Increased Voltages for General Supply of Light and Power, J. E. King. Elec. World, vol. 86, no. 20, Nov. 14, 1925, pp. 997-1000, 2 figs. Past practice hampered by shortsightedness as to load growth; advantages of 4600-volt service; example of its successful adoption on Connecticut Light & Power system.

ELECTRIC FURNACES

HIGH-FREQUENCY INDUCTION. High-Frequency Induction Furnace, D. F. Campbell. Iron & Steel Inst.—advance paper, no. 3, for mtg. Sept. 1925, 7 pp., 2 figs. Advantages of high-frequency furnaces for research work are very great, owing to speed with which small heats can be made, either in vacuo or in air.

IRON-MELTING. The Electric Melting of Cast Iron, Geo. E. Lamb. Am. Foundrymen's Assn.—advance paper, no. 464, for mtg. Oct. 5-9, 1925, 16 pp. Discusses use of electric furnace in melting cast iron in localities where cost of suitable materials for cupolas for melting are such that electric furnace can compete disregarding entirely quality of iron produced by electric melting process; describes melting equipment of plant with which author is associated in Pacific northwest; operation of furnace; type of lining used was acid type consisting of silica brick walls and roof and cotton made of silica sand with binder rammed in place; troubles encountered in melting alternate heats of iron and steel; practices tried in endeavor to keep down carbon in steel heats following those of iron; tabular data.

MELTING, REFRACTORY PROBLEM. Some Refractory Problems in the Non-Ferrous Electric Furnace Casting Shop, G. F. Hughes. Am. Foundrymen's Assn.—advance paper, no. 469, for mtg. Oct. 5-9, 1925, 15 pp., 6 figs. Discusses refractory problem when using induction and rocking-arc electric melting furnaces to melt yellow brass, copper-tin alloys and that which has been done and remains to be done to bring induction furnace into field where its use may be universal in non-ferrous melting; discusses lining construction of induction furnace together with method of operation to secure best results; careful preheating of newly lined furnace is one of most important factors; consideration of refractory cements.

RESISTANCE. An Electric Resistance Furnace for Laboratory Roasting, A. T. Fry. Chem. Eng. and Min. Rev., vol. 17, no. 204, Sept. 5, 1925, pp. 479-481, 1 fig. Describes electric resistance furnace installed by E. R. Crutcher in research laboratory of Mt. Lyll M. and R. Co., Ltd., under direction of R. Sticht.

TYPES AND APPLICATIONS. Electric Heat as Used in Modern Industry, C. L. Wilson. Indus. Mgmt. (N. Y.), vol. 70, no. 5, Nov. 1925, pp. 277-282, 7 figs. Requirements for various heat-treating industrial processes; analysis of different kinds of electric furnaces and their capabilities.

ELECTRIC METERS

THREE-PHASE POWER, FOR. The Metering of Three-Phase Power, G. D. Malcolm. Elec. Rev., vol. 97, no. 2501, Oct. 30, 1925, pp. 689-690, 1 fig. Effect of abnormal conditions on single-phase and polyphase meters.

ELECTRIC MOTORS, A. C.

CIRCULATING PUMPS, FOR. Synchronous Motors for Dual-Driven Circulating Pumps, J. W. Anderson. Elec. World, vol. 86, no. 19, Nov. 7, 1925, pp. 954-955, 3 figs. Describes installation of power-factor synchronous motors on pumps at Delaware station of Phila. Elec. Co.

INDUCTION. The Reversed-Rotation Short-Circuit Temperature-Rise of Induction Motors, J. H. R. Nixon. Instn. Elec. Engrs.—Jl., vol. 63, no. 346, Oct. 1925, pp. 1012-1017, 3 figs. Analyzes method of testing induction motors for temperature rise, used mainly when means of loading are not available; it is shown that results of such tests are of greatest value when studied in conjunction with certain design features of machines, and simple expressions are developed which enable test measurements of heating to be converted to probable value of full-load temperature rise.

ELECTRIC POWER

HIGH-TENSION, MEASUREMENT OF. Errors in High-Tension Power Measurement When Instrument Transformers are Employed, E. Lienbard. Brown Boveri Rev., vol. 12, no. 8, Aug. 1925, pp. 168-173, 8 figs. Phase errors of current and potential transformers; errors in single and three-phase measurements due to "angle or error" of current and potential transformers; numerical examples.

ELECTRIC SWITCHES

RECHARGEABLE FUSE. Preliminary Tests on New Rechargeable Fuse Switch. Elec. World, vol. 86, no. 20, Nov. 14, 1924, p. 1004, 1 fig. Results of 16 consecutive short-circuit tests conducted by C. F. Harding, on combined rechargeable fuse and disconnecting switch made by Roy. Elec. Mfg. Co.

ELECTRIC TRANSMISSION LINES

CALCULATING DEVICE FOR. The Instant Heavisidion—A Kinematic Computing Device for Long Transmission Lines, V. Karapetoff. Gen. Elec. Rev., vol. 28, no. 11, Nov. 1925, pp. 746-751, 4 figs. Describes modification of author's original device, which is not so universal in its adjustments, but much easier to build, and requiring no previous practice to operate; its theory and practical use.

CIRCLE DIAGRAM FOR. Circle Diagram for Long Lines, P. H. Thomas. Elec. World, vol. 86, no. 18, Oct. 31, 1925, pp. 899-902, 7 figs. Working formulas and graphical solutions developed for calculating power factor or out-of-phase component of receiving and sending ends of long transmission lines.

EARTH POTENTIALS OF A. C. The Regulation of the Earth Potentials of Alternating-Current Systems, T. R. Warren. Instn. Elec. Engrs.—Jl., vol. 63, no. 346, Oct. 1925, pp. 1018-1022, 3 figs. Determination of change in value of earth potential of any part of a.c. system, when that part is earthed through impedance of known value; discussion of Petersen-coil method of earthing, special reference being made to transient-current phenomena; dangers attending use of coil are explained; this method of earthing would be expected to fulfill same duties on any type of a.c. system, irrespective of form of its voltage diagram.

ELECTROPLATING

CHROMIUM, PLATING OF STEEL. Chromium Plating is Brought Down to Commercial Basis, A. H. Packer. Automotive Industries, vol. 53, no. 20, Nov. 12, 1925, pp. 831-832. Process is worked out by Vacuum Can. Co. whereby surface coating one-fourteen-thousandth of inch thick is applied to ferrous metal parts to increase resistance to heat, wear and corrosion.

ELECTRIC WELDING

BUTT-WELDING MULTI-THROW CRANKS. Butt-welding Multi-throw Cranks, A. M. Lount. Machy. (N. Y.), vol. 32, no. 3, Nov. 1925, pp. 222-223, 5 figs. Cutting off stock, bending and forging sections; turning pins and cutting off sections; welding sections together; turning ends and line bearings.

ELECTRIC WELDING, ARC

A. C. WELDING REGULATION. Arc Welding, O. Thanning. Brown Boveri Rev., vol. 12, no. 9, Sept. 1925, pp. 186-190, 6 figs. Discusses the various systems of regulation employed for arc welding by direct current, which are: generator voltage constant, regulation by series rheostat; generator voltage variable, series resistance fixed; generator characteristics sharply falling, no series resistance.

TANK CONSTRUCTION. Automatic Arc Welding in Tank Construction, W. L. Warner. Am. Mach., vol. 63, nos. 17 and 18, Oct. 22 and 29, 1925, pp. 643-645 and 689-692, 6 figs. Oct. 22: Development of arc welding to replace riveting; welding methods for tanks; design of tanks to be welded; strength formulas. Oct. 29: Automatic hand welding; tests on hand and automatically welded tanks; safety factor; specifications for design.

ELECTRIC WELDING, RESISTANCE

TESTS. Mechanical and Metallographic Test of Electric Resistance Welding (Mechanische und metallographische Prüfung von elektrischen Widerstandschweissungen), E. Bock. Maschinenbau, vol. 4, no. 20, Oct. 1, 1925, pp. 989-993, 32 figs. on supp. plates. Discusses structure of material; compares micrographs of weld joints and transition zones for butt and fusion welding; gives hardness tests of welds and adjacent points.

EMPLOYMENT MANAGEMENT

PERSONNEL FORMS. An Analysis of Personnel Forms, D. R. Craig. Indus. Mgmt. (N. Y.), vol. 70, no. 2, Aug. 1920, pp. 122-124, 6 figs. Keeping red tape at minimum by studying current practice in personnel work; service records; how these forms can be used.

ENGINEERING

MEASUREMENT OF WORK. Measurement of Engineering Work, T. G. Price. Elec. Light & Power, vol. 3, no. 10, Oct. 1925, pp. 15-17 and 84, 11 figs. Describes system for measurement of effort expended and amount of engineering work accomplished, devised and placed in operation in Distribution Engineering Division of Commonwealth of Edison Co. of Chicago, purpose of which is to provide engineer of distribution, heads of various subdivisions under his jurisdiction, and interested executives of company with information as to volume of work, effort, cost, etc.

EXPLOSIVES

STANDARDIZATION. Standardization of Explosives, R. N. Van Winkle. Pit & Quarry, vol. 11, no. 3, Nov. 1, 1925, pp. 59-61. Article in which author introduces new viewpoint.

F

FACTORIES

LOCATION. Taking Advantage of "Complementary" Plants, J. A. Piquet. Indus. Mgmt. (N. Y.), vol. 70, no. 5, Nov. 1925, pp. 313-316. Discusses question of location near other plants whose needs or products fit in at one or other end of plant in question; points out that this is often matter, not of relocating, but of attracting such plants to locate in vicinity.

FATIGUE

INDUSTRIAL. Carbon Dioxide as an Index of Fatigue, W. N. Polakov. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1043-1046, 3 figs. Suggests simple and practical procedure for reducing (if not eliminating) ill effects of fatigue through joint study of work and workman; apparently immediate and reliable indications offered by measurement of CO_2 content in exhalations of workman will enable management to organize work so that organism of workman will produce maximum result with minimum exertion.

FIRECLAYS

PROPERTIES. The Chemical and Physical Properties of Fire Clays from Various Producing Districts, M. C. Booze. Am. Ceramic Soc.—Jl., vol. 8, no. 10, Oct. 1925, pp. 655-665, 29 figs. Chemical analyses, fusion points and firing characteristics of number of flint and plastic clays from various districts, together with short discussion of results and use which can be made of them.

FITS

DESIRABILITY DIAGRAMS. Measuring Systems and Tolerance Limits, P. J. Darlington. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 903-905, 4 figs. Fit-desirability diagrams and what they show about systems of measuring.

LIMIT SYSTEM. A System of Limits for Different Kinds of Fits, C. D. Albert. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 901-903. Hole vs. shaft as basis of fit system; best method of expressing tolerances; Newall and A. E. S. C. systems; standard method needed to express tolerances.

FLOTATION

P. S. N. PROCESS. The P. S. N. Flotation Process, R. D. Nevett. Chem. Eng. & Min. Rev., vol. 17, no. 202, July 5, 1925, pp. 392-394. Patented by Palmer, Seale and Nevett; process depends solely on use of elemental sulphur which may be added to pulp in form of a powder, or it may be dissolved in any suitable solvent and added to pulp as a solution; application of process to dump material plant.

SULPHIDIZING OXIDIZED ORES. Barium Polysulphide in Sulphidizing Oxidized Ores for Flotation, E. S. Leaver and H. M. Lawrence. U. S. Bur. Mines, Reports of Investigations, Serial No. 2698, Aug. 1925, 4 pp. Results of comparative investigation of sulphides and polysulphides of alkaline and alkaline-earth metals; it is thought that barium polysulphide may prove to be a more satisfactory sulphidizing reagent than others now in use under conditions that favor cheaper barium reagent; for investigation two fairly typical oxidized ores of copper and lead were selected; results obtained by J. B. Lain on sample of ore from Chino Copper Co. included.

FLOW METERS

APPLICATION. Practical Application of Steam Flow Meters. Steam Power, Vol. 4, July and Aug. 1925, pp. 6, 8 and 10; and 6 and 10, 8 figs. Describes practical application in power plant.

FORGINGS

BRASS BARS AND SECTIONS. British Standard Specification for Brass Bars and Sections Suitable for Forgings and Drop Forgings. Brit. Eng. Standards Assn., no. 218, June 1925, 8 pp., 7 figs. Specification covering quality of material, methods of manufacture, freedom from defects, provision of test pieces, mechanical tests, re-tests, inspection, and testing facilities. Appendix giving forms of British standard tensile test pieces.

RING, MANUFACTURE OF LARGE. A Method of Manufacturing Large Ring Forgings, W. L. Blankenship. Am. Soc. Steel Treating—Trans., vol. 8, no. 4, Oct. 1925, pp. 74-483, 10 figs. Presents unique method for production of large ring forgings when using forging press or steam hammer having insufficient space between supporting columns to accommodate forging; describes method employed in production of 8-in., 56-caliber training circle forging starting with split I-bar; method of bending, opening and finish; method of heat treating finished forging.

FOUNDATIONS

CONCRETE PIT FOR ROCK CRUSHER. Concrete Pit Structure Subjected to Diverse Stresses, A. E. Wynn. Eng. News-Rec., vol. 95, no. 19, Nov. 5, 1925, pp. 762-763, 2 figs. Provides watertight foundation and inclosure for rock crusher; copper construction joints; winter construction.

FOUNDRIES

HEAVY CASTINGS. Handling Heavy Castings. Foundry, vol. 53, no. 20, Oct. 15, 1925, pp. 814-817, 6 figs. Describes foundry of Dominion Eng. Works, Montreal, Can., engaged in manufacture of paper-making, hydraulic and hydro-electric machinery and general heavy foundry and machine-work business; mold-drying equipment; coke-fired ovens; charging platform.

MANAGEMENT. Foundry Progress: Past, Present and Future, J. D. Towne. Am. Foundrymen's Assn.—advance paper, no. 473, for mtg. Oct. 5-9, 1925, 13 pp. Early historical developments of ferrous-casting industry; discusses reasons why industries' management has not, as whole, developed as has that of certain other industries; states that average foundry manager misunderstands meaning and extent of modern methods of management; author believes that planning and manufacturing are two headings under which most progress is being made; gives detailed results obtained by analytical study of cleaning-room operations of steel foundry.

FRICTION

CAUSE OF. The Prime Cause of Friction, E. W. Davis. Mech. Eng., vol. 47, no. 11, Nov. 1925, p. 906. Cohesion, under certain conditions, friction; friction wear merely minute and continued breakage.

FUELS

CHEMISTRY. Progress in Chemistry and Use of Fuels (Fortschritte auf dem Gebiete der Brennstoffchemie und Brennstoffverwertung), W. Zisch. Brennstoff- u. Wärmewirtschaft, vol. 17, no. 15, Aug. (1st no.), 1925, pp. 293-298. Reviews recent work done in field of solid, liquid and gaseous fuels.

SELECTION OF. Factors Affecting the Selection of Fuel. Forging—Stamping—Heat Treating, vol. 11, no. 10, Oct. 1925, pp. 366-370, 3 figs. Ultimate choice should be based on cost per unit of goods manufactured, and various secondary advantages of convenience and cleanliness.

[*See also Oil Fuel; Pulverized Coal.*]

FURNACES, INDUSTRIAL

EFFICIENCY. Industrial-Furnace Efficiency, V. J. Azbe. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1061-1064. Heat losses encountered in industrial-furnace operation; dilution of products of combustion; application of waste-heat boilers to industrial furnaces; incomplete combustion; furnace design.

G

GAS

HEATING VALUE OF. Relation Between Heating Value of Gas and Its Usefulness to the consumer, A Critical Review of the Published Data, E. R. Weaver. U. S. Bur. Standards, Technologic Paper No. 290, July 21, 1925, pp. 347-463, 51 figs. Character of available data; direct observations upon use of gas; discussion of direct evidence regarding usefulness of various qualities of gas; data regarding quantity of gas used by customers and its relation to usefulness of gas; discussion of changes in volume of gas used before and after a change of heating value.

GAS TURBINES

HOLZWARTH. The Holzwarth Gas and Oil Turbine. Mar. Eng., vol. 30, no. 10, Oct. 1925, pp. 570-574, 7 figs. Is of constant-volume combustion or intermittent explosion type in which a slightly pre-compared mixture of gas or oil and air is burned at constant volume in a number of explosion chambers, gases being allowed to expand in turbine nozzles only after complete combustion has occurred in chambers; developments in Germany show commercial possibilities; tests being made on 5000-kw. turbine.

GEAR CUTTERS

DISK, INSPECTION OF. Recommended Practice for the Inspection of Disk Gear Cutters. Am. Mach., vol. 63, no. 19, Nov. 5, 1925, p. 737. Report made by Inspection Committee of Am. Gear Mfrs.' Assn. and adopted as recommended practice.

GEAR CUTTING

SYKES GENERATOR. Sykes Herringbone Gear Generator. Iron Age, vol. 116, no. 18, Oct. 29, 1925, pp. 1189-1191 and 1225, 5 figs. Machines now being placed on market; method of cutting continuous gears, and operation of equipment.

Generating Herringbone Gears, W. E. Sykes. Machy, (N. Y.), vol. 32, no. 3, Nov. 1925, pp. 233-236, 6 figs. Sykes process of cutting double helical gears of continuous-face type, and important features of generators used.

GEARS

EFFICIENCY AND DURABILITY TESTS. Recent Tests on the Efficiency and Durability of Gearing, C. W. Ham. Machy. (N. Y.), vol. 32, no. 3, Nov. 1925, p. 197. Results of tests carried out by author and J. W. Huckert, using testing machine designed and built by W. Lewis; summary of conclusions in regard to durability. (Abstract.) Paper read before Am. Gear Mfrs.' Assn.

INTERNAL. A New Development in Internal Gearing—Comment, A. Fisher. Machy. (Lond.), vol. 27, no. 683, Oct. 29, 1925, pp. 147-149, 5 figs. Analyzes tooth action of new gearing, described in previous issue of same journal, and compares it more closely with tooth action of ordinary involute gearing than is done in original article, so as to arrive at clearer view of relative value of two systems; author concludes that new development in internal gears is theoretically and fundamentally incorrect, and odontoidal tooth contact is non-existent.

STANDARDIZATION. Standardization by Gear Manufacturers. Machy. (N. Y.), vol. 32, no. 3, Nov. 1925, pp. 194-197, 3 figs. Review of papers and reports presented before Am. Gear Mfrs.' Assn.

TOOTH LOADS. Gear Tooth Loads, E. Buckingham. Am. Mach., vol. 63, no. 20, Nov. 12, 1925, pp. 783-785, 5 figs. Elementary treatment of various factors that enter into gear-tooth loads, such as torque, horsepower, pitch-line velocity.

GIRDER, DEFLECTION OF. The Deflection of and the Unit Influence Lines of Deflection for Girders Beams, H. W. Coultas. Concrete & Construcional Eng., vol. 20s, no. 9 and 10, Sept. and Oct. 1925, pp. 491-496 and 565-570, 9 figs. Deflections of continuous beams carrying single unit load in only one bay; unit influence lines of deflection as unit load passes over span.

GRAPHITE

ONTARIO, CANADA. Graphite-Called Plumbago and Black Lead, R. C. Rowe. Power House, vol. 18, no. 17, Sept. 5, 1925, pp. 21-26, 10 figs. Describes deposits in Renfrew county, Ontario, and various methods of reclaiming graphite.

GRINDING

CENTERLESS. Centerless Grinding. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 943-946, 7 figs. "Through feed" and "in feed" methods of centerless grinding; increased production of pistons and piston pins obtained by use of centerless grinder; new theory on relation between control wheel, cutting wheel and work. Discussion of paper by W. J. Peets, published in Sept. issue of Journal.

GRINDING WHEELS

FAILURE. Some Causes of Wheel Failures, O. J. Lof. Abrasive Industry, vol. 6, no. 9, Sept. 1925, pp. 279-281. Explains causes of wheel accidents; a thorough investigation of each failure should be made as soon as possible.

GUNITE

CLINGING STRENGTH, REASON FOR. Does Scour Explain Why Gunite Clings Tight to Rock, J. D. Paton. Coal Age, vol. 28, no. 15, Oct. 8, 1925, p. 490. Theory advanced is that blast removes oxidized surface and enables cementing material to react with raw rock face.

GYPSUM

MANUFACTURE. A New and Efficient Gypsum Plant, E. D. Roberts. Pit & Quarry, vol. 11, no. 3, Nov. 1, 1925, pp. 63-70, 8 figs. Describes new plant and equipment of Standard Gypsum Co., at Long Beach, California.

H

HARDNESS

TESTING. Hardness Testing of Hardened Steels (Die Härteprüfung von gehärteten Stählen), R. Mailänder, Stahl u. Eisen, vol. 45, no. 43, Oct. 22, 1925, pp. 1769-1773, 5 figs. Influence of hardness of balls employed in test; tests with diamond balls and cold-hardened steel balls; limits for accurate measurements; Meyer's law for hardened steels.

HEAT

RESISTANCES. Heat Resistances (Die Wärmewiderstände), Wierz. Gesundheits-Ingenieur, vol. 48, no. 37, Sept. 12, 1925, pp. 457-460, 12 figs. Develops calculation of heat resistance in sense of electric resistance, temperature drop, etc., and its application to heat transmission in simple and compound walls, heat delivery of radiators in hot-water and in steam heating, heat transmission in heating boilers, etc.

HEAT TRANSMISSION

HEAT EXCHANGERS. Heat Exchangers (Die Einführung eines Formwertes bei Wärmetauschern), H. Preussler. Stahl u. Eisen, vol. 45, no. 41, Oct. 8, 1925, pp. 1705-1709. Relation of heat-carrier volume to construction design; calculation of design coefficient; load coefficient; feature of heat carrier; importance of heat-absorption and heat-emission capacity; heat accumulators and air heaters.

HEATING

BUILDINGS. Heating Buildings of Large Areas and High Roofs, W. W. Gaylord. Heat & Vent. Mag., vol. 22, no. 10, Oct. 1925, pp. 66-68, 1 fig. Discussion with comparative installation and operating costs, using direct radiation in one case and unit heaters in other.

HEAT REQUIREMENTS, DETERMINATION OF. Heat Requirements of Intermittently-Heated Buildings, W. Sommer. Heat & Vent. Mag., vol. 22, no. 10, Oct. 1925, pp. 72-75, 7 figs. New graphic method of computation, for walls of any construction and for all outside and inside temperatures.

HEATING, HOUSE

GAS AND OIL COMBINATION, USE OF. House-Heating by Combining the Use of Gas and Oil, H. O. Loebell. Heat & Vent. Mag., vol. 22, no. 9, Sept. 1925, pp. 84-86, 1 fig. Characteristics which a desirable fuel for house heating should have; production of oil and its uses; gas best fuel, limited by price; characteristic house-heating load problem; application of degree-day; effect on gas load-factor of duplexing oil and gas fuel.

HEATING, STEAM

CENTRAL. Central Steam-Heating in Winnipeg, J. W. Sanger. Can. Inst. Min. & Metallurgy—Bul., no. 161, Sept. 1925, pp. 874-889, 1 fig. Central steam heating system inaugurated in Winnipeg, October 1924; events which led up to proposal of central steam heating; notes on conditions favoring central heating in Winnipeg, preliminary estimates, location of steam plant, pipe estimates, conduits, pipe insulation, etc.; description of steam plant, with cost data, and losses.

HIGHWAYS

SEAWALL FOR RETAINING. Seawall Retains Picturesque California Highway, H. D. Miller. Eng. News-Rec., vol. 95, no. 18, Oct. 29, 1925, pp. 720-721, 4 figs. Structure 20 ft. high and 1¼ mi. long, built along Rincon Cliffs; will retain sand fill upon which highway will be built.

SNOW-DRIFT CONTROL. Snow Drift Prevention and Control on Highways, V. R. Burton. Eng. News-Rec., vol. 95, no. 19, Nov. 5, 1925, pp. 752-754, 6 figs. Based on state-wide snowfall survey; prevention and control of drifts advocated as best and most economical way of keeping roads clear.

HOUSES

CONCRETE, CORK-LINED. Cork Lined Concrete Houses, H. Whipple. Concrete, vol. 27, no. 5, Nov. 1925, pp. 15-20, 14 figs. How Parmeter-Curns organization is erecting concrete dwellings for Detroit market, using cork for a lining, at a cost that is quite low, competing with frame.

HYDRAULIC TURBINES

INSPECTION. Compressed Air Used for Hydraulic-Turbine Inspection, C. R. Reid. Power, vol. 62, no. 19, Nov. 10, 1925, pp. 716-717, 1 fig. In La Gabelle power house of St. Maurice Power Co., Shawinigan Falls, Quebec, compressed air is used to lower tailwater in wheel chamber of 33,000-hp. turbines when inspections are to be made.

ISLE MALIGNE PLANT, QUEBEC. Erection of Turbines at Isle Maligne, C. M. Scudder. Can. Engr., vol. 49, no. 15, Oct. 13, 1925, pp. 449-452, 7 figs. Description of procedure followed in installation of twelve 45,000 hp. hydraulic turbines at Grande discharge for Duke-Price Power Co., Ltd.; fast time made under severe climatic conditions.

HYDRO-ELECTRIC DEVELOPMENTS

BONNINGTON FALLS, B. C. Power Plant at Lower Bonnington Falls. Contract Rec., vol. 39, no. 41, Oct. 14, 1925, pp. 992-994, 9 figs. Particulars of hydro-electric development recently completed by West Kootenay Power & Light Co., comprising three 20,000 hp. units; replaces an old 4000-hp. low-head plant.

ISLAND PORTAGE, CANADA. Hydro-Electric Development at Island Portage. Can. Engr., vol. 49, no. 14, Oct. 6, 1925, pp. 429-431, 7 figs. General description of project on Abitibi River which will supply power to Hollinger Consolidated Gold Mines, Ltd., at Timmins, Ont.; two 12,000-hp. vertical turbines direct-connected to 12,000-kva. generators.

NIAGARA FALLS PROBLEMS. Some Problems at Niagara Falls. Can. Engr., vol. 49, no. 18, Nov. 3, 1925, pp. 520-521, 1 fig. Horseshoe Falls receding in center; submerged dams would evenly distribute flow over crest and release more water for power purposes; proposal to take water from whirlpool rapids for power development.

NOVA SCOTIA. Capital Costs of Sheet Harbor System, H. S. Johnston. Can. Engr., vol. 49, no. 18, Nov. 3, 1925, pp. 509-511, 4 figs. Further notes covering hydro-electric power developments of Nova Scotia Power Commission at Malay Falls and Ruth Falls; actual costs of both development and transmission line between Sheet Harbor and Pictou.

ST. LAWRENCE RIVER. Hydro Report on St. Lawrence River. Can. Engr., vol. 49, no. 12, Sept. 22, 1925, pp. 339-340. Abstract from statement and report by Hydro-Electric Power Commission of Ontario submitted to International Joint Commission together with supplementary information; report refers to three proposed schemes for power development.

SWITZERLAND. Hydro-Electric Progress in Switzerland. Elec. Rev., vol. 97, no. 2498, Oct. 9, 1925, pp. 581-582, 5 figs. Some details of Amsteg (Uri) power station; barrage is located at Pfaffensprung, and impounds 200,000 cu. meters of water at an available head of 270 m.; turbines are of Pelton type, coupled direct to Oerlikon alternators, designed to work with water under a head of 902 ft. and a delivery of 1045 gal. per sec., running speed being 333½ r.p.m.

HYDRO-ELECTRIC PLANTS

DIX RIVER, KENTUCKY. Dix River Hydro-Electric Development, F. A. Dale. Elec. World, vol. 86, no. 19, Nov. 7, 1925, pp. 939-942, 7 figs. Existence of superpower system makes possible practically 100 per cent utilization of stream flow; plant designed for variation of head from 165 ft. to 235 ft.

GREAT FALLS, TENNESSEE. Great Falls Plant Provides Peak Load Capacity, L. R. Lee. Power Plant Eng., vol. 29, no. 22, Nov. 15, 1925, pp. 1150-1151, 3 figs. Hydro plant of 30,000-kva. capacity is designed to tie in with steam plants; dam provides storage for dry periods.

ISLE MALIGNE, CANADA. Saguenay River Furnishes 540,000 Hp. Power Plant Eng., vol. 29, no. 18, Sept. 15, 1925, pp. 966-968, 8 figs. Isle Maligne hydro-electric plant near Lake St. John, containing twelve 45,000-hp. units, to be completed beginning of 1926; construction work electrical equipment.

OPERATION. Operating Practice in Hydro-Electric Plants, C. B. Hawley. Engrs. & Eng., vol. 42, no. 9, Sept. 1925, pp. 235-245, 4 figs. Discussion of some of the more important considerations governing selection and operation of hydro-electric machinery and accessory equipment; subject is treated from point of view of designing and operating engineers whose province is to select and assemble standard and special equipment available from manufacturer.

SEMI-AUTOMATIC OPERATION. Semi-Automatic Operation for Small Hydro Plants, C. W. Geiger. Power Plant Eng., vol. 29, no. 21, Nov. 1, 1925, pp. 1106-1107, 5 figs. Installation of automatic equipment to convert manually operated plants into semi-automatic plants proves successful.

I

IMPACT TESTING

NOTCHED-BAR TESTS. The Effect of Temperature on the Behaviour of Iron and Steel in the Notched-Bar Impact Test, R. H. Greaves and J. A. Jones. Iron & Steel Inst.—advance paper, no. 9, for mtg. Sept. 1925, 40 pp., 27 figs. Results of study carried out by authors to determine influence of changes of atmospheric temperature on test, to investigate embrittling action of cold, and elucidate, if possible, features of blue brittleness of iron and steel, and temper brittleness of alloy steels. Bibliography. See also Engineering, vol. 120, no. 3121, Oct. 23, 1925, pp. 524-527, 23 figs.

SLOW-BEND vs. Comparative Slow Bend and Impact Notched Bar Tests on Some Metals, S. N. Petrenko. Am. Soc. Steel Treating—Trans., vol. 8, no. 5, Nov. 1925, pp. 519-564, 26 figs. Results of tests to determine whether slow bend test may be used as substitute for, or as useful addition to, impact test; they were made in Izod pendulum-type impact machine 120 foot-pounds capacity and Humfrey slow-bend machine of 100 foot-pounds capacity, on cantilever beam-type specimens, having 10-by-10-mm. sections; slow-bend test gave values lower than impact for non-ferrous materials and higher than impact for steels; slow-bend is less convenient than impact test for ordinary routine practice. Bibliography.

INDUSTRIAL MANAGEMENT

PLANNING DEPARTMENT. A Planning Department—for What? Automotive Industries, vol. 53, no. 18, Oct. 29, 1925, pp. 734-736. If only for production, without taking into equal account such important factors as market conditions and sales possibilities, its value is apt to be small; sales and production must be planned together.

SALES ORGANIZATION. Liquid Carbonic Sales Organization, W. J. Graham. Mgmt. & Admin., vol. 10, no. 5, Nov. 1925, pp. 255-258. Organization of sales department of Liquid Carbonic Co.; territorial organization; general sales manager; assistant sales manager; special sales executives; branch manager; sales research and planning; classes of customers, orders, and terms; sales information manual; sales conventions; contests among salesmen and branches.

SIMPLIFICATION. Are There Any Real Obstacles to Simplification, R. M. Hudson. Factory, vol. 35, no. 4, Oct. 1925, pp. 537-538, 586, 588 and 590. These obstacles are discussed under heads of antipathy to government, fear of government regulation or control, fear of prosecution, lack of co-operative spirit.

INDUSTRIAL PLANTS

DESIGN. Influence of Plant Design on Plant Efficiency, H. T. Moore. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1059-1060. Economical selection of industrial site; basic data which determine plant design; site limitations which affect plant layout; design of plant.

ELECTRIC-POWER COSTS. Electrical Power Costs, D. Ross-Ross. Mgmt. & Admin., vol. 10, no. 5, Nov. 1925, pp. 285-286, 4 figs. Analysis of how to avoid maximum demand charges.

INDUSTRIAL RELATIONS

FOREMAN'S HELP IN IMPROVING. Winning the Foreman's Help, H. Diemer. Am. Mach., vol. 63, no. 20, Nov. 12, 1925, pp. 775-777. Existing attitudes toward industrial relations and personnel policies; winning foreman's help in promoting satisfactory relations; things foreman can do.

INTERNAL-COMBUSTION ENGINES

MICHELL CRANKLESS. The Michell Crankless Engine. Automobile Engr., vol. 15, no. 207, Oct. 1925, pp. 316-320, 13 figs. New form of high-speed multi-cylinder engine which, by radical novelty of its construction, evades several of most serious difficulties confronting designers of conventional type of engine; new design is in perfect dynamic balance.

See also Airplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Oil Engines.

IRON

Desulphurization of. Desulphurization of Ferrous Metals, Geo. A. Drysdale. Am. Foundrymen's Assn.—advance paper, no. 463, for mtg. Oct. 5-9, 1925, 10 pp. Author states that in dealing with ferrous metals, good deal of trouble encountered is caused by action of sulphur and oxides when metal is poured into mold and while it is setting; action of sulphur on cast iron is very detrimental, causing excessive shrinkage, hardness, porosity, and blowholes; effect of using sodium compound as desulphurizer and purifier, in melting of high-sulphur iron, produces softer iron and eliminates hard spots, excessive shrinkage, porosity and sulphur scab; resulting castings tend to give higher physical properties and lower Brinell hardness; use of sodium compound as flux; results of experiments.

Magnetic Permeability. Checking the Magnetic Permeability of Iron, P. B. Findley. Scientific Am., vol. 133, no. 4, Oct. 1925, p. 233, 3 figs. Notes on a new method for quick testing of cores and wire for radio and other apparatus.

IRON AND STEEL

Electrolytic Corrosion. The Electrolytic Corrosion of Ferrous Metals, W. M. Thornton and J. A. Harle. Faraday Soc.—Trans., vol. 21, part 1, no. 61, Aug. 1925, pp. 23-32 and (discussion) 32-35, 4 figs. From experimental results, conclusion is reached that not only have pure metals definite rates of corrosion according to Faraday's law of electrolysis, but that every ferrous alloy examined has specific rate of electrolytic corrosion by which it can be identified with certainty.

Hardness. The Influence of Strain and of Heat on the Hardness of Iron and Steel, A. Saveur and D. C. Lee. Iron & Steel Inst.—advance paper, no. 18, for mtg. Sept. 1925, 7 pp., 4 figs. Experiments show that on heating normalized iron and steel above atmospheric temperature their strength and hardness are at first slightly decreased, this being followed by increase which reaches its maximum in blue-heat range of temperature; straining normalized iron or steel above their elastic limit increases both strength and hardness; hardness resulting from cold deformation at room temperature is increased further by heating metal above atmospheric temperature.

IRON CASTINGS

Design. Metallurgical Points on Casting Design, F. C. Edwards. Metal Industry (Lond.), vol. 27, no. 16, Oct. 16, 1925, pp. 365-367, 6 figs. Influence of size of section on strength of cast iron; thickness of section and size of graphite; differential shrinkage; points out typical case in historic example of failure of hydraulic cylinder during building of Menai bridge; shrinkage more important than crystal structure at sharp corners; reinforcing cast-iron section.

L

LIGHTING

Street. Electric Street Lighting in Rural Areas, E. C. Lennox. Gas Jl., vol. 172, no. 3256, Oct. 7, 1925, pp. 38-40, 2 figs. Discusses electric lamp, switching, fittings, underground cables. Abstracts from paper before Instn. Pub. Lighting Engrs.

LIQUIDS

Characteristic Curves of Jets. The Characteristics Curves of Liquid Jets, E. Tyler and E. G. Richardson. Physical Soc. Lond.—Proc., vol. 37, part 5, Aug. 15, 1925, pp. 297-311, 10 figs. Continuing work of S. W. J. Smith and H. Moss upon relation between length of capillary jet and its velocity of efflux from cylindrical orifice, further examination has been made of causes to which main features of curves obtained by these authors are due; results indicate that, while surface tension is of prime importance in first parts of these curves, viscosity is dominating factor in second.

Viscosity at Boiling Point. On the Viscosities of Liquids at Their Boiling Points, D. B. Macleod. Faraday Soc.—Trans., vol. 21, part 1, no. 61, Aug. 1925, pp. 160-167. Concludes that boiling points are unsatisfactory temperatures at which to compare viscosities of liquids; by correcting boiling points to condition of equal free space, viscosities of liquids become proportional to their molecular weights in liquid state.

LOCOMOTIVES

Coaling Plants. Locomotive Coaling Plant: Latest German Practice, H. Koblenz. Indus. Mgmt. (Lond.), vol. 12, no. 10, Oct. 1925, pp. 474-476 and 486, 12 figs. Chief requirements that a locomotive coaling plant should fulfill; describes development of German system.

Diesel-Engined. The Baden Diesel Locomotive (Die "Baden"-Motor-Lokomotive). Motorwagen, vol. 28, no. 22, Aug. 10, 1925, pp. 480-481, 4 figs. Locomotive contain hydraulic transmission in successful commercial service; transmissions consist of vane pump and vane engine; speed is changed by connection in a varying number of compartments in pump.

Feedwater Treatment. Treated Water Increases Locomotive Efficiency, R. C. Bardwell. Ry. Rev., vol. 77, no. 18, Oct. 31, 1925, pp. 669-671. Notes on scale pitting, and foaming; boiler compounds, soda-ash treatment, zeolite, lime-soda plant, and continuous plants; savings effected by treatment. Paper presented at Am. Ry. Bridge & Bldg. Assn.

Stokers for. *See Stokers, Locomotive.*

Testing Plant. The Locomotive Testing Plant and Its Influence on Steam-Locomotive Design, L. H. Fry. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 881-886, 7 figs. Brief history of locomotive testing plants and their contributions to development of locomotive; work done by Altoona testing plant; contracts of size and economy of locomotives made 20 years ago and at present time. (Abridged.) See also Ry. Age, vol. 79, no. 17, Oct. 24, 1925, pp. 752-755, 3 figs.

LOGGING

Machinery for. Logging Machinery Used on the Pacific Coast, Wm. C. Shaw. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 913-914, 1 fig. Notes on steam engines, frames, gears and drums, boilers and Diesel engines.

LUBRICANTS

Grease. Lubricating Grease, G. B. Vroom. Am. Soc. Naval Engrs.—Jl., vol. 37, no. 3, Aug 1925, pp. 551-559, 4 figs. Discusses consistency, flow point, characteristics of contained oil, and freedom from impurities and fillers; determination, by experimental laboratory data, of behavior of greases made up to conform to known operating conditions, in respect to bearing temperature and pressure, and temperatures of cups, both gravity and continuous feed types; answers to objection that placing grease on a scientific footing would result in an increase of costs.

LUBRICATING OILS

Density at Low Temperatures. Density of a Lubricating Oil at Temperatures from -40° to +20° C., H. K. Griffin. Indus. & Eng. Chem., vol. 17, no. 11, Nov. 1925, pp. 1157-1158, 2 figs. Properties of oil; filling pycnometer; experimental procedure.

Filter for Recovery of. The Steam-Line Oil Filter. Petroleum Times, vol. 14, no. 351, Sept. 26, 1925, pp. 535-536, 2 figs. Describes invention by H. S. Hele-Shaw for recovery of used lubricating oils.

LUBRICATION

Problems. Lubricants and Lubricating, Jas. Duguid. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 887-894. Supply of lubricating oils; theory of lubrication; cylinder oils; lubrication of cylindrical bearings; bearing loads and temperatures; application of lubricants to bearings; power losses; packing waste; reclamation of used packing and oil; cost of lubrication. (Abridged.)

M

MACHINE DESIGN

Analysis of Problems. The Question of Mark in Machine Design, F. E. Cardullo. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1009-1011, 3 figs. Difficulties encountered in analysis of design problems that call for exercise of judgment; loose thinking and its probable effects on engineering design; false impressions current with regard to design of machine foundations, bearings, open-side machine frames, etc.

MACHINE-TOOL INDUSTRY

Future of. Future of the Machine Tool Industry, O. B. Iles. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 894-896. Forecast covering next 15 or 20 years, dealing with design, construction, and business phases, and based on opinions held by leaders in industry.

MACHINE TOOLS

Arrangement for Processing Parts. Machine-Tool Arrangement for Processing Parts, H. H. Edge. Am. Mach., vol. 63, no. 20, Nov. 12, 1925, pp. 759-761, 10 figs. Successful operating plan that provides for dividing parts to be machined into two classes, round work and flat work.

MATHEMATICS

Dimensional Notation. Dimensional System of Notation, V. Petrovsky. Gen. Elec. Rev., vol. 28, no. 11, Nov. 1925, pp. 757-761. Presents modification of older attempts at dimensional notation.

MALLEABLE IRON

Annealing. A Consideration of the Annealing Operation in the Malleable Foundry, C. J. McNamara and C. H. Lorig. Am. Foundrymen's Assn.—advance paper, no. 466, for mtg. Oct. 5-9, 1925, 11 pp., 14 figs. Results of data secured by experiments which were carried out with object of obtaining knowledge of rate at which iron graphitizes; continued slow cooling below critical point is said to be of little purpose in producing good malleable iron; specimens quenched in water from temperature just below critical range were as ductile as those which were allowed to cool in furnace; excessive oxidation of annealing pots is one real disadvantage resulting from opening annealing oven at too high a temperature.

Rapid Annealing. The Effects of Some Modifications of a Rapid Annealing Method on the Physical Properties of Malleable Iron, A. Hayes, E. L. Henderson and G. R. Bessmer. Am. Foundrymen's Assn.—advance paper, no. 481, Oct. 5-9, 1925, pp. 6-11, 9 figs. Preliminary report of careful study being made of influences of modification of various rapid methods of annealing upon physical properties of product: results of author's investigations lead to conclusion that any annealing method which produces small grain structure and well rounded carbon spots, and which results in complete graphitization, will duplicate physical properties of malleable iron produced by present commercial methods; such properties can be duplicated in annealing periods of 40 hours or less.

MANGANESE STEEL

Heat Treatment, Effect on. Certain Unsolved Problems Relating to Manganese Steel, Rob. Hadfield. Chem. & Industry, vol. 44, no. 43, Oct. 23, 1925, pp. 1042-1044, 4 figs. Effect of heat treatment on hardness and magnetic character; photomicrographic examination.

MATERIALS HANDLING

Problems. Materials-Handling Problems and Their Solution, F. D. Campbell. Mech. Eng., vol. 47, no. 11a, Mid-November, 1925, pp. 973-978, 9 figs. Deals with problems of movement of products in industrial plants, whether goods are being received or are going through various processes of operation, distribution, assembly, collection, packing, storage and shipment, and application of mechanical means to effect such movement.

Transferring, Without. Handling Without Transferring, M. W. Potts. Indus. Mgmt. (N. Y.), vol. 70, no. 5, Nov. 1925, pp. 296-300, 10 figs. Systems which do away with unnecessary rehandling.

MEASUREMENTS

Bibliography. Literature on Measuring. Eng. Progress, vol. 6, no. 9, Sept. 1925, pp. 307-308. Bibliography of general articles; length and capacity measuring; time measurement; pressures, velocities, etc.; mechanical properties and composition of bodies; heat measurements; electric and magnetic measurements; optical and acoustic measurements.

Precision. Precision Measurements, G. Berndt. Eng. Progress, vol. 6, no. 9, Sept. 1925, pp. 289-291, 4 figs. Their significance and utility in engineering; examples taken from machine construction and instrument making, illustrating great savings achieved by applying precision measuring. (Abstract.) Lecture presented before Cologne Mtg. on Measuring Instruments.

MEASURING INSTRUMENTS

Optical. Optics as Applied to Measuring. O. Eppenstein. Eng. Progress, vol. 6, no. 9, Sept. 1925, pp. 293-301, 23 figs. Applications in construction of apparatus and machines; notes on magnifying glass; optical dividing head; measuring microscope; projecting apparatus; thread-measuring comparator; micrometer; optimeter; measuring machine; measuring by light interference.

MECHANISMS

Geneva-Stop Analysis. Graphical Analysis of the Geneva Stop, C. M. Conradson. Machy. (N. Y.), vol. 32, no. 3, Nov. 1925, pp. 212-214, 9 figs. Analysis presented with view to making study of this mechanism easier; it is shown that pair of imaginary arms connected by imaginary link van be substituted for Geneva stop mechanism and be kinematically identical with it.

METALS

Fatigue Tests. High-Frequency Fatigue Tests. Metallurgist (Supp. to Engineer, vol. 140, no. 3644), Oct. 30, 1925, pp. 145-146. Review of account by C. F. Jenkin, of Oxford, of series of tests at very high speeds; he has succeeded in reaching 2000 alternations per second in oscillatory bending test.

X-Ray Examination. New X-Ray Studies of the Ultimate Structures of Commercial Metals, Geo. L. Clark, E. W. Brugmann, and S. D. Heath. Indus. & Eng. Chem., vol. 17, no. 11, Nov. 1925, pp. 1142-1146, 17 figs. Presents monochromatic pinhole method as most fruitful for utilizing X-rays in practical identification of working and heat-treating processes in metals; reproduces representative X-ray photographic diagrams for metals with different properties, to show great possibilities of obtaining purely scientific information, of fundamentally relating physical properties with ultimate structures, and of controlling and perfecting manufacturing technique by this method.

MINERAL DEPOSITS

Canada. The Mineral Resources of Northern Ontario, W. A. Parks. Roy. Soc. Arts—Jl., vol. 73, no. 3796, Aug. 21, 1925, pp. 898-915 and (discussion) 915-917. Outline of general geology of Canadian Shield, drawing attention to certain superficial conditions that seriously affect discovery and winning of ores; review of silver, nickel, gold, iron, copper, cobalt and other metals, with short reference to non-metals and general conditions.

MOLDING MACHINES

Electric. The Electric Molder, A. Jensen, Jr. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 984-986, 4 figs. Analysis of its power requirements and production possibilities in woodworking, and comparison with belt-driven molder.

MOTOR TRUCKS

DENNIS. A 30-cwt. Dennis. Motor Transport (Lond.), vol. 41, no. 1077, Oct. 19, 1925, pp. 481-483, 9 figs. Low first cost, simplicity in design and ease of upkeep characterize entirely new chassis; four-cylinder engine with 18-21 hp. R.A.C. rating.

TRANSMISSION CASE, MACHINING. Machining the Transmission Case of the Mack Truck and Bus, F. W. Curtis. Am. Mach., vol. 63, nos. 19 and 20, Nov. 5 and 12, 1925, pp. 729-733 and 765-768, 26 figs. Nov. 5: Inspection of rough castings; limits of accuracy required; variety of milling operations; boring of shaft holes in one setting; unusual types of trunnion jigs. Nov. 12: Method of driving studs; forming selector-shaft holes; rigid inspection methods employed; machining operations for top cover.

N

NICKEL PLATING

ADHESION TO BASE METAL. Adhesion of Deposited Nickel to the Base Metal, E. A. Ollard. Faraday Soc.—Trans., vol. 21, part 1, no. 61, Aug. 1925, pp. 81-87 and (discussion) 87-90, 6 figs. Investigation undertaken with intention of studying factors governing adhesion of deposits, and of obtaining definite test of true adhesion; experiments were made with nickel on steel shafts; it is shown that considerable adhesion is attained when nickel is deposited on mild steel under correct conditions.

NON-FERROUS METALS

ENDURANCE PROPERTIES. Endurance Properties of Non-ferrous Metals, D. J. McAdam, Jr. Am. Inst. Min. & Met. Engrs.—Trans., no. 1506-E., Oct. 1925, 22 pp., 14 figs. Typical stress-cycle graphs for non-ferrous metals as obtained at Naval Engineering Experiment Station, University of Illinois, and McCook Field; form of stress-cycle graph; possible reasons for abnormal graphs for some non-ferrous metal obtained at University of Illinois and at McCook Field. Bibliography.

MELTING, ATOMIZED-COAL SYSTEM OF. Atomized Coal System of Non-Ferrous Melting, R. Black and C. L. Shafer. Am. Foundrymen's Assn.—advance paper, no. 472, for mtg. Oct. 5-9, 1925, 7 pp. Atomized coal system is name applied to use of specially prepared bituminous coal for melting non-ferrous metal which, so far has been applied only to crucible melting; describes preparation of coal, and method and equipment used in burning; it is stated that theory of burning as worked out for pulverized coal does not hold good for atomized coal as related to requirements of combustion; for atomized coal, air supply and combustion space in experimental work has been steadily diminished; costs of atomizing coal and of melting with it are given.

TEMPERATURE DETERMINATION. The Temperature Determination of Non-Ferrous Alloys, R. L. Binney. Am. Foundrymen's Assn.—advance paper, no. 470, for mtg. Oct. 5-9, 1925, 11 pp. Discusses points brought out in author's study of temperature control; types of devices investigated were optical, radiation, base-metal pyrometers, temperature cones, potentiometer vs. high- and low-resistance meters and combinations of these methods.

O

OIL ENGINES

CYLINDER WEAR DUE TO DIRTY FUEL. How Dirty Fuel May Damage Oil-Engine Cylinders, A. B. Newell. Power, vol. 62, no. 17, Oct. 27, 1925, pp. 644-645, Points out that engines burning dirty fuel always show abnormal cylinder wear, thus wear ultimately is traceable to foreign substances; absence of abnormal wear at lower end of cylinder indicates that abrasive in fuel is not directly causing trouble; better lubrication needed.

OIL FUEL

BURNERS. Some Hints on Installing and Operating Domestic Oil Burners, C. H. Chalmers. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 31, no. 10, Oct. 1925, pp. 471-475, 1 fig. Notes on oil storage, and sub-basement tank; U. S. Government recommendations on boiler and furnace design for oil burners.

The Filam Oil Burner. Petroleum Times, vol. 14, no. 347, Aug. 29, 1925, pp. 365-366, 2 figs. Simplified oil-firing device in which complete atomization of fuel at low velocity has been perfected in such manner that there is correct combustion, resulting in flame of high temperature, short length and soft diffusion.

OIL WELLS

DRILLING. Drilling Screen Holes in Oil-Well Casing, C. S. Ashley. Machy. (N.Y.), vol. 32, no. 3, Nov. 1925, p. 190, 2 figs. Describes method adopted in oil wells in Southern California of drilling screen pipe or casing from inside; equipment used consists of 2 multiple-spindle drilling machines.

ORE DRESSING

CRUSHING PLANTS. A Model Crushing Plant at Douglas, Arizona, G. J. Young. Eng. & Min. Jl.—Press, vol. 120, no. 17, Oct. 24, 1925, pp. 653-657, 11 figs. Describes crushing plant of Calumet & Arizona Min. Co. at its smelter at Douglas, Ariz, designed to receive run-of-mine ore and to crush to ½-in. size for reverberatory smelting; provision is made for mechanical sampling; individual drives liberally used; remarkably little dust when running.

CRUSHING PRACTICE. Crushing Practice at Ajo, D. Cole. Min. & Metallurgy, vol. 6, no. 226, Oct. 1925, pp. 524-526, 2 figs. Describes crushing plant of New Cornelia Copper Co. constructed to serve its new flotation concentrator; flow scheme and machinery which were finally adopted; unique method separating finished portion from center of stream issuing from rolls, results in rod-mill feed that is not at all definitely sized but which, when roll shells are in good condition, contains much smaller percentage of oversize than would be imagined.

OXY-ACETYLENE WELDING

PIPE LINES. Welding City Pipe Lines, E. E. Lungren. Gas Industry (Mfrd. Gas Edition), vol. 25, no. 8, Aug. 1925, pp. 285-290, 5 figs. Discusses use of oxy-acetylene welding in city lines service. Welding pipe joints ends gas leak troubles; preventing breaks from contraction stresses; comparative installation costs; uses of blowpipe in gas industry.

P

PAINTS

TESTING. Testing Paint by the Removed Film Method. Ry. Mech. Engr., vol. 99, no. 11, Nov. 1925, pp. 693-697, 4 figs. Presence of inferior bases and reducing oils can be easily determined; tests of new stock prevent waste. Abstracts of paper by W. O. Quest, and committee report before Am. Ry. Assn.

PAPER MANUFACTURE

PULP MANUFACTURE. Pulp Making in British Columbia, Geo. M. Taylor. Can. Machy., vol. 34, no. 13, Sept. 24, 1925, pp. 13-14, 4 figs. Outlines methods in manufacture of pulp and describes outstanding mills in British Columbia.

WOOD PULPING. Soluble Sulphites and Their Bisulphites In the Pulping of Wood, J. D. Rue. Paper Trade Jl., vol. 81, no. 16, Oct. 15, 1925, pp. 54-56. Review of literature.

PAPER MILLS. A Proposal for Reducing the Contamination of Streams by Strawboard Mills, D. Rue and F. G. Rawling. Paper Trade Jl., vol. 81, no. 15, Oct. 8, 1925, pp. 48-49. Discusses difficulties of disposing of waste from lime process, and new process which it is believed will obviate many of the difficulties; cost of new process. Paper to be presented at Technical Assn. Pulp & Paper Industry convention, Oct. 14-15, 1925.

PAVEMENTS

ASPHALT RESURFACING. Salvaging Old Streets by Asphalt Resurfacing and Oiling. Eng. News-Rec., vol. 95, no. 19, Nov. 5, 1925, pp. 758-761. Abstracts of papers presented to Asphalt Assn., giving details of methods and costs of resurfacing streets with asphalt, as follows: Resurfacing of Paved Streets at Columbus, Ohio. R. H. Simpson: Double-Seal Method of Resurfacing Macadam at Rockford, Ill. B. C. Harvey; Resurfacing Gravel at Grand Rapids, Mich., C. A. Paige; Methods and Cost of Oiling Macadam, Rockford, Ill., C. B. Harvey; Reconditioning Macadam for Resurfacing, Springfield, Mass. W. H. Woodward; Cost of Oiling Gravel Roads in Cuddo Parish, Louisiana, J. T. Bullen; Surface Treating Gravel Streets, Springfield, Mass., W. H. Woodward.

PLANERS

GEAR. 14-inch Spiral Bevel Gear Planer. Machy. (Lond.), vol. 27, no. 684, Nov. 5, 1925, pp. 171-173, 5 figs. New machine by Alfred Herbert, Coventry, suitable for cutting all standard tooth pitches up to and including 5-diametrical, or equivalent, in circular or module pitch, and is notable for simplicity and convenience with which it can be set and operated.

VARIABLE-VOLTAGE REVERSING DRIVE. Variable-voltage Reversing Planer Drive, A. L. Harvey. Machy. (N. Y.), vol. 32, no. 3, Nov. 1925, pp. 215-216, 1 fig. Enumerates advantages of variable-voltage equipment; describes Westinghouse planer equipment, which consists of reversing planer motor, motor-generator set, panel for field-reversing contactors, field rheostats to obtain proper speed on cutting and return strokes, etc.; comparison of constant-voltage and variable-voltage drives.

POLES, CONCRETE

CENTRIFUGAL METHOD, BY. Hollow concrete Poles by the Centrifugal Method. Concrete, vol. 27, no. 4, Oct. 1925, pp. 40-41, 1 fig. Hennebique patents; uses for concrete poles; centrifugal process; mixing concrete.

POWER FACTOR

NOMOGRAM FOR CALCULATION. Determination of the Reactive Kv-a. and the Capacity Necessary to Improve Power-factor, J. Hak. Gen. Elec. Rev., vol. 28, no. 11, Nov. 1925, pp. 798-799, 2 figs. Describes nomogram which offers labor-saving tool with which many engineering calculations may be shortened and tedious work of repeated slide-rule calculations avoided. Translated from Revue Générale de l'Electricité.

POWER TRANSMISSION

LINESHAFT ERECTION. Practical Pointers on the Groundwork Necessary Before Erecting a Lineshaft, G. Trimm. Indus. Engr., vol. 83, no. 11, Nov. 1925, pp. 519-523 and 554, 8 figs. Points out methods of rigidly supporting lineshafts so that they will maintain proper alignment in various types of buildings.

PULVERIZED COAL

COMBUSTION. Chemistry of Combustion of Pulverized Coal, S. C. Martin. Power Plant Eng., vol. 29, no. 21, Nov. 1, 1925, pp. 1091-1092, 2 figs. High velocity of both air and fuel necessary in removing inert gaseous envelope surrounding particles of fuel.

PULVERIZERS. The Development of a Unit Pulverizer, R. S. Riley. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1047-1052, 10 figs. Describes machine for preparing coal to be burned in powdered form and of its development; results of tests to determine its reliability, ability to pulverize wet coal, power consumption, durability, fineness of grinding, etc.

MALLEABLE FURNACES. Malleable Furnace Fired With Pulverized Coal, W. Hathaway. Foundry, vol. 53, no. 20, Oct. 15, 1925, pp. 824-828 and 832, 5 figs. Economy in operation secured through replacement of hand-fired method with new system.

PUMPING STATIONS

DIESEL ENGINES IN. Diesel Engine Experience in a Pumping Plant, L. C. L. Smith. New England Water Wks. Assn.—Jl., vol. 39, no. 2, June 1925, pp. 135-137. Describes large economy and satisfactory service on ten months initial run at Huntington, Long Island.

HYDROPNEUMATIC. Some Novel Hydro-Pneumatic Pumping Plants. Engineer, vol. 140, no. 3642, Oct. 16, 1925, pp. 413-414, 6 figs. Describes various developments arising from water-lifting device called hydrautomat, which is self-acting device for using energy of low heads of running water to raise liquids to high levels through agency of compressed air.

PUMPS

CIRCULATING, MOTOR-DRIVEN. Control for Dual-Driven Circulating Pumps, J. W. Anderson. Elec. World, vol. 86, no. 20, Nov. 14, 1925, pp. 1006-1007, 1 fig. Philadelphia Electric Co. uses synchronous motors in its Delaware station for circulating pumps; describes detailed control system.

PUMPS, CENTRIFUGAL

STARTING WITHOUT PRIMING. Starting Centrifugal Pumps Without Priming, C. H. S. Tupholme. Power Plant Eng., vol. 29, no. 18, Sept. 15, 1925, pp. 946-947, 2 figs. Device, installed at one of big London plants, consists of closed steel plate cylinder located on suction line of pump and somewhat higher level; inlet to device is at top and outlet to pump immediately beneath, conical pipe being fixed between the two; describes action of device.

R

RADIOTELEGRAPHY

FREQUENCY MEASUREMENT. The Measurement of Frequency and Allied Quantities in Wireless Telegraphy, K. E. Edgeworth and G. W. N. Cobbold. Instn. Elec. Engrs.—Jl., vol. 63, no. 345, Sept. 1925, pp. 919-920 and (discussion) 920-922. Authors suggest description of frequencies in terms of "pitch", a term which is defined as relationship of particular frequency to some standard frequency; proposed standard is frequency of 1 cycle per sec., and relationship suggested is such that pitch is logarithm of ratio between there frequencies; possible advantages of use of pitch.

SHORT-WAVE TRANSMITTERS AND RECEIVERS. Recent Commercial Development in Short Wave Transmitters and Receivers, S. E. Anderson, L. M. Clement and G. C. De Coutouly. Inst. Radio Engrs.—Proc., vol. 13, no. 4, Aug. 1925, pp. 413-436, 13 figs. Describes transmitter and receiver recently developed for use of U. S. Coast Guard, for operation on wave lengths between 100 and 200 m.; summary of various circuit considerations; actual transmitter finally developed and its operating characteristics; various problems to be met in design of radio receiver of this character; frequency characteristics of receiver as developed and method of determining them.

RADIOTELEPHONY

AMPLIFIERS. Selective Amplifiers, P. K. Turner. Experimental Wireless, vol. 2, no. 25, Oct. 1925, pp. 801-809, 11 figs. A short review of question of correct selectivity, with simple graphs and charts for design purposes.

History and Future. History and Future of Radio, S. M. Kintner. Iron & Steel Engr., vol. 2, no. 10, Oct. 1925, pp. 418-424. Notes on radiotelephony; continuous waves; heterodyne; world's war radio uses; entrance of large electrical companies into radio; perfection of trans-oceanic service; carrier-current developments; radio broadcasting; short waves; future of radio.

RAILWAY ELECTRIFICATION

Great Northern, Washington. Great Northern Electrification, E. Marsball. Ry. Age, vol. 79, no. 20, Nov. 14, 1925, pp. 899-901, 3 figs. Motor-generator locomotives will be used on 24-mi. heavy-grade section including Cascade tunnel.

RAILWAY MANAGEMENT

Materials Inspection. The Inspection of Railway Materials. Ry. Engr., vol. 46, no. 549, Oct. 1925, p. 353. Writer urges need for improving inspection arrangements in order to secure more effective supervision and economy in time.

RAILWAY MOTOR CARS

Gasoline-Electric. Double End Controlled Brill Gas-Electric Car. Ry. Age, vol. 79, no. 17, Oct. 24, 1925, pp. 757-758, 5 figs. Driven by Brill-Westinghouse 250-hp. gas engine; flexible control incorporated in one throttle.

Oil-Electric. New C. N. R. Oil-Electric Passenger Cars. Can. Engr., vol. 49, no. 19, Nov. 10, 1925, pp. 529-533, 5 figs. Canadian Nat. Rys. introduce two new types of self-propelled car for passenger service; power plant in both cases consists of Diesel engine direct connected to d.c. generators; standard railway-type motors mounted on trucks.

RAILWAY OPERATION

Stopping and Starting Trains, Cost of. Estimated Cost of Stopping and Starting Trains, O. O. Carr. Ry. & Locomotive Eng., vol. 38, no. 10, Oct. 1925, pp. 291-292. Results of series of tests and checks made with dynamomenter car in connection with other tests being made at time.

Train Control. Reading Three-Speed Control. A. H. Yocum. Ry. Signaling, vol. 18, no. 11, Nov. 1925, pp. 409-412, 7 figs. Continuous system installed on high-speed dense traffic line of double track Camden, N. J., to Atlantic City.

RAILWAY SHOPS

Locomotive. Some Impressions of Burnham Locomotive Sbop. Ry. Mech. Engr., vol. 99, no. 11, Nov. 1925, pp. 713-718, 11 figs. Improved morale evident at new Denver & Rio Grande Western sbop; effective routing and material-delivery systems; time-saving shop devices.

RAILWAY SIGNALING

Automatic Block. I. C. C. Signal Statistics. Ry. Signaling, vol. 18, no. 11, Nov. 1925, pp. 429-433, 3 figs. Review of block-signals statistics issued by Bur. of Safety of Interstate Commerce Commission from information furnished by railroads; automatic block mileage increased 2302 miles in 1924.

Colored-Light Signals. Light Signals Replacing Semaphores. Ry. Signaling, vol. 18, no. 11, Nov. 1925, pp. 413-415, 12 figs. New York Central makes this change between Buffalo, N. Y., and Cleveland, O.

Economic Operation. The Economic Aspect of Signalling, A. E. Tattersall. Ry. Gaz., vol. 43, no. 16, Oct. 16, 1925, pp. 454-456, 4 figs. How signaling may be arranged to reduce operating expenses; track circuiting and power signaling; triangular junctions.

RAILWAY TIES

Composite Cross. A New Substitute Tie. Ry. Eng. & Maintenance, vol. 21, no. 11, Nov. 1925, pp. 438-440, 1 fig. Composite cross tie, consisting of two pieces of 100-lb. scrap rail enclosing core of concrete; tested by Terminal Railroad Assn of St. Louis.

Concrete. Experiments witb Concrete Ties. Eng. News-Rec., vol. 95, no. 18, Oct. 29, 1925, pp. 708-709 2 figs. Satisfactory experience with trial lot of 22 reinforced-concrete ties laid in 1916 at Eagle Pass, Tex., has led Southern Pac. Ry. to make 100 ties of same type, to be placed in heavy-traffic main-line service.

RAILWAY TRACK

Grade Crossings. Highway Crossing Protection, A. H. Rudd. Ry. Signaling, vol. 18, no. 11, Nov. 1925, pp. 417-420. Advantages of center of road location for signal; disadvantages of center mounting; advantages and disadvantages of roadside location; summary of points to be considered; uniformity of indication and signals needed; study of results of crossing accidents. (Abstract.) Committee report before Am. Ry. Assn.

REFRACTORIES

Gray-Iron Foundry. Refractory Requirements in the Gray Iron Foundry, R. Moldenke. Am. Ceramic Soc.—Jl., vol. 8, no. 11, Nov. 1925, pp. 712-719. Calls attention to lack of information on foundry refractories on part of both foundrymen and makers of refractory materials; enumerates application of tbcse materials in foundry practice, and details requirements sufficiently to enable manufacturer to select proper grades of brick and clay for cupola and air-furnace operation, as well as for lining up of ladles.

Thermal Efficiency. The Relation of Structure and Composition to Thermal Efficiency of Refractories When Used in Regenerators, S. M. Phelps. Am. Ceramic Soc.—Jl., vol. 8, no. 10, Oct. 1925, pp. 648-654, 5 figs. Study shows relative rates of heat transmission in typical clay, silica, diaspore, fused alumina and silicon carbide refractories, when used as checker brick; it is shown tbat by lowering porosity of checker brick increase in efficiency is obtained by virtue of its greater heat capacity, which is function of weight and specific beat of material.

REFUSE DISPOSAL

Incinerator Practice. Basic Principles in Refuse Incinerator Practice. Mun. & Cty. Eng., vol. 69, no. 4, Oct. 1925, pp. 221-224. Outlines principles of design, construction and operation of municipal refuse incinerators. Text of progress report of Committee of Am. Pub. Health Assn.

REGULATORS

Induction. The Use of Induction Regulators in Feeder Circuits, L. H. A. Carr. Instn. Elec. Engrs.—Jl., vol. 63, no. 345, Sept. 1925, pp. 864-873 and (discussion) 874-876, 18 figs. Uses and possibilities of induction regulators as applied to feeder and interconnector circuits; describes three types of induction regulators, together with their characteristics, namely, single polyphase, double polyphase, and single-phase regulators; application to various types of circuit; effect of regulator impedance; operation, construction and control of induction regulators.

Mercury-Controlled Pressure. Pressure Regulators at the Inland Steel Co., C. J. Smitb. Iron & Steel Engr., vol. 2, no. 10, Oct. 1925, pp. 424-426, 5 figs. Describes mercury-controlled pump governor eliminating all counterweights, springs, stuffing boxes, etc., and their resulting friction, used with thin rubber diaphragm which has equal water pressure on both sides; same principle has been developed to bandle regulation problems of various kinds; patented under name of Mercon regulators.

RESERVOIRS

Color of Water. Color and Other Phenomena of Water From an Unstripped Reservoir in New England, C. M. Saville. New England Water Wks. Assn.—Jl., vol. 39, no. 2, June 1925, pp. 145-163 and (discussion) 163-170, 11 figs. Facts regarding conditions in Nepaug and other reservoirs of Hartford (Conn.) water supply system.

Covered. 8-Million Gallon Covered Service Reservoir at Bushey Heath. Engineer, vol. 140, no. 3644, Oct. 30, 1925, pp. 456-457, 5 figs. partly on p. 464. Describes reservoir being constructed by Colne Valley Water Co.; it is rectangular in plan and being built partly in excavation and partly above ground level, walls being of mass concrete; roof, which is composed of concrete arches, is supported on brick piers.

ROAD CONSTRUCTION

Types. Modern Road Construction, W. Bell. Surveyor & Mun. & Cty. Engr., vol. 68, no. 1760, Oct. 9, 1925, pp. 295-299. Author's opinions and experience with the various methods of road construction at present in vogue, including macadam, bituminous, wood block, sett paving; footways. Paper read before Instn. Mun. & Cty. Engrs.

ROADS

Amiesite. Laying Amiesite Pavements, Longueuil, H. Bertrand. Can. Engr., vol. 49, no. 1, Sept. 15, 1925, pp. 217-218, 4 figs. Amiesite laid at Longueuil when Quebec, Montreal & Soutb. Ry. relaid tracks through city; as a result this material was laid on all streets having concrete foundations; method employed in laying amiesite.

Creosoted-Block. Maintenance of Creosoted Block Pavements, A. D. Carpenter. Eng. & Contracting (Roads & Streets), vol. 64, no. 4, Oct. 7, 1925, pp. 782-784. Methods and costs of treatment. Paper read before Minn. Engrs. & Surveyors' Soc.

Drainage. The Surface and Subsoil Water Drainage of Roads, A. H. Richards. Surveyor & Mun. & Cty. Engr., vol. 68, no. 1759, Oct. 2, 1925, pp. 283-285, 1 fig. Design of a surface and subsoil water drainage systems.

Maintenance. Highway Maintenance in Manitoba, A. McGillivray. Contract Rec., vol. 39, no. 39, Sept. 30, 1925, pp. 959-961 and 947. Highway system of this province consists almost entirely of gravel and earth roads; organization for keeping them in shape and methods employed. See also Can. Engrs., vol. 49, no. 15, Oct. 13, 1925, pp. 461-464.

Quebec, Canada. Good Roads in the Province of Quebec, J. L. Boulanger, Can. Engr., vol. 49, no. 11, Sept. 15, 1925, pp. 305-308, 5 figs. Remarkable development of good roads movement in Quebec; provence has 31,000 mi. of roads of which 6600 have been permanently improved; about 300 mi. of main roads built in 1925; traffic supervision and regulation. See also Contract Rec., vol. 39, no. 37, Sept. 15, 1925, pp. 894-897, 10 figs.

Subgrades. The Present Status of Subgrade Studies, A. C. Rose. Pub. Roads, vol. 6, no. 7, Sept. 1925, pp. 137-162, 11 figs. Review of progress of subgrade research and results of highway research in all its phases. Bibliography.

ROADS, ASPHALT

Life of. What is the Life of Aspbaltic Pavements? R. H. Simpson. Contract Rec., vol. 39, no. 41, Oct. 14, 1925, pp. 995-998, 2 figs. Cost of repairs averaged on a square yard per year basis; how maintenance expense varies from year to year; 30 to 35 years service is a reasonable expectation. See also Can. Engr. Vol. 49, no. 13, Sept. 1925, p. 368.

ROADS, BITUMINOUS

Design. Bituminous Pavements for Heavy Traffic, P. Hubbard. Can. Engr., vol. 49, no. 1, Sept. 15, 1925, pp. 313-315. Trend in design of bituminous wearing courses and pavement structures. Paper read at convention of Assn. Highway Officials of N. Atlantic States.

ROADS, CONCRETE

Comparison of Sections. A Comparison of Typical Concrete Road Sections, H. B. Breed. Am. City, vol. 33, no. 4, Oct. 1925, pp. 414-418, 1 fig. Discusses subsoil conditions; comparison of the different types of design in use among the various states.

Hexagonal Slab Design. The Hexagonal Slab Design of Concrete Pavement. L. A. Perry. Am. Soc. Civ. Engrs.—Proc., vol. 51, no. 9, Nov. 1925, pp. 1793-1808, 11 figs. Records results of experiments conducted by writer to learn what relation shape of pavement slab has on its strength; witb record of these experiments, study of moments, as developed in various shaped slabs, is reported; also discusses current practice in light of information gained from these studies; pavements of correct slab shape, as determined from these studies, are illustrated and described.

ROADS, GRAVEL

Dust Elimination. Dust Elimination on Gravel Roads, B. C. Tiney. Contract Rec., vol. 39, no. 39, Sept. 30, 1925, pp. 955-957. Discusses two distinct lines of treatment, viz., use of dust palliatives and application of bituminous surfacings; manner of using materials and cost of treatments. See, also Can. Engr.; Vol. 49, no. 13, Sept. 29, 1925, pp. 359-363, 2 figs.

ROADS, MACADAM

Bituminous. Design of Bituminous Macadam Pavements, J. S. Crandell. Can. Engr., vol. 49, no. 16, Oct. 20, 1925, pp. 477-479. Developments in design and maintenance; construction of foundation and wearing course; application of surface treatments.

Machine Maintenance of. Machine Maintenance of Macadam, Monroe County, Mich. Eng. News-Rec., vol. 95, no. 17, Oct. 22, 1925, pp. 681-682, 4 figs. Manpower reduced by dust blower, mechanical chip distributor, tar sprinkler and locomotive crane.

S

SAND, MOLDING

Core Sands. Methods of Testing Core Sand Mixtures, J. F. Harper and W. J. Stevenson. Am. Foundrymen's Assn.—advance paper, no. 496, for mtg. Oct. 5-9, 1925, 12 pp. 2 figs. It would appear that green or unbaked strength of core sands should be determined by means of Doty cohesiveness test and baked strength by means of transverse test as outlined; transverse test has proved excellent method of comparison and it lends itself to easy operation without large number of testing variables.

Mixtures, Control Tests of. Control Tests of Steel Molding and Core Sand Mixtures. Research group News, vol. 2, no. 3, Oct. 1925, pp. 4-7, 3 figs. Review of activities of Joint Committee on Molding Sand Research, undertaken by Am. Foundrymen's Assn. in co-operation with other organizations; describes routine methods which have been very beneficial in maintaining uniformity in molding and coresand mixtures.

Treating and Handling. A Method of Treating and Handling of Molding Sand, M. Sklovsky. Am. Foundrymen's Assn.—advance paper, no. 482, for mtg. Oct. 5-9, 1925, 12 pp., 8 figs. Describes method and special apparatus in handling molding sand in continuous-operation unit; molding sand is not hand shoveled at any stage of production operation; special revolving shelved apparatus is used to cool, aerate and cut sand so that sand passes through complete cycle every 30 minutes; number of field molds at any time is less than 5 per cent of total daily production; this rapid cycle permits use of very few flasks and facilitates quick change over jobs. See (abstract) in Foundry, vol. 53, no. 21, Nov. 1, 1925, pp. 882-885, 8 figs.

SEMI-STEEL

Mixing. Semi-Steel, J. H. List. Foundry Trade Jl., vol. 32, no. 479, Oct. 22, 1925, p. 343. Describes method of mixing with which author has had several years of experience.

SEWAGE DISPOSAL

Activated Sludge Process. A British View of the Activated Sludge Process, F. W. Harris. Mun. and Cty. Eng., vol. 69, no. 4, Oct. 1925, pp. 198-201. Discusses tanks and their equipment, mechanical and aeration problems, the three systems of activated sludge process, etc. Paper read before Royal Sanitary Assn. Scotland.

Chlorine in. Chlorine in Sewage and Waste Disposal, J. C. Baker. Indus. and Eng. Chem., vol. 17, no. 10, Oct. 1925, pp. 1059-1060, 1 fig. History of sewage chlorination; methods and applications; theory of action of chlorine.

Sludge Disposal. Utilization of Sewage Sludge Report to Two Societies. Eng. News-Rec., vol. 95, no. 21, Nov. 19, 1925, pp. 836-837. Progress in several cities and sewerage districts; special outlets for sale of sludge; present research. Identical report of Committee on Sewage Sludge to Sanitary Section, Am. Puc. Health Assn. and to Am. Soc. Mun. Improvements.

Treatment Works. The Sewage Treatment Works of Syracuse, N. Y., Am. City, vol. 33, nos. 4 and 5, Oct. and Nov. 1925, pp. 356-359 and 501-502, 12 figs. System involves large intercepting sewer, plain sedimentation, dilution, and sludge sterilization.

Works. New Sewage Purification Works for Epsom. Surveyor and Mun. and Cty Engr., vol. 68, no. 1761, Oct. 16, 1925, pp. 315-317, 2 figs. Describes new disposal works which has recently been completed for purification of sewage from large mental hospitals in Epsom district, England, by "Simplex" surface aeration process; operation.

SEWAGE TREATMENT

Purification. Methods of Sewage Purification, F. W. Harris. Surveyor and Mun. and Cty. Engr., vol. 68, no. 1755, Sept. 4, 1925, pp. 197-198. Discusses activated sludge or bio-aeration process. Paper read before Roy. Sanitary Assn. Scotland.

SEWERS

Intercepting. Intercepting Sewers and Disposal Plant at Laramis, Wyoming, F. M. Veatch. Eng. News-Rec., vol. 95, no. 20, Nov. 12, 1925, pp. 794-795, 2 figs. Details of investigation, disposal plant and sludge bed.

Pipe, Laying of Vitrified-Clay. How to Lay Vitrified Clay Sewer Pipe. Contract Rec., vol. 39, no. 40, Oct. 7, 1925, pp. 974-975. Practice recommended by Clay Products Assn.; specifications cover excavation, bracing and shoring, foundations, pipe laying, joints and backfilling.

SHEET METAL

Drawability of Sheets and Strips. Drawability of Sheets and Strips, H. S. Marsh and R. S. Cochran. Iron Age, vol. 116, no. 19, Nov. 5, 1925, pp. 1251-1252, 1 fig. Marco system of measuring; simplified method of expressing Erichsen and similar results.

SHEET-METAL WORKING

Hot Stampings. Hot Stampings and Their Production, G. F. Keyes. Soc. Automotive Engrs.—Jl., vol. 17, no. 5, Nov. 1925, pp. 452-454, 5 figs. Dies are cast from models; make "pick-ups" for "break-downs"; quality results from long experience.

SLIDE RULES

Making of Special. The Making of Special Slide Rules, G. W. Greenwood. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1002-1006, 14 figs. Details of steps to be taken in constructing arithmetical and logarithmic scales, and of their use in construction of slide rules; description of slide rules for solution of various formulas.

SNOW REMOVAL

Streets. Snow Removal from City Streets, L. W. Russel. Am. City, vol. 33, nos. 4 and 5, Oct. and Nov. 1925, pp. 389-392 and 503-506, 4 figs. Anticipation of storms is a great aid in determining nature, severity, and probable time of their arrival; attack should be planned in advance; in Worcester, Mass., storms should be divided into 8 divisions as follows: heavy rain-storms, slush-storms, slippery streets and walks, light snow, heavy snow, blizzards with very heavy snow, heavy ice storms, and unexpected emergencies.

SPRINGS

Electric Measuring Instruments. Springs for Electrical Measuring Instruments, B. W. St. Clair. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1057-1058, 4 figs. Brief statement of general spring problem in so far as it relates to electrical instruments.

Helical. Manufacture of Commercial Steel Helical Springs, F. H. Brown. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 1053-1055, 2 figs. Present status of art of manufacturing small- and medium-diameter springs; trade requirements; methods of manufacture; materials and their selection.

STEAM

High-Pressure. Electrotechnics and High-Pressure Steam (Elektrotechnik und Hochdruckdampf), Löffler. Elektrotechnik u. Maschinenbau, vol. 43, no. 28, Sept. 20, 1925, pp. 738-744, 4 figs. Discusses production of high-pressure steam, safety of high-pressure vessels, application in electric power plants, bleeding steam for feedwater preheating, pulverized coal firing, etc.; concludes that with high-pressure steam operation greater efficiency can be obtained than with any other method of energy production.

Growth of Steam Pressure and Economies, W. R. Herod. Power Plant Eng., vol. 29. no. 22, Nov. 15, 1925, pp. 1137-1138, 2 figs. Recital of events that have reduced steam consumption from 150,000 to 11,000 B.t.u. per kw-hr. generated.

Natural, from Geyser. Electric Generators Driven by Geyser Power, J. Hammond. Assn. Chinese & Am. Engrs.—Jl., vol. 6, no. 7, July 1925, pp. 73-75. Two wells were drilled in Sonoma County, California; at depth of 203 ft. unharnessing constant flow of live, superheated steam; electrical possibilities were tried out by connecting 35-kw. General Electric turbine-generator to original tap; nearby hotel, cottages, etc., were electrically illuminated from this source.

Pressure Regulation. Pressure Regulation in Process-Heating Installations (La distribution de la vapeur à pression constante). Génie Civil, vol. 87, no. 13, Sept. 26, 1925, pp. 271-273, 7 figs. Live steam has often to be used to supplement steam exhausted or extracted from prime movers, and there are frequently considerable variations in pressure owing to independent fluctuations in demand for power and process steam; as result of such variations in pressure, valves in heating mains are commonly opened too widely; consumption of steam is therefore excessive, and materials may be damaged by overheating; best results are obtained by operating heating mains at constant pressure, and by not subordinating running of prime movers to steam demand of heating apparatus; describes use of Ruths steam accumulator, controlled by Arca pressure regulator.

STEAM ENGINES

Foundations. Fractures in Horizontal Engine Beds, E. Ingham. Power, vol. 62, no. 18, Nov. 3, 1925, pp. 688-689, 2 figs. Principal causes are unsatisfactory design, faulty casting, and yielding of foundations, each of which is discussed.

STEAM METERS

Siemens & Halske. Steam Meters. Power Engr., vol. 20, no. 235, Oct. 1925, pp. 386-388, 7 figs. Utility of these instruments is displayed by means of several examples, after which principles and construction of Siemens & Halske design are described.

STEAM POWER PLANTS

Cost Analysis. Cost Analysis Indicates Way to Economy. Power Plant Eng., vol. 29, no. 18, Sept. 15, 1925, pp. 947-950, 5 figs. Careful analysis of power costs in Cincinnati office building shows advisability of retaining their private plant.

Economical Operation. Results of an Engineering Study of Paper Coating Factory's Power Plant, J. G. Berger. Power, vol. 62, no. 20, Nov. 17, 1925, pp. 752-753, 2 figs. Outline of method followed in study of power problems of factory; engines were over loaded to point of poor economy; purchased current was recommended for auxiliary power, which plan reduced cost of power.

Fuel Waste. An Amazing Example of Fuel Waste, F. C. DeWeese. Power Plant Eng., vol. 29, no. 22, Nov. 15, 1925, pp. 1152-1154, 2 figs. Investigation of conditions in individual power plant reveals loss of $17,000 per year.

Industrial. The Supply of Industrial Power, Wm. H. Larkin, Jr. Mech. Eng., vol. 47, no. 11a, Mid-November 1925, pp. 993-1001, 7 figs. To assist in determining efficiency of plant operation, tables of actual operating data and costs from industrial power plants scattered about country are shown, including plants which use purchased electric power; paragraphs are included on economy of operation which indicate desirability of power-plant supervision from manager's office—need of instruments so that what is taking place can be known; necessity and value of feedwater treatment; importance of accuracy in making up power costs; advisability of coal and fuel testing; outlines methods by which quality and relative cost of supply of industrial power may be estimated.

Small. Justifiable Small Power Plants, A. B. Mallison. Instn. Elec. Engrs.—Jl., vol. 63, no. 345, Sept. 1925, pp. 896-901 and (discussion) 901-915. Discusses power plants, water, wind, by-product to process steam, from process refuse, household and town refuse; comments on small self-contained power plant relative to superpower station and its network; examples of capital and operating costs of typical installations in various industries.

STEAM TURBINES

Back-Pressure. Steam-Consumption Tests on a Back-Pressure Turbine Built by Brown, Boveri & Co., Ltd., Baden, Switzerland, A. Stodola. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 915-916, 1 fig. Results of tests on 1000-kw. back-pressure turbine fitted with single-row impulse wheel and 28 reaction stages mounted on a drum. Translated from Zeit. des Vereines deutscher Ingenieure, vol. 69, no. 37, Sept. 12, 1925.

Brown-Boveri. The New Brown Boveri Turbines for Large Outputs, W. G. Noack. Brown Boveri Review, vol. 12, no. 10, Oct. 1925, pp. 199-202, 4 figs. Describes new type of turbine for large outputs which is a reaction turbine constructed in three cylinders for normal heat drops; only first and second stages work on impulse principle but with a certain amount of reaction.

Efficiency. Steam Measurements of a BBC Maximum Efficiency Turbine (Dampfmessungen an einer BBC-Grenzleistungsturbine), Ad. Meyer. Elektrotechnik u. Maschinenbau, vol. 43, no. 40, Oct. 4, 1925, pp. 800-805, 9 figs. Details of verification test for determining thermodynamic efficiency at various loads of Kopenhagen turbine, carried out by Prof. Dresden of Delft, showing an efficiency of 80.3-83 per cent at full load, 78.9 per cent at 70 per cent load, and 81.6 per cent at 30 per cent excess load, considered as very good for a turbine of simple design.

STEEL

Aeronautics, Use in. Steels Used in Aero Work, W. H. Hatfield. Roy. Aeronautical Soc.—Jl., vol. 29, no. 178, Oct. 1925, pp. 469-511 and (discussion) 511-534, 30 figs. Deals with use of steel in aeronautics; discusses use of high-class material; scientific methods in works practice; duties of various parts; factors of strength; mechanical tests; thermal phenomena of steels; typical steels; forging and drop stamping; normalizing and annealing; hardening and tempering; machining properties; case-hardening; specifications.

Alloy. *See Alloy Steels.*

Defective. Defective Material and Processes, H. Brearley. Forging—Stamping—Heat Treating, vol. 11, no. 10, Oct. 1925, pp. 375-378, 6 figs. Commends use of simple means of investigation for defects such as pickling, etching and sulphur printing.

Definition. Definition of "Steel" and "Cast Iron," K. Honda. Iron and Coal Trades Rev., vol. 111, no. 3003, Sept. 18, 1925, p. 450, 2 figs. Discusses different definitions.

Iron and. *See Iron and Steel.*

Manganese. *See Manganese Steel.*

Rolled, Defects in. Developments in Drop Forging Production. Forging—Stamping—Heat Treating, vol. 11, no. 10, Oct. 1925, pp. 353-354. Brief review of most prevalent defects in rolled steel found by regular bar inspection; accurate checks possible on forging qualities of steel.

STEEL CASTINGS

Manufacture for Navy Use. Making Miscellaneous Steel Castings for Navy Use, D. F. Ducey. Am. Foundrymen's Assn.—advance paper, no. 475, for mtg. Oct. 5-9, 1925, 13 pp. 4 figs. Methods used in managing steel foundry supplying repair castings for U. S. Navy; describes equipment of foundry; discusses special green sand facing together with use of special fillets; describes system of planning and routing and forms used. See (abstract) in Foundry Trade Jl., vol. 32, no. 478, Oct. 15, 1925, p. 330, 1 fig.

Samples, Preparation for Chemical Analysis. Preparation of Samples from Steel Castings for Chemical Analysis. Research Group News, vol. 2, no. 3, Oct. 1925, pp. 7-8. Enumerates cause from which incorrect determinations may result; emphasizes importance of precautions such as are outlined.

STEEL, HEAT TREATMENT OF

Alloy Steel. Steel Treating and Its Value to the Steel Engineer, R. F. Crump. Iron and Steel Engr., vol. 2, no. 10, Oct. 1925, pp. 409-416, 5 figs. Development of machinery parts; methods and materials in use to give more effective results in wearing problems encountered; nature and physical properties of Stroh steel, its advantages and use in steel-plant wearing problems; definite application of special alloy to steel industry, with comparative costs and wearing life.

Electric Annealing. Electric Annealing of Steel, H. Fulwider. Iron and Steel of Can., vol. 8, no. 10, Oct. 1925, pp. 208-209. Advantages of electric heat; aging iron castings; annealing silicon sheet steel. (Abstract.) Report included in power committee report of Nat. Elec. Light Assn.

Fundamental Purposes and Effects. Heat Treatment and Metallography of Steel, H. C. Knerr. Forging—Stamping—Heat Treating, vol. 11, no. 10, Oct. 1925, pp. 361-365, 11 figs. Practical course in elements of physical metallurgy. Heat treatment: fundamental purposes and effects; annealing.

Principles of. Facts and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. Steel Treating—Trans., vol. 8, no. 4, Oct. 1925, pp. 484-506, 7 figs. Objectives of annealing and lonealing; relieving strains; softening; refining grain and toughening; purchase of annealed steel; annealing process; heating for annealing; soaking at annealing temperature; cooling; effect of heat treatment on free cementite; normalizing; spheroidizing; lonealing.

Quenching. Initial Temperature and Mass Effects in Quenching, H. J. French and O. Z. Klopach. U. S. Bur. Standards, Technologic Papers, no. 295, Aug. 25, pp. 590-618, 11 figs. Results of quenching experiments with high-carbon steels in which speed of cooling was determined at center of spheres, rounds, and plates of various dimensions quenched from various temperatures into different coolants, such as water, 5 per cent NaOH, oils, and air; cooling velocity at 720 deg. cent. is taken as best measure of hardening produced, and relations are developed between this and size and shape of steel quenched.

STEEL MANUFACTURE

Basic Process. The Production of Different Kinds of Steel in Basic Steel Works (Die Herstellung verschiedener Stahlsorten im Thomaswerk), E. Faust. Stahl u. Eisen, vol. 45, nos. 41 and 42, Oct. 8 and 15, 1925, pp. 1701-1704 and 1739-1742 and (discussion) 1742-1743. Characteristics of suitable pig-iron compositions for blasting of weldable steel, rail and hard steel, as well as different kinds of wire steel; comparison of methods employed by different works for production of these steels.

Converter Process. Carbon Steel and Carhon Vanadium Steel by the Converter Process, S. R. Robinson. Am. Foundrymen's Assn.—advance paper, no. 474, for mtg. Oct. 5-9, 1925, 8 pp. Practice is that of plant making castings, entering into such product as locomotive cranes, which plant is using converter method of producing steel; gives physical specification for "as cast" unannealed steel, then discusses melting and refining equipment used; refining processes are detailed; heat treatments for regular carhon steel and for cast tooth gears for extra heavy duty; carhon-vanadium steel practice; use of special skim gates for steel castings is said to have eliminated much trouhle due to dirty castings.

STOKERS

Developments. Stokers and Furnaces. Combustion, vol. 13, no. 5, Nov. 1925, pp. 280-284 and 290, 4 figs. Discussion of air heaters, water-cooling furnace walls, furnace repairs, foreign practice, etc., together with statements hy memher companies. From 1925 Report of prime Movers Committee of Nat. Elec. Light Assn.

STREAM POLLUTION

Investigations and Problems. Stream Pollution—A Symposium. Am. Soc. Civ. Engrs.—Proc., vol. 51, no. 9, Nov. 1925. Contains following contributions: Review of the Work of the United States Public Health Service in Investigations of Stream Pollution, W. H. Frost, pp. 1810-1818, including hibliography; Rate of Deoxygenation of Polluted Water, E. J. Thériault, pp. 1819-1828, 3 figs.; Rate of Atmospheric Reaeration of Sewage Polluted streams, H. J. W. Stokim, pp. 1829-1842, 10 figs.; Quantitative Studies of Bacterial Pollution and Natural Purification in the

STREETS

Widening and Resurfacing. Pavements Salvaged by Widening and Resurfacing. Eng. News-Rec., vol. 95, no. 21, Nov. 19, 1925, pp. 838-840, 4 figs. Rough and narrow Chicago streets being converted into adequate traffic ways serviceable for another decade by asphalt topping and expansion sideways.

STRUCTURAL STEEL

Commercial and Technical Problems. Larger Markets and Better Methods for Structural Steel. Eng. News-Rec., vol. 95, no. 21, Nov. 19, 1925, pp. 844-845. Fabricators at meeting of Am. Inst. Steel Constr. take up commercial and technical prohlems; fireproofing, earthquakes, welded joints and rivet heating, are discussed.

SURVEYING

Stereoscopic Photography. The Predhumeau Stereotopometer. Engineering, vol. 12, no. 3122, Oct. 30, 1925, pp. 531-533, 8 figs. Special system of surveying hy stereoscopic photography developed hy M. J. Predhumeau of France; main novelty of methods lies in instrument used for measuring or mapping "virtual model" provided by stereoscopic photographs; describes also instrument for taking photographs.

SWITCHGEAR

Design. Some Considerations on Modern Switchgear, E. Brian. Brown, Boveri Rev., vol. 12, no. 10, Oct. 1925, pp. 209-213, 4 figs. Influence on switchgear design of experience gained in operating power stations in parallel.

T

TELEPHONY

Testing Methods. Telephone Testing Methods, P. K. Higgins. Telephone Engr., vol. 29, no. 10, Oct. 1925, pp. 33-37 and 48, 20 figs. Description of various instruments employed and methods of using them; importance of insulation tests; locating alternating current crosses; determining and testing assorted troubles.

TEXTILE MACHINERY

Wool-Spinning. Wool-Spinning Machinery at the British Empire Exhibition. Engineering, vol. 120, no. 3122, Oct. 30, 1925, pp. 558-559, 5 figs. Details of exhibits at Australian pavilion; includes collection of working machinery which shows whole process which wool goes through after it has been washed and dried up to its delivery in hanks or "heads" of yarn in hundles ready for wrapping and distribution.

TRAFFIC

Control. Some Unconsidered Factors in the Control of Street Traffic, A. G. Dalzell. Contract Rec., vol. 39, no. 38, Sept. 23, 1925, pp. 922-925, 8 figs. Consideration not usually given to effect of curb obstructions in slowing up traffic; there must he fewer inducements for traffic to stop if congestion is to be prevented.

Synchronized Traffic Control is Costly to Street Railway, L. D. Bale. Aera, vol. 14, no. 2, Sept. 1925, pp. 163-169, 5 figs. Cleveland has synchronized traffic control system in operation in part of its downtown district, and it is proposed that system be extended to certain parallel streets; Cleveland Ry. finds by investigation that while such regulation of vehicular traffic speeds movements of autos and prohably makes for safety of pedestrians, it slows schedules of cars, increases amount of power consumed and creates new problems costly to solve.

TRANSFORMERS

Magnetizing-Current Wave Forms. Polyphase Transformer Magnetizing-Current Wave Forms, P. Kemp. and H. P. Young. Instn. Elec. Engrs.—Jl., vol. 63, no. 345, Sept. 1925, pp. 877-895, 25 figs. Deals with analyses of magnetizing currents taken by groups of transformers connected in various manners for operating on polyphase (and particularly on 3-phase) systems; discusses properties of star, delta, tee- and vee-connected windings, particularly with reference to harmonics, oscillographic confirmation being given where possihle. Bibliography.

Testing. Testing Westinghouse Transformers. C. H. Champlain. Mgmt. and Admin., vol. 10, no. 5, Nov. 1925, pp. 265-266, 4 figs. Equipment and methods used at new Sharon plant.

TRANSPORTATION

Munich Show, Germany. German Transportation Exposition at Munich, 1925 (Deutsche Verkehrs-Ausstellung München 1925), D. Przygode. Elektrotechnische Zeit., vol. 46, nos. 38 and 40, Sept. 17 and Oct. 1, 1925, pp. 1431-1436 and 1504-1508, 16 figs. Details of design and construction of electric, Diesel-electric, and storage-battery locomotives; trucks; electric communication, telegraph and telephone; instruments; generators; etc.

Railplane System. The "Railplane" System of Transport. Ry. Gaz., vol. 43, no. 13, Sept. 25, 1925, pp. 381-382, 4 figs. Aerial cars, driven by screws, suspended from overhead guide-rail structures carried over existing railways or roads; system devised by Geo. Bennie, of Bute, N. B.

Railway and Highway, Co-ordination of. The Co-ordination of Rail and Road Transport, D. R. Lamb. Inst. Transport—Jl., vol. 6, no. 9, July 1925, pp. 468-478 and (discussion) 478-491. Author endeavors to set forth present position in connection with commercial road transport, in so far as it affects railways, road haulers and traders; to indicate lines of possible development and to suggest methods of co-ordination calculated to prove of mutual advantage to road transport and railway industries.

TUBES

Flexible. Production and Use of Thin-walled Flexible Metal Tubes (Entstehung, Herstellung und Verwendung dünnwändiger defernder Metallrohre), H. Sandvoss. Gesundheits-Ingenieur, vol. 48, no. 36, Sept. 5, 1925, pp. 445-450, 38 figs. Discusses production of tubes of 0.2 mm, wall thickness from red brass seamless tubes, and their application in construction of thermostats for various uses; water temperature control apparatus, steam pressure redness, draft regulators for hot-water heating boilers and low-pressure steam hoilers, distance thermostats, etc.

Steel, Seamless. Making Seamless Steel Tuhes by Improved Processes, E. F. Ross. Iron Trade Rev., vol. 77, no. 18, Oct. 29, 1925, pp. 1079-1083 and 1091, 9 figs. Most recent development is perfection of new process which features use of square hillets; Wellman-Peters process has been known in Germany for over 2 years hut most recent and modern installation is at steel works of Howell & Co., Sheffield, Eng.; also known as push-hench process.

Steel, Welding. Welding Steel Tuhing and Sheet with Chromium-Molybdenum Welding Wire, F. T. Sisco and H. W. Boulton. Am. Soc. Steel Treating—Trans., vol. 8, no. 5, Nov. 1925, pp. 589-619 and (discussion) 619-620 and 665-668, 26 figs. In welding chromium-molybdenum steel seamless tubing and chromium-vanadium steel sheet, chromium-molyhdenum welding wire produces weld which has more desirable and uniform structure than low-carhon welding wire; in welding chromium-molyhdenum steel tubing to plain carbon steel tuhing chromium-molybdenum steel welding wire is not greatly superior and may even be inferior to low-carbon welding wire.

TUNNELING

Windsor-Detroit. Tunnels Planned from Windsor to Detroit, Contract Rec., vol. 39, no. 43, Oct. 28, 1925, pp. 1034-1039, 8 figs. Details regarding construction of a system of electric railway and automohile tunnels under Detroit River between Detroit, Mich., and Windsor, Ont., excellent terminal arrangements.

V

VENTILATION

Nature of. What is Ventilation? P. West. Am. Soc. Heat and Vent. Engrs.—Jl., vol. 31, no. 10, Oct. 1925, pp. 477-485. Definition of ventilation; necessity of ventilation; kind of ventilation to use; advantages of ventilation; cost of ventilating equipment and of its operation; kind of ventilating apparatus to use; design and operation of ventilating apparatus.

VIBRATION

Effect on Metals. Vibration. Metallurgist (Supp. to Engineer, vol. 140, no. 3644), Oct. 30, 1925, p. 145. Results of fatigue tests carried out hy C. F. Jenkin, of Oxford; it seems that, provided amplitude of vihrations is kept well below normal fatigue range, no injury to material need be feared as result of more rapidity of oscillations.

Recorder. An Instrument for Recording Vibrations, L. H. Young. Mech. Eng., vol. 47, no. 11, Nov. 1925, pp. 907-908, 6 figs. Portahle instrument for measuring and recording amplitude and frequency of vibrations encountered in buildings, bridges, and small earth tremors, developed in Laboratory of Indus. Physcis at Mass. Inst. of Technology.

W

WAGES

Group-Bonus Plan. Wage Incentives—The Group-Bonus Plan, B. R. Mayne. Am. Foundrymen's Assn.—advance paper, no. 483, for mtg. Oct. 5-9 1925, 11 pp., 1 fig. Describes method of setting bonuses for various groups as follows: core-room labor; core delivery and assembly; pouring iron; shifting weights and molds; operating bull ladles; night work; melting; hard iron smelting; sorting and grinding; annealing; and foreman bonuses; time study is used in determining rates.

Incentives. Payment and Incentive in Industry, C. Haslett. Indus. Mgmt. (Lond.), vol. 12, no. 10, Oct. 1925, pp. 479-481. Discusses payment in relation to output, pricing committees, piecework price lists or "parish paters," labor costs, railway work-shops, payment by premium bonus, calculating premium, overcoming fluctuations, and "Pluck" system.

WATER PIPES

Iron Bacteria and Incrustation. Iron Bacteria and Water-Pipe. Surveyor and Mun. and Cty. Engr., vol. 68, no. 1757, Sept. 18, 1925, pp. 241-242. Notes on investigation into its causes.

WATER POWER

Comparison with Steam Power. Water Power and Steam Power (Vattenkraft och Angkraft), S. Velander. Teknisk Tidskrift (Elektroteknik), vol. 55, no. 9, Sept. 5, 1925, pp. 145-152, 4 figs. Contribution to subject of economical comparisons between water and steam power; author maintains that accepted standards of comparison between two possihilities of future development in Sweden to not place some of important features of water-power development in their proper light; conclusions indicate that future development in Sweden should be centered on water power, and that steam-power generation should be used only in cases where waste material from sawmills and similar fuels are availahle.

WATER PURIFICATION

Bacteriological Examination. Bacteriological Examination of Water, C. T. Butterfield. Can. Engr., vol. 49, no. 17, Oct. 27, 1925, pp. 500-501. Detailed description of methods which constitute good practice for water purification plant lahoratories. Paper read at Third Annual Ohio Conference on Water Purification.

WATER SUPPLY

Hetch Hetchy Project, California. Present Status of Hetch Hetchy Water Supply and Power Project, N. A. Eckert. Mun. and City, Eng., vol. 69, no. 4, Oct. 1925, pp. 213-218. Notes on Lake Eleanor dam, O'Shaughnessy dam, watershed, early intake diversion dam, aqueduct tunnel, Priest dam and reservoir, Moccasin power tunnel, surge chamber penstocks, power house huilding, water wheels and generators, transformers, transmission line, power contract and Bay Crossing division.

Intakes. Construction of Intake at Goderich, Ont., E. H. Darling. Can. Engr., vol. 49, no. 16, Oct. 20, 1925, pp. 469-471, 5 figs. Low water necessitated laying of new intake into Lake Huron to increase water supply; new intake is 24-in. diameter, 2482 ft. long, and is made up of both cast iron and steel pipe.

WATER TREATMENT

Sedimentation. The Value of Sedimentation in the Treatment of Turhid River Water, W. Kiersted. Am. City, vol. 33, no. 5, Nov. 1925, pp. 469-473. Discusses history of sedimentation, observed action of settling basins, forces influencing sedimentation, conditions influencing sedimentation, conditions affecting structural economy, principles of flow, method of operating settling basin, inlet and outlet arrangements, layout of sedimentation basin. From paper read before Texas Section of Southwest Water Wks. Assn.

WELDING

Definitions and Symbols. Definitions and Designations in Welding Technics und Bezeichnungen auf dem Gehiete der Schweisstechnik), G. Hilpert. Maschinenbau, vol. 4, no. 20, Oct. 1, 1925, pp. 999-1001, 3 figs. Details of definitions and symbols proposed hy German Committee on Welding to designate the various kinds of welding and symbols for seams resulting.

Electric. *See Electric Welding; Electric Welding, Arc; Electric Welding-Resistance.*

Oxyacetylene. *See Oxyacetylene Welding.*

Engineering Index

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A

AIR COMPRESSORS

Centrifugal, Testing. The Heat Balance Method of Testing Centrifugal Compressors, M. G. Robinson. Am. Soc. Mech. Engrs.—advance paper for mtg. Nov. 30-Dec. 4, 1925, 23 pp., 11 figs. Describes method which is simple and direct, in which principle is used that balance exists between mechanical energy supplied by rotation of shaft and heat-energy increase in air which is being compressed, heat-energy increase in cooling water used, and heat lost from casing, bearings, and packings; with proper testing apparatus and due precautions this heat energy may be accurately measured and hence power input established; very satisfactory results have been obtained by application of method.

Electrically-driven. A New Type of Electrically-driven Air Compressor. Commonwealth Engr., vol. 13, no. 1, Aug. 1, 1925, pp. 17-18. Particulars of N-SE electrically-driven compressors manufactured by Consolidated Pneumatic Tool Co., Fraserburgh, Scotland, made in capacities from 107 to 1196 c. ft. of free air per minute piston displacement, which in horsepower rating is from 20 to 100; suitable for all classes of work where air pressure does not exceed 125 lb. per sq. in.

AIR PUMPS

Steam-Jet. New Developments in High Vacuum Apparatus, G. L. Lothny. Soc. Nav. Architects & Mar. Engrs.—advance paper, no. 1, for mtg. Nov. 12-13, 1925, 7 pp., 13 figs. on 11 supp. plates; also (abstract) in Mar. Eng. & Shipg. Age, vol. 30, no. 12, Dec. 1925, pp. 717-718, 3 figs. and (discussion) pp. 689-690. Records most important developments in design and performance of steam air ejectors made during last 6 years.

AIRPLANE ENGINES

Design. Designing Engines Into Airplanes, J. G. Vincent. Aviation, vol. 19, no. 22, Nov. 30, 1925, pp. 776-778, 3 figs. Air and water-cooled engines; types of water-cooled engines; geared or direct drive; advantages of geared drive; engines for pursuit types.

Splines and Serrations. Splines and Serrations, H. T. Wright. Machy. (Lond.), vol. 27, no. 687, Nov. 26, 1925, pp. 259-262, 13 figs. Principles underlying design of splined connections and serrated shafts, with special reference to aircraft work.

AIRPLANES

Aerodynamic Characteristics. Aerodynamic Characteristics of Aircraft with Reference to Their Use, M. Panetti. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 339, Nov. 1925, 12 pp. Definition of characteristics of airplanes, gradually becoming more precise, minutely describes and almost identifies type, by imposing choice of ever more perfect shape for satisfying requirement; necessity of positive knowledge of properties of wing profiles and of aerodynamic characteristics of wings and stabilizing planes, is pointed out. Translated from L'Ala d'Italia, Apr. 1925.

All-Metal. Advantages of the All-Metal Airplane, W. B. Stout. Automotive Mfr., vol. 67, no. 7, Oct. 1925, pp. 8-10 and 26. A consideration of airplane transport from a purely commercial viewpoint, and type of "ship" which has resulted; constructional details.

Statics. Stage of Development and Problems in Modern Airplane Statics (Entwicklungsstand und Probleme der modernen Flugzeugstatik), K. Rühl. Bauingenieur, vol. 6, no. 25, Sept. 25, 1925, pp. 58-75, 6 figs. Discusses importance of statics and gives numerical examples; examines static structure of airplane; discusses principal post-war tendencies, influence of airplane statics on general building statics.

Wings. A Method for the Direct Determination of Wing-Section Drag, A. Betz. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 337, Nov. 1925, 8 pp., 3 figs. on supp. plate. Explains theoretical principles on which method developed by Ackeret for calculating wing-section drag directly from energy loss of air is based. Translated from Zeit. für Flugtechnik u. Motorluftschiffahrt.

AIRSHIPS

Large. Some Matters Relating to Large Airships, G. Fulton. Soc. Nav. Architects & Mar. Engrs.—advance paper, no. 12, for mtg. Nov. 13-14, 1925, 14 pp., 12 figs. on 11 supp. plates; also (abstract) in Mar. Eng. & Shipg. Age, vol. 30, no. 12, Dec. 1925, pp. 702-703. Author thinks there is no room for doubt as to ultimate future of airship as means for bridging long over-water distances, and one thing stands out clearly—use and handling of large airships is intimately bound up with marine knowledge. Includes appendix, giving comparatively characteristics of Shenandoah and Los Angeles.

ALLOY STEELS

Electric. Electric Alloy Steel, F. E. Clark. Am. Iron & Steel Inst.—advance paper, for mtg. Oct. 23, 1925, 10 pp. Basic electric process; acid process; general considerations.

See also Silicon Steel; Tool Steel; Vanadium Steel.

ALLOYS

Aluminum. *See Aluminum Alloys.*

Brass. *See Brass.*

ALUMINUM ALLOYS

Duralumin. *See Duralumin.*

Influence of Various Metals on. On the Influence of Various Metals in Small Quantities On the Nature of Aluminium Alloys, T. Harada. College of Eng.—Memoirs, Kyoto Imper. Univ., vol. 3, no. 9, June 1925, pp. 231-265, 86 figs. on supp. plates. Particulars of research whose aim was based on study of influence of various metals in small quantities upon physical, chemical, and mechanical properties and structure of aluminum, and to obtain some new alloys with improved properties applicable to present-day aluminum industry.

AMMONIA COMPRESSORS

Lubrication. Notes on the Lubrication of Ammonia Compressors, C. H. S. Tupholme. World Power, vol. 4, no. 23, Nov. 1925, pp. 272-273. Quality of oil is essential property influencing amount of feed necessary for maintenance of proper lubrication and piston seal, and oil of poor quality will do neither; other objectionable results from use of unsuitable oils.

Sleeve-Valve. New Sleeve Valve Compressors at Barking. Cold Storage, vol. 28, no. 311, Oct. 15, 1925, pp. 414-417, 8 figs. Results achieved at ice making, cold-storage, and ice-cream plant of East London Cold Storage and Ice Co., Ltd., at Barking, where two three-cylinder high-speed compressors of sleeve-valve type have been running almost continuously day and night since April.

AMMONIA CONDENSERS

Care and Operation. Operation and Care of Ammonia Condensers, H. R. Halterman. Universal Engr., vol. 42, no. 5, Nov. 1925, pp. 24-26. Condensers classified; care and operation; condenser water supply; cooling ponds; cooling towers. Papers read before N.A.P.R.E.

APPRENTICES, TRAINING OF

Self-Supporting System. A Self-supporting Apprenticeship System. Machy. (N. Y.), vol. 32, no. 4, Dec. 1925, pp. 326-328, 4 figs. Features of apprenticeship system conducted by Marion Steam Shovel Co., Marion, O.

ARCHES

Pressure Pipe-Line. Pressure Pipe-Line Arch over the Durance. Engineering, vol. 120, no. 3123, Nov. 6, 1925, pp. 506-507, 11 figs. partly on supp. plates. Describes conduit in the Hautes Alpes, France, which has interior diam. of 2.688 m. (8 ft. 9¾ in.) and span of 68 m. (223 ft.); it is entirely self-supporting.

AUTOMOBILE ENGINES

Carburetors. *See Carburetors.*

Developments. Recent Tendencies in the Field of Automobile Engines (Nutida sträbanden på automobilmotoromradet), E. Hubendick. Teknisk Tidskrift, vol. 55, nos. 38 and 42, Sept. 19 and Oct. 17, 1925, pp. 113-122 and 130-137, 50 figs. Discusses constructive improvements, behavior at maximum compression, size and form of combustion chamber, reduction of piston weight, light metal and cast-iron pistons, fuel consumption, Daimler-Mercedes engine, etc.

Six-Cylindered. Six-Cylinder Commercial-Vehicle Engine. Engineering, vol. 120, no. 3128, Dec. 11, 1925, pp. 738-739 and 742, 4 figs. Details of 6-cylinder engine with side-by-side valves, designated by makers, W. H. Dorman & Co., as 6-J.U. model.

Spark Plugs. *See Spark Plugs.*

AUTOMOBILES

Headlights. Improved Automobile Headlighting, A. W. Devine. Illuminating Eng. Soc.—Trans., vol. 20, no. 9, Nov. 1925, pp. 937-956, 2 figs. Gives short history of development of automobile headlamps and of efforts by state authorities to handle problem of headlighting; outline of problem given and solution offered which is based on improvement in headlamp construction and more stringent specifications for laboratory test; principles upon which approval of electric headlamps by state authorities is based; etc.

Improving Motor Vehicle Headlighting Under the American Standard System, R. N. Falge. Illuminating Eng. Soc.—Trans., vol. 20, no. 9, Nov. 1925, pp. 957-969 and (discussion) 969-980, 10 figs. partly on supp. plates. Outlines development of motor-vehicle headlighting practice and factors that at present make night-driving conditions unsatisfactory; takes up especially limitations of fixed beam system and great advantage to be gained with depressible beams; explains in detail new two-filament lamp for depressible-beam lighting and optical principles involved in its most effective application in equipments.

Transmissions. Arrangement of Mechanical and Hydraulic Power Transmission Between Engine and Driving Axle in Motor Vehicles (Anordningar för mekanisk och hydraulisk kraftöverföring mellan motor och drivaxlar å motorfordon), E. Nothin. Teknisk Tidskrift, vol. 55, no. 38, Sept. 19, 1925, pp. 122-128 (Mekanik), 12 figs. Discusses A.E.G., Delavauds, and Constantinesco mechanical types, Föttinger, Lenz, Williams-Janney hydraulic types, their design, construction and operation.

B

BEARINGS

Oil Film in, Study of. Charts for Studying the Oil Film in Bearings, Geo. B. Karelitz. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 22 pp., 14 figs. It has been shown several times that hydrodynamical theory of lubrication satisfactorily explains mechanism of lubrication; charts presented give designer or investigator means of determining with sufficient accuracy shape and pressures in oil film for bearings under different conditions.

BEARINGS, BALL

Lubrication. The Lubrication of Ball and Roller Bearings. Commonwealth Engr., vol. 12, no. 12, July 1, 1925, pp. 443-447, 6 figs. Aim of ball and roller bearings is to replace sliding friction by rolling friction, but they must be well lubricated, otherwise they deteriorate rapidly; aim of lubricant is to provide a fluid film between balls and cages, to preserve polished film on surfaces of balls, and to seal bearings against ingress of dust, moisture or corrosive influences where housings are not capable of so doing; points are dealt with.

BELTING

Leather. Applications of Leather Belting, R. F. Jones. Textile Wld., vol. 67, nos. 14 and 19, Oct. 3 and Nov. 9, 1925, pp. 85, 87, and 89; and 77 and 79, 12 figs. Summary of research work by Leather Belting Exchange Foundation, covering pulley diameter, pulley ratio, center distance between pulleys, effect of high belt speeds, gravity idler, and new rating curves and tables for leather belting.

Determining the Quality of Leather Belting, L. W. Arny. Paper Mill, vol. 49, no. 44, Oct. 31, 1925, pp. 6, 16, and 46, 5 figs. Discusses methods of determining quality and requirements of a good belt.

Tension Ratio and Transmission Power. The Tension Ratio and Transmissive Power of Belts, C. A. Norman. Mech. Eng., vol. 47, no. 12, Nov. 1925, pp. 1111-1113, 5 figs. Investigation of increase of transmissive power with slip was conducted on apparatus patterned after that of Friedrich at Ohio State Univ. on rubber, leather, and fabric belts; results of investigation are given in form of curves, and conclusions drawn from tests are noted.

BLAST FURNACES

Tapping. Tapping the Furnace in Safety, E. B. Speer. Blast Furnace & Steel Plant, vol. 13, no. 12, Dec. 1925, pp. 478-481, 6 figs. Increasing size and capacity of blast furnaces demands replacement of old-fashioned hand methods by modern mechanical equipment.

BLASTING

Explosives, Use of. Blasting and the Use of Explosives, F. F. McLaughlin. Eng. & Contracting (General Contracting), vol. 64, no. 6, Nov. 18, 1925, pp. 1107-1111. Describes accident prevention measures in quarrying. Paper presented at convention of Nat. Safety Council.

BOILER FEEDWATER

Treatment. Zeolite Method, C. W. Sturdevant. Pac. Ry. Club—Jl., vol. 9, no. 5, Aug. 1925, pp. 28-30 and (discussion) 30-39. Advantages of base-exchange softening process, and experiences with zeolite plant in boiler plant of general shops of Southern Pac. Co. in Los Angeles.

BOILER FURNACES

Pulsations, Influence on Combustion. Influence of Pulsations on Combustion, J. Deschamps. Fuels & Furnaces, vol. 3, no. 9, Sept. 1925, pp. 957-958. Transverse movements of air in gas-producer fuel bed created by air pulsations improve operation. Translated from Revue Universelle des Mines.

Radiation in. Radiation in Boiler Furnaces, B. N. Broido. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 27 pp., 9 figs. Analysis of fundamentals of radiation and of effect of water-cooled walls on gas temperatures in furnaces; standard curve is drawn which enables designer to determine with sufficient accuracy what part of total heat generated in furnace at different ratings is absorbed by water-cooled walls; this curve can also be used to find heat transmission by radiation per sq. ft. of heating surface for any given conditions of furnace; based on number of installations with water-cooled walls, most advantageous arrangement of such surface for given conditions is suggested; effect of radiation from gases on heat transmission and influence of radiation upon measurement of gas temperatures.

BOILER PLANTS

Instruments. The Fallacy of "Dead Reckoning" in Power Plant Operation, F. Juraschek. Indus. Mgmt. (N. Y.), vol. 70, no. 6, Dec. 1925, pp. 362-366, 6 figs. How even smallest plant can cut its power costs; as instance of what indicating and recording instruments mean to power plant, author cites case of Connecticut manufacturer operating three boilers with total rated capacity of 485 b.hp. and annual coal consumption of 2,500 tons; simple corrections in firing methods and damper control resulted in fuel saving of $1,540. per year —almost 3 times cost of instruments and changes.

BOILERS

Efficiency. What Is Boiler Efficiency? M. A. Rooney. Am. Soc. Heat & Vent. Engrs.—Jl., vol. 31, no. 8, Aug. 1925, pp. 419-422, 3 figs. Makes calculation, in connection with design of boilers for maximum economy; gives curves.

Evaporation Tests. Results of Evaporation Test On a Water Tube Boiler, F. H. Bivens. Gas Age-Rec., vol. 56, no. 19, Nov. 7, 1925, p. 667. Results of an evaporation test made on a water-tube boiler equipped with underfeed stokers; maximum rating obtained was 254 per cent.

Flue Handling. How Two Men Handle 1000 Flues a Week. F. C. Hudson. Am. Mach., vol. 63, no. 25, Dec. 17, 1925, pp. 955-957, 7 figs. Apparatus and methods that enable Grand Trunk shop at Battle Creek to handle boiler and superheater flues at very low cost.

Locomotive. *See Locomotive Boilers.*

Rating. Rating Heating Boilers for Hot Blast Service, Chas. L. Hubbard. Domestic Eng. (Chicago), vol. 113, no. 5, Oct. 31, 1925, pp. 20-21 and 45, 4 figs. Methods employed in obtaining usual catalog ratings; in general, these are based on the pound of low pressure steam (about 5-lb. gage) generated per hour, without driving or priming, when using coal having an average calorific value of 13,000 B.t.u. per lb. Considers boiler capacity.

See also Steam Generators.

BRAKES

Foundation. Foundation Brake and Leverage, M. C. Meehan. Car Foremen's Assn. of Chicago—Official Proc., vol. 20, no. 1, Oct. 1925, pp. 32, 35-36, and 39-42, 8 figs. Compilation of data on abuse of foundation brake and consequent destruction of wheels by sliding and means and ways of reducing this waste.

BRASS

Nickel-Manganese. Nickel-Manganese Brasses, Metal Industry (Lond.), vol. 27, no. 20, Nov. 13, 1925, p. 456. Composition recommended; varying equivalent copper-zinc content; mixing, melting, and casting. Abridged translation of paper presented before Franco-Belgian Foundry Congress. See also Foundry Trade Jl., vol. 32, no. 484, Nov. 26, 1925, p. 447.

Flux, Use of. Profitable Use of Flux, R. Micks. Can. Foundryman, vol. 16, no. 11, Nov. 1925, pp. 20-21, 1 fig. Points out that there are still many brass founders who fail to see advantage of using good flux when melting their metal; boron sux-oxide is acknowledged to be best flux for copper, while yellow prussiate of potassium has also given good results; chloride of zinc most popular flux for aluminum; fluorspar as flux for nickel.

BRIDGES, CONCRETE

Highway. Reinforced Concrete Bridges, W. N. Twelvetrees. Roads & Road Constr., vol. 3, no. 35, Nov. 2, 1925, pp. 329-311, 7 figs. Discusses applicability of reinforced concrete as material for building of new bridges, and reconstruction, strengthening and widening of existing bridges.

BRIDGES, HIGHWAY

Strengthening. The Strengthening of Bridges, C. G. Mitchell and C. S. Crettoe. Engineering, vol. 120, no. 3127, Dec. 4, 1925, pp. 721-723, 22 figs. Types of bridges; and methods of strengthening them. Paper read before Pub. Works, Roads & Transports Congress.

BRIDGES, RAILWAY

Strengthening by Electric Welding. Strengthening Railway Bridge by Electric Welding, W. D. Chapman. Commonwealth, vol. 13, no. 1, Aug. 1925, pp. 21-22, 2 figs. Particulars of strengthening of bridge over Murray river at Echuca for heavier locomotives, in connection with construction of Moama to Balranald railway; work is being carried out by Quasi-Arc system of welding.

BUILDING CONSTRUCTION

Lakeolith Method. Lakeolith—Houses Built in Sections by New Methods, H. E. Smith. Cement, Mill & Quarry, vol. 27, no. 10, Nov. 20, 1925, pp. 50, 52, 54, 56 and 58, 10 figs. Particulars of a new method of constructing houses and other buildings by means of concrete units; lakeolith is a new product suitable for all kinds of building construction from a bungalow or garage or even to largest skyscraper; it is constructed with sealed hollow walls, floors and roofs and in that respect resembles a vacuum bottle, thus providing thorough insulation from heat and cold.

C

CABLES, ELECTRIC

High-Tension. Analysis of High-Tension Cables, K. Konstantinowsky. Elec. World, vol. 86, no. 22, Nov. 28, 1925, pp. 1102-1104, 8 figs. Study of dielectric field of cables; Höchstädter design details; experimental work carried on; discussion on dielectrics.

Joints. Investigation of High-Tension Cable Joints, E. W. Davis and C. J. Crowdes. Am. Inst. Elec. Engrs.—Jl., vol. 44, no. 12, Dec. 1925, pp. 1354. Essential properties of good joint are simplicity of design, high dielectric strength, low dielectric loss; data from experimental tests carried out on 7 different types. Abstract of paper, complete copy of which is available in pamphlet form only. See also (discussion), pp. 1342-1347.

CABLEWAYS

Mine. Ropeways of Compania Espanola de Minas del Rif. Iron & Coal Trades Rev., vol. 91, no. 3009, Oct. 30, 1925, pp. 684-686, 7 figs. Properties of this company, consisting of large and rich ore deposits, are situated about 15 miles from port of Melilla on north coast of Morocco, and to bring ore down to port a railway was constructed up to a point about 1½ miles from mines; transport over intervening distance between rail-head and mines is accomplished by aerial ropeways, which have a heavy hourly capacity. Description of installation; operating costs.

CAR DUMPERS

Loading Coal into Ships. Pennsylvania R. R. Car-Dumper for Loading Coal into Ships. Eng. News-Rec., vol. 95, no. 23, Dec. 3, 1925, p. 907, 1 fig. Cradle operated by d.c. engines instead of by gearing; large sheaves for operating cables.

Sand. Quantity production of Automatic Unloader Cars for Transporting Sand (Reihenanfertigung von Selbstentladewagen für Sandtransport), Werner. Werkstattstechnik, vol. 19, no. 18, Sept. 15, 1925, pp. 656-660, 9 figs. Details of design and construction of cars having a capacity of 60 tons and weighing 16 tons, which for unloading are run onto a side rail, the deviation from the vertical resulting in unloading by tipping.

CARBURETORS

Characteristics. Commercial Carburetor Characteristics, C. S. Kegerreis, O. Chenoweth and M. J. Zucrow. Purdue Univ., Eng. Expert. Sta., Bul. No. 21, Aug. 1925, 115 pp., 84 figs. Details and results of investigation carried to determine by actual test how nearly available commercial carburetors meet service demands.

CARS, PASSENGER

Steel. All-Steel Cars of the New South Wales Railways. Commonwealth Engr., vol. 12, no. 12, July 1, 1925, pp. 440-442, 3 figs. Leading dimensions are generally similar to those of large E.B.B.-type cars on North Shore and Bankstown lines, but arrangement of doorways, interior partitions, and seating accommodation is slightly different; particulars of car.

Main Line Metal Cars for First and Second Class (Voiture métallique mixte de 1re et 2e classes pour grandes lignes étudiée par l'office central d'études de matériel de chemins de fer), J. Vallancien. Revue Générale des Chemins de Fer, vol. 44, no. 4, Oct. 1925, pp. 263-284, 12 figs. Design and construction of new corridor cars by Central Office for Railway Material Research in France for use on new electrified main and suburban lines; length 20 m., 58 seats; Vickers lighting system, Westinghouse brakes; resistance tests.

CASE-HARDENING

Gears. Case-Hardened Gears for Street Cars and Electric Locomotives (Gehärtete Zahnräder für Strassenbahnen und elektrische Lokomotiven), Gräfer. Verkehrstechnik, vol. 42, no. 40, Oct. 1925, pp. 792-793, 7 figs. Discusses basic conditions for faultless working of gears; describes new process of case-hardening by Krupp, in which a hardening powder giving off carbon is placed in a layer 3-4 cm. thick around tool to be hardened which is inserted in a box, heated to 850 deg. and subsequently tempered in oil or water.

Process. Case-Hardening (Die Einsatzhärtung), P. Schweibguth. Werkstattstechnik, vol. 19, no. 18, Sept. 15, 1925, pp. 653-656, 8 figs. Discusses treatment of gun-tool and machine parts such as spring bolts, piston pins, etc., with very hard contact surfaces and soft heads; case-hardening process, hardening powders; annealing depth of penetration, etc.

CAST IRON

Alloy Additions, Effect of. Structure Change with Alloy Additions in Ladle. Foundry, vol. 53, no. 22, Nov. 15, 1925, pp. 927-928, 4 figs. Results of series of experiments carried out at Driver-Harris Co's foundry at Harrison, N.J., to determine if addition of material conferred any real benefit on cast iron and to devise method by which addition might be made with minimum amount of trouble and in such manner that amount of each element added might be controlled accurately.

Aluminum, Influence of. The Influence of Aluminium on Cast Iron, A. B. Everest. Brit. Cast Iron Research Assn.—Bul., no. 10, Oct. 1925, pp. 4-6. Review of investigations and bibliography.

Brinell Hardness and Tensile Strength. Brinell Hardness and Tensile Strength of Cast Iron. Brit. Cast Iron Research Assn.—Bul., no. 10, Oct. 1925, pp. 6-9. It is shown that no concordant results are obtained by plotting either actual tensile or actual compression against actual Brinell values; it can be said that as thickness of finger increases, hardness decreases and tensile and compression decrease, but there is no definite relationship connecting the two; formulas proposed by Portevin and Schuz for cast iron give calculated tensile values from Brinell figure 1.5 to 3 times as great as actual tensile value, so that they do not appear to be of any service whatever.

Gray, Mechanical Tests. Correlating Gray Iron Tests, J. W. Bolton. Foundry, vol. 53, nos. 22 and 23, Nov. 15 and Dec. 1, 1925, pp. 912-915 and 958-961, 18 figs. Outline of more commonly used tests for gray irons; consideration of more common mechanical tests, related engineering properties and correlation of these tests to observations of structure of gray iron. Author points out that while four major components, pearlite, ferrite, graphite and steadite, may be approximated closely from analysis, still sizes and distribution of grain structures are determined best microscopically. Annual exchange paper prepared under auspices of Am. Foundrymen's Assn. for presentation before Belgian and French foundrymen's associations.

Research. Practical Points from Recent Researches in Cast Iron, B. Rogers. Foundry Trade Jl., vol. 32, no. 483, Nov. 19, 1925, pp. 427-429. Deals principally with those writers who have themselves experimented upon practical lines; factors influencing total carbon; casting temperature. Recommends list of papers as being capable of giving sound information upon study.

Thyssen-Emmel Process. Low Carburized Cast Iron Produced in Cupolas, K. Emmel. Am. Metal Market—Monthly Rev. Section, vol. 32, no. 222, Nov. 17, 1925, pp. 3-5, 8 figs. Describes Thyssen-Emmel process; problem has been solved of producing with ordinary cupola a cast iron of total carbon content guaranteed below 3 per cent; nature of process concerns measures in cupola working which revolutionize former conceptions and practice. Translated from Stahl u. Eisen.

CEMENT, PORTLAND

Retarders for. Retarders for Portland Cement, E. E. Berger. Pitt & Quarry, vol. 11, nos. 3 and 4, Nov. 1 and 15, 1925, pp. 81-88, and 55-64, 12 figs. Nov. 1: Discusses form or mixture of forms best adapted for retarder. Nov. 15: effect of different retarders on consistency and plasticity of clinker.

CENTRAL STATIONS

Colfax, Pittsburgh, Pa. Recent Developments at Colfax Station. Duquesne Light Co., Chas. W. E. Clarke. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 21 pp., 13 figs. Test results of 3-A element of station which showed net heat rates of 12,750 B.t.u. per kw-hr. at 30,333 kw., 13,021 B.t.u. per kw-hr. at 22,400 kw., and 14,200 B.t.u. per kw-hr. at 15,050 kw.; brief history of physical plant involved in original station and in unit extensions Nos. 1, 2 and 3, with data on boiler and turbine outages and condenser cleaning; total cost of station haa been to date $115,80 per kw. for 190,000 kw. of installed capacity.

Hell Gate, New York City. An American Super-Power Station—The Hell Gate Station at New York, J. B. N. Kershaw. World Power, vol. 4, no. 23, Nov. 1925, pp. 245-249, 5 figs. Details of layout and equipment; operating data.

Hydro-electric vs. Steam. Will Hydro Finally Displace Steam Power? L. M. Arkley. Power House, vol. 18, no. 20, Oct. 20, 1925, p. 91. It is demonstrated that hydro-electric power plants will never replace all steam-driven plants, but that there will be a judicious combination of both, in interests of efficiency and economy.

Private Plant, vs. Central-Station Service Most Economical, H. C. Thuerk. Elec. World, vol. 86, no. 22, Nov. 28, 1925, pp. 1112-1114, 3 figs. How careful analysis of hot water required for process work and study of costs with isolated plant showed marked saving by purchasing power.

Steam. Steam Station Design and Equipment, C. F. Hirshfeld. Elec. Light & Power, vol. 3, nos. 11 and 12, Nov. and Dec. 1925, pp. 27-28, 84, 86, 88, 90 and 92; and 25-26, 82 and 84, 6 figs. An analysis of past, present and future trend.

CITY PLANNING

Iowa. City-Planning Procedure for Iowa Municipalities, R. S. Wallis. Ia. State College of Agriculture & Mechanic Arts—Official Pub., vol. 24, no. 7, June 24, 1925, Bul. 74, 19 pp.

COAL

Carbonization. Low Temperature Carbonization in Revolving Retorts, A. Thau. Blast Furnace & Steel Plant, vol. 13, no. 11, Nov. 1925, pp. 434-441, 8 figs. Deals with one of three designs of revolving retorts which have been developed in Germany and with which writer was particularly acquainted as superintendent; retort is constructed by Fellner & Ziegler at Frankfurt, and is being operated at blast-furnace works at Gelsenkirchen, Westphalia.

Low Temperature Carbonization as a Commercial Process, Wm. H. Blauvelt. Chem. & Met. Eng., vol. 32, no. 18, Dec. 1925, pp. 925-927. Discusses probable market for smokeless fuel, high-heat value gas and tar oils produced.

Conversion by Hydrogenation. Conversion of Coal into Oil by Hydrogenation, J. K. Graham. Iron & Coal Trades Rev., vol. 91, no. 3008, Oct. 23, 1925, pp. 635-637. Historical data; Mining Research Laboratory experiments; action of steam on coal. Abstract of paper read before North Staffordshire Inst. Min. Engrs., Oct. 19, 1925. Also in Colliery Guardian, vol. 130, no. 3382, Oct. 23, 1925, pp. 973-975.

COAL HANDLING

Power Plants. Where Gravity Helps the Power Bill, M. W. Potts. Indus. Mgmt. (N. Y.), vol. 70, no. 6, Dec. 1925, pp. 351-354, 6 figs. Handling coal and ashes at Hammermill paper plant at Erie, Pa.

COAL MINES

Electrical Coal Strip Pit. First All-Electric Coal Strip Mine Is Saving Northern Pacific $700,000 a Year, H. E. Stevens. Coal Age, vol. 28, no. 20, Nov. 12, 1925, pp. 660-663, 4 figs. First completely electrified coal strip pit in country at Colstrip, Mont.

Water Problems. Colliery Water Problems, W. H. Bellin. Colliery Eng., vol. 2, no. 21, Nov. 1925, pp. 487-488, 2 figs. Discussion on considerations governing inrushes of water from disused workings.

COAL STORAGE

Sulphur Oxidation as Factor. The Oxidation of Sulphur as a Factor in Coal Storage, S. W. Parr and E. R. Hilgard. Fuel, vol. 4, no. 11, Nov. 1925, pp. 492-493, 2 figs. Points out that sulphur may be initial source of heat after all, and that judgment should be suspended in matter until further evidence is in hand.

COAL WASHING

Flotation. Sand Flotation Process Engers Bituminous Field, A. F. Brosky. Coal Age, vol. 28, no. 23, Dec. 3, 1925, pp. 769-773, 8 figs. Cleaning method well known in anthracite is now used in central plant serving 3 broad-top mines; cuts ash content to uniform percentage.

COMPRESSED AIR

Aircraft Manufacture. Some Typical Uses of Compressed Air in the Manufacture of Aircraft, P. G. Johnson. Compressed Air Mag., vol. 30, no. 11, Nov. 1925, pp. 1429-1432, 13 figs. Mentions some of most striking applications that have proved of especial value to single concern, the Boeing Airplane Co., Seattle, Wash.

CONCRETE

Diatomaceous-Earth Admixture. Concrete Improved by the Use of Diatomaceous Earth, C. N. Conner. Eng. News-Rec., vol. 95, no. 25, Dec. 17, 1925, pp. 995-996, 1 fig. Tests by North Carolina Highway Dept. show strength and workability increased with included celite.

CONCRETE CONSTRUCTION

Defects. Defects in Concrete, H. C. Badder. Roads & Road Construction, vol. 3, no. 34, Oct. 1, 1925, pp. 296-297. Discusses laitance, crazing, and efflorescence; waterproofing.

Precast Unit for Railway Structures. Precast Concrete Units for Railway Structures, T. H. Strate. Eng. News-Rec., vol. 95, no. 25, Dec. 15, 1925, pp. 990-990. Varied uses and sizes; bridge decks; building blocks and structural parts; piles, poles and track signs. (Abstract.) Report presented before Am. Ry. Bridge & Bldg. Assn.

CONCRETE CONSTRUCTION, REINFORCED

Rapid-Hardening Cement Concretes. Reinforced Concrete Design With Rapid Hardening Cement Concretes, G. D. Balsille. Commonwealth Engr., vol. 12, no. 12, July 1, 1925, pp. 439-440. Author has found that introduction of rapid-hardening cements makes most of the design tables dealing with Portland cement obsolete as regards new material; he has therefore revised his tables and presents them herewith in a tentative form.

CONCRETING

Winter. Rigid Control of Winter Concreting, J. R. Macauley and H. L. Mahaffy. Contract Rec., vol. 39, no. 47, Nov. 25, 1925, pp. 1125-1128. Modern methods of placing concrete during cold weather; wherein salamanders are defective; outline of specification which should be insisted upon.

CONDENSERS, STEAM

Locomotive. The Locomotive Condenser. Ry. Engr., vol. 46, no. 551, Dec. 1925, p. 433, 1 fig. Survey of various types and their characteristics.

Surface. Efficient Marine Steam-Plant Operation. Mar. Engr. & Motorship Bldr., vol. 48, no. 578, Nov. 1925, pp. 413-415. Practical problems affecting working of surface condensers.

CONVEYORS

Pneumatic. Pneumatic Conveying Plants of Large and Small Capacity (Pneumatic Förderanlagen für grosse und kleine Leistungen), O. Kleier. Fördertechnik u. Frachtverkehr, vol. 18, no. 18, Sept. 20, 1925, pp. 288-289, 5 figs. Design and operation of Luther plant for unloading grain from ships; capacity up to 300 tons per hour; small-grain coal from railway cars, etc.

Types. Modern Conveying in Factory Operation (Neuzeitliche Förderungen in Fabrikbetrieben), O. Hochstetter. Fördertechnik u. Frachtverkehr, vol. 18, no. 16, Aug. 18, 1925, pp. 241-246, 32 figs. Discusses types of chains for conveying and driving, continuous and intermittent; belt conveyors, rocking conveyors and elevators, bucket chains, band conveyors, roller conveyors, coal-handling plants, etc.

COUPLINGS

Shaft, Flexible. Flexible Shaft Coupling. Textile Wld., vol. 68, no. 18, Oct. 31, 1925, p. 53, 2 figs. Describes new type of shaft coupling placed on market by Farrel Foundry & Machine Co., Buffalo, N. Y., called "Sykes universal shaft coupling"; differs from other flexible couplings in that it is really a universal joint and is therefore capable of not only taking care of small errors in alignment but of successfully connecting shafts which are grossly misaligned, its limit of angularity is stated to be 5 deg.

CRANES

Overhead. Traction and Adhesion in the Design of Overhead Cranes. Mech. World, vol. 78, no. 2026, Oct. 30, 1925, pp. 343-345, 4 figs. Deals with question of design of electric travelling cranes from point of view of obtaining satisfactory travel motions.

Steam Titan. 50-Ton Steam Titan Crane. Engineer, vol. 140, no. 3647, Nov. 20, 1925, p. 561, 2 figs. partly on p. 552. Built by Stobert & Pitt, Bath, Eng., for Union of South Africa; it consists of upper structure of double cantilever type which revolves by means of live ring of steel rollers upon truck, which forms full portal for passage of traffic and block trucks.

CRUSHING

Surface Measurement of Particles. Surface Measurement on Finely Ground Particles and Its Relationship to the Crushing Laws, J. Gross, S. R. Zimmerly and S. J. Swainson. Univ. of Utah, (Research Investigation)—Bul., no. 16, Aug. 1925, pp. 57-76. Investigation to devise method whereby actual surface of finely ground and irregularly shapel particles can be measured; this method, when developed, is to be used in fundamental study of energy consumed in crushing.

CUPOLAS

Mechanical Charging. Charges Cupolas Mechanically, Wm. G. Hammerstrom. Foundry, vol. 53, no. 22, Nov. 15, 1925, pp. 908-911, 8 figs. Electric charging device with one operator replaces crew of 8 men on charging platform at Radford, Va., works of Lynchburg Foundry Co., Lynchburg, Va.

CURING

Semi-Arid Climate, in. Curing Concrete in a Semi-Arid Climate. Contract Rec., vol. 39, no. 47, Nov. 25, 1925, p. 1130. Conclusions drawn from an investigation conducted under auspices of Structural Materials Research Laboratory.

CYLINDERS

Aircraft Engines. The Design of Air-Cooled Cylinders, C. F. Taylor. Aviation, vol. 18, nos. 23 and 24, June 8 and 15, 1925, pp. 634-636 and 664-667, 4 figs. Sets forth ideas based largely on results of experiments made by Engineering Division, Air Service, and corroborated in laboratories of Wright Aeronautical Corp.

Lapping. Commercial Cylindrical Lapping, C. T. Appleton. Mech. Eng., vol. 47, no. 12, Dec. 1925, pp. 1106-1110, 6 figs. Cylindrical lapping machine and its operation; production of piston pins; tolerances; conservative rate of commercial lapping; work holders; truing lapping wheels; lapping experiments and conclusions drawn therefrom. Discussion of paper by P. M. Mueller, published in Sept. 1925 issue of Journal.

D

DAMS

Test, Experiments on Large. Experiments on a Large Test Dam. Eng. Jl., vol. 8, no. 12, Dec. 1925, pp. 493-495, 3 figs. Tentative outline for experiments on test dam in California by Committee of Engineering Foundation.

DIESEL ENGINES

FUEL FOR. Diesel Engine and Its Fuel, L. Wolff. Pac. Mar. Rev., vol. 22, no. 12, Dec. 1925, pp. 558-560, 2 figs. Review of developments in design of Diesel engines; advantages of Diesel operation; question of suitable and adequate fuel supply.

LUBRICATION. Lubrication of the Diesel, P. Aikens. Power House, vol. 18, no. 20, Oct. 20, 1925, pp. 95-96. Minimizes repairs; oil of correct body; lubrication requirements of air-compressor cylinders; oxidation; lubrication bearings; treatment of oil; contaminated oil; reliability with economy.

MANUFACTURE. Building Diesel Engines for the Panama Canal, F. W. Curtis. Am. Mach., vol. 63, no. 25, Dec. 17, 1925, pp. 959-962, 8 figs. Specifications of units; assembling bedplates; planing cylinders; turning pistons; machining cylinder heads. Built by Nordberg Mfg. Co., Milwaukee, Wis.

TORSIONAL VIBRATION. Torsional Vibration in the Diesel Engine, F. M. Lewis. Soc. Nav. Architects & Mar. Engrs.—advance paper, no. 9, for mtg. Nov. 12-13, 1925, 32 pp., 19 supp. plates. Review of more fundamental aspects; calculation of natural frequencies of vibration; vibration in multi-cylinder engine; types of installation and their vibration characteristics; elimination of vibration; speed regulation—action of flywheel. Bibliography.

WORTHINGTON. The Double-Acting, Two-Cycle Oil-Engine, O. E. Jorgensen. Soc. Nav. Architects & Mar. Engrs.—advance paper, no. 14, for mtg. Nov. 13-14, 1925, 9 pp., 15 figs. on 14 supp. plates. Describes new Worthington engine and compares its method of operation with single-acting engines and double-acting 4-cycle type; comparison is made of weights, power output and heat transfer of different types and of their relative costs; describes features peculiar to Worthington engine; experiments to determine rate of heat transfer in cylinder walls and variations of pressure in piston-rod stuffing boxes. See also discussion in Mar. Eng. & Shipg. Age, vol. 30, no. 12, Dec. 1925, pp. 704-705.

DIRECTION FINDING

EQUIPMENT. The Direction-Finding Equipment at Niton and Cullercoats, J. H. Reyner. Instn. Elec. Engrs.—Jl., vol. 63, no. 347, Nov. 1925, pp. 1138-1140, 3 figs. These stations are first to be equipped for regular direction-finding service; apparatus, which is of Bellini-Tosi pattern, is described and methods employed in taking a bearing discussed; influence of neighboring bodies on error curve is investigated; satisfactory installation of apparatus is followed by calibration in co-operation with ship.

DRYDOCKS

ESQUIMALT, B. C. The New Esquimalt Drydock, J. P. Forde. Eng. Jl., vol. 8, no. 12, Dec. 1925, pp. 477-482, 5 figs. General details of construction and equipment of new drydock in British Columbia; choice of site and its characteristics; general dimensions and comparison with other docks; construction details; tunnel for compressed air, water and power mains; lighting equipment; sanitary provisions; mechanical equipment; electric power supply and capstans; caissons for closing dock; landing and fitting-out wharf.

DRILLING MACHINES

ROTATING TABLES ON MULTIPLE. Using Rotating Tables on Multiple Drills, W. F. Sandmann. Machy. (N. Y.), vol. 32, no. 4, Dec. 1925, pp. 310-312, 6 figs. Combined drilling and tapping machines; combined drilling and reaming operations; set-up for drilling closely spaced holes; fixed type of bushing plate.

DURALUMIN

DETERIORATION, IN "SHENANDOAH". Deterioration of Duralumin in the "Shenandoah". Eng. News-Rec., vol. 95, no. 25, Dec. 17, 1925, pp. 1000-1001. Results of Bur. of Standard tests brought out before court; intercrystalline corrosions widespread.

TREATMENT. The Duralumin Problem (Das Duraluminproblem), W. Fraenkel. Zeit. für angewandte Chemie, vol. 38, no. 33, Aug. 13, 1925, pp. 696-699, 1 fig. Discusses scientific problem of improving aluminum alloys by heat treating, hardening, tempering, etc.; increase of tensile strength, mixed crystal formation, electric conductivity, etc.

E

EDUCATION, ENGINEERING

COLLEGES, OPPORTUNITY FOR SERVICE. The Engineering College—Its Opportunity for Service, A. A. Potter. Jl. Eng. Education, vol. 16, no. 1, Sept. 1925, pp. 4-24. Points out that industry and engineering colleges are interdependent; outstanding characteristics of engineering colleges; technique of engineering education; concentric methods of engineering education; instruction along functional lines: commercial training; character building and development of personality; guiding students to discover their aptitudes; cultural training; research as aid to engineering education.

GERMAN ASSOCIATION FOR TECHNICAL INSTRUCTION. Technical Works Instruction in Germany. Engineering, vol. 120, no. 3128, Dec. 11, 1925, p. 752. Organization and aims of the DATSCH (Deutsche Ausschuss für Technisches Schulwesen), which has become central office for intermediate technical instruction, training of apprentices and employees, coming from ordinary or trade schools and intending to proceed in due time to technical high schools.

GRADUATES AND TEACHING PERSONNEL. Engineering Graduates and Engineering Teaching Personnel. Mech Eng., vol. 47, no. 12, Dec. 1925, pp. 1181-1197, 4 figs. Reports of committees of Soc. for Promotion of Eng. Education as follows: Report of Committee on Engineering Students and Graduates, June 1, 1925; Preliminary Report of Committee on Teaching Personnel.

RESEARCH AND. The Relation between Engineering Education and Research, R. W. Sorensen. Am. Inst. Elec. Engrs.—Jl., vol. 44, no. 12, Dec. 1925, pp. 1288-1290. With particular reference to California Inst. of Technology plan.

STUDENTS AND GRADUATES. Society for the Promotion of Engineering Education, Report of Committee on Engineering Students and Graduates. Jl. Eng. Education, vol. 16, no. 1, Sept. 1925, pp. 75-84, 3 figs. Results of study based upon returns covering approximately 4000 individual students attending 32 institutions; secondary school preparation; educational guidance of entering students; conclusions.

ELECTRIC COMMUNICATION

ADVANCES. Recent Advances in the Communication Art. Am. Inst. Elec. Engrs.—Jl., vol. 44, no. 12, Dec. 1925, pp. 1302-1308, 3 figs. Summary of advances which have been made of come into prominence during past year in telegraphy, telephone signaling, machine switching, telephone distributing frame wire, telephone transmission, radio and radio broadcasting, inductive relations of power and communication circuits, communication in railway operation, electric transmission of pictures. Report of Committee on Communication.

ELECTRIC CONDUCTORS

MAGNETIC-FLUX ENERGY. Magnetic Flux Energy, C. Hering. Franklin Inst.—Jl., vol. 200, no. 6, Dec. 1925, pp. 747-756. Author shows that in calculating stored energy in magnetic flux more care should have been taken not to add together again, as by integration, energies whose components had already been added. Supplement to author's paper, published in Feb. 1925 issue of same journal, giving results of investigation of properties of single, straight conductor, far removed from all others.

ELECTRIC DRIVE

SECTIONAL. The Evolution of the Sectional Drive, H. W. Rogers. Paper Trade Jl., vol. 81, no. 18, Oct. 29, 1925, pp. 99-102, 5 figs. Discusses horsepower per ton daily, influence of drive on product, exacting requirements, two types of drives and difference between the types, stages of development, etc.

ELECTRIC FURNACES

CONVERSION FROM OIL-FIRED FURNACE. Converting an Oil-Fired Furnace to Electric Heating, W. J. Walsh. Elec. World, vol. 86, no. 22, Nov. 28, 1925, pp. 1110-1111, 2 figs. Describes reconstruction of oil-fired unit consisting of 3 heating chambers; Leeds & Northrup 2-point special gun furnace control was adopted; check-up of cost of both types of operation.

ELECTRIC FUSES

DESIGN AND BEHAVIOR, FACTORS AFFECTING. Fuses and Fusible Cut-Outs, P. G. Ashley. Instn. Elec. Engrs.—Jl., vol. 63, no. 347, Nov. 1925, pp. 1133-1137. Reviews history of development of fusible cut-outs, and discusses in turn the various factors affecting design and behavior of wire and plate fuses in air; considers main features of fuse wires in oil, and also how their design and behavior compare with those of fuses in air; describes various types of enclosed and semi-enclosed cut-outs, as well as oil-immersed switch fuses; theoretical aspect of mechanism of fusing; present position as to standardization.

ELECTRIC GENERATORS, A.C.

LARGE 3-PHASE. Europe's Largest Three-Phase Generator. Elec. World, vol. 86, no. 23, Dec. 5, 1925, p. 1150. New generator built by Siemens-Schuckert Works for one of large Rhenish-Westphalian generating stations in Germany, is coupled to steam turbine of 80,000 hp., operating at 1,000 r.p.m., electrical output being 60,000 kw., 3-phase, at 7,000 volts; it is composed of 26 rotor disks mounted on continuous shaft, 1.1 m. in maximum diam. and 8.7 m. in total length.

ELECTRIC LOCOMOTIVES

DIESEL-ELECTRIC. Comparative Tests with Diesel and Steam Locomotives. Eng. Progress, vol. 6, no. 10, Oct. 1925, pp. 319-320, 7 figs. Results of comparative tests conducted in November 1925, on Russian test bed at Maschinenfabrik Esslingen with first 1-E-1 Diesel-electric locomotive of Russian Government Rys. and one of 700 Russian E-coupled freight engines built in Germany; results showed savings of fuel with Diesel locomotive.

OIL-ELECTRIC. Oil-Electric Switching Locomotive of 100 Tons Weight Developed for Long Island Railroad. Ry. & Locomotive Eng., vol. 38, no. 11, Nov. 1925, pp. 328-329, 2 figs. 100-ton locomotive will have 2 oil-engine-driven generator sets to furnish power to 4 direct-current, geared traction motors; engines, manufactured by Ingersoll-Rand Co., are 6-cylinder, vertical units of 4-cycle type, with piston of 10-in. diam. and 12 in. stroke.

ELECTRIC METERS

RECORDING DATA. Methods that Expedite Meter Work, K. H. Bausman. Elec. World, vol. 86, no. 22, Nov. 28, 1925, pp. 1093-1096, 10 figs. System used by Dayton Power & Light Co. to maintain information that is essential to convenient operation without involving unnecessary records.

ELECTRIC MOTORS

BALL-BEARING. Ball-bearing Electric Motors, T. C. Delaval-Crow. Machy. (N. Y.), vol. 32, no. 4, Dec. 1925, pp. 265-269, 9 figs. Advantages of ball bearings for motors and methods of mounting and lubricating.

LUBRICATION. Electric Motors and Their Lubrication. Lubrication, vol. 2, no. 10, Oct. 1925, pp. 109-120, 21 figs. Notes on function and construction of electric motor; discusses lubricating systems, including ring oilers, ball and roller bearings, wick lubrication, waste packed and wool yarn systems of lubrication, electric railway motors, flushing and cleaning of bearings.

OUTPUT TEMPERATURE RISES. The Output of Totally-Enclosed Electric Motors for Specified Temperature Rises, F. Murgatroyd. Engineering, vol. 120, no. 3123, Nov. 6, 1925, p. 563, 1 fig. Gives curve showing maximum output of machine plotted against time; methods of measuring temperatures; heating curves.

ELECTRIC MOTORS, A.C.

CASCADE INDUCTION. The Two-Speed Cascade Induction Motor, A. H. M. Arnold. Instn. Elec. Engrs. — Jl., vol. 63, no. 347, Nov. 1925, pp. 1115-1122, 15 figs. Considers general conditions of operation of two motors in direct and differential cascade, with special reference to possibility of set running at speed near synchronous speed of primary machine, while still connected in cascades; describes Hunt's cascade motor.

SQUIRREL-CAGE. High-Torque High-Efficiency Squirrel-Cage Motor. Mech. World, vol. 78, no. 2025, Oct. 23, 1925, pp. 319-320, 6 figs. High-starting-torque induction motor, introduced by Metropolitan-Vickers Elec. Co., Manchester, Eng., known as C. K. B. motor.

ELECTRIC RAILWAYS

CAR DESIGN. Report of Committee on Unification of Car Design. Elec. Traction, vol. 21, no. 10, Oct. 1925, pp. 535-536. Report to Am. Elec. Ry. Assn.

CHICAGO, NORTH SHORE & MILWAUKEE R. R. North Shore Speeds Service. Elec. Traction, vol. 21, no. 11, Nov. 1925, pp. 582-586, 6 figs. 36 mi. of new double-track being constructed by Chicago, North Shore and Milwaukee R. R. through Skokie Valley as cut-off for high-speed service.

EQUIPMENT. Report of the Committee on Equipment. Elec. Traction, vol. 21, no. 10, Oct. 1925, pp. 536-542. Recommendations for bearing clearance; axle bearings; babbitting bearings; tinning alloy; tinning bronze shells that are to be babbitted; anchor holes in iron shells; heating mandrels and shells for babbitting; methods of car painting; motor-coach design problems; devices for trolley contact; helical and spur gearing; gearing noises and methods of reducing them; sources of track noise and suggested remedies; wheels, trucks, brakes, gearing, motors, body, etc. Bibliography. Report to Am. Elec. Ry. Assn.

REPLACEMENT OF OBSOLETE EQUIPMENT. Replacement of Obsolete Equipment Demands Serious Attention. Elec. Ry. Jl., vol., 66. no. 20, Nov. 14, 1925, pp. 853-854, 2 figs. Analysis of condition of present electric railway rolling stock shows minimum of 25,000 obsolete cars in service; new physical equipment is important from standpoint of merchandising railway transportation.

ELECTRIC TRANSMISSION LINES

CALCULATION. Three-phase Transmission Lines, G. Ashworth. Elec. Rev., vol. 97, no. 2503, Nov. 13, 1925, pp. 767-770, 2 figs. Rapid preliminary electrical calculations with aid of charts.

FAULT LOCATION. Locating Circuit Faults, S. Aronoff. Elec. World, vol. 86, no. 21, Nov. 21, 1925, pp. 1041-1045, 16 figs. Inherent errors of generally used methods and relative merits; other methods which have better characteristics for this class of work and are inherently capable of better and desired accuracy.

WASHINGTON. The Long Span Across the Narrows at Tacoma, J. V. Gongwer and A. F. Darland. Am. Inst. Elec. Engrs. Jl., vol. 44, no. 12, Dec. 1925, pp. 1296-1302, and (discussion) p. 1351, 11 figs. Double transmission lines being built by City of Tacoma, Wash., as part of its new Cushman Power Development, reaches 44 mi. from North Fork of Skokomish River across Narrows to Tacoma; notes on choice of conductor; circuit arrangement; general structural design; economical considerations affecting sag and tower heights; cables and fittings; insulator assemblies; towers and tower footings, anchorages and sheaves; construction and erection; cost of development.

ELECTRIC WELDING, ARC

COSTS. Arc Welding Costs, K. R. Hare, Am. Welding Soc.—Jl., vol. 4, no. 9, Sept. 1925, pp. 17-19, 1 fig. Presents table showing pounds of metal deposited per hour with different heat values and different sizes of electrodes, from which it is apparent that there is distinct advantage along lines of increased production in using larger sizes of electrodes wherever possible.

MANUFACTURING PROCESS. Arc Welding as a Manufacturing Process, H. M. Hobard and W. Spraragen. Am Welding Soc.—Jl., vol. 4, no. 10, Oct. 1925, pp. 71-103, 15 figs. Deals with fundamental considerations, such as design, material, welding rods, jigs and fixtures, inspection, testing, cost data, speed of arc welding, etc., examples of arc-welding applications; use of arc welding in Westinghouse Elec. & Mfg. Co's works.

WELDABILITY OF FERROUS METALS. Metallic Arc Weldability of Ferrous Metals, C. J. Holslag. Am. Welding Soc.—Jl., vol. 4, no. 10, Oct. 1925, pp. 37-43. Discusses weldability of various alloy steels, cast iron, malleable iron, and cast steel.

ELECTRIC WELDING, RESISTANCE

NON-FERROUS METALS. Welding of Non-Ferrous and Special Metals by the Resistance Welding Process, H. A. Woofter. Am. Welding Soc.—Jl., vol. 4, no. 9, Sept. 1925, pp. 46-49. Notes on welding of aluminum brass, copper, duralumin, monel metal and special metals.

SPOT AND SEAM. Prescot Spot and Seam-Welding Machines. Engineering, vol. 120, no. 3127, Dec. 4, 1925, pp. 724-726, 9 figs. Salient features of two types of machines, made by Brit. Insulated & Helsby Cables, Ltd., Prescot, Lancashire, Eng.

ELECTRICITY SUPPLY

ECONOMICS AND INDUSTRIAL. Economics and Industrial Electrification, A. Tustin. Instn. Elec. Engrs.—Jl., vol. 63, no. 347, Nov. 1925, pp. 1141-1146. Attempts to define exactly what aim should be in policy of power supply; discusses degree of dependence of British foreign trade upon cheap power, and implications of ordinary methods of comparing economy of various schemes; suggests lines of investigation by which best policy may be selected, and discusses methods of charging for power.

ELECTRONS

MOTION IN GASES. Motion of Electrons in Gases, J. S. Townsend. Franklin Inst. Jl., vol. 200, no. 5, Nov. 1925, pp. 563-590, 10 figs. Most direct method of investigating motion of electrons through gas is to determine experimentally velocity of agitation and velocity in direction of electric force; from results of these experiments effect of collision with molecule on motion of electron may be estimated by methods similar to those used in kinetic theory of gases.

ELEVATORS

FAULT LOCATION. Locating Faults in Electric Elevatrrs—Direct-Current Controllers, Chas. A. Armstrong. Power, vol. 62, nos. 18, 20 and 25, Nov. 3, 17 and 22, 1925, pp. 674-677, 4 figs.; 760-763, 6 figs.; and 969-972, 13 figs. Nov. 3: Faults that may cause main fuses to blow and make potential switch fail to function properly. Nov. 17: Faults in controllers of mechanically controlled elevators that may cause motor to start or fail to come up to speed if it does start. Dec. 22: Faults in full-magnet-type controllers.

ENAMELLING

PISTOL SPRAY FOR. The Aerograph Pistol Spray. Engineering, vol. 120, no. 3123, Nov. 6, 1925, pp. 590-591, 1 fig. Describes latest design of pistol spray introduced by Aerograph Co., London; it is known as G. P. model and is particularly suitable for cellulose enamels, but may also be used for general purposes with ordinary paints and varnishes.

EQUIPMENT MANUFACTURE. Engineering Planning for Manufacture, G. A. Pennock. Bell System Technical Jl., vol. 4, no. 4, Oct. 1925, pp. 542-560, 6 figs. Discusses complete analysis, from a manufacturing point of view, to which every item of telephone apparatus is submitted at Hawthorne Plant of West. Elec. Co.; these works employing, at present, about 25,000, produce over 110,000 different kinds of parts which enter into some 13,000 separate forms of apparatus; advantages of careful engineering analysis of each new job coming to factory, as well as those which have been in connection; the various steps which are worked out in connection with each analysis.

ESCALATORS

ITALY. Escalators for the Urban Section in Naples of the Rome-Naples Express (Scale mobili per il tratto urbano in Napoli della drettissima Roma-Napoli), E. D'Andrea. Rivista Tecnica delle Ferrovie Italiane, vol. 28, no. 4, Oct. 15, 1925, pp. 129-137, 9 figs., partly on supp. plates. Details of design and construction of escalator plants at Montesaeto and Cavour subway stations, mechanical and electric equipment, power consumption, etc.

EVAPORATORS

POWER-HOUSE. Power-house Evaporators, D. McHutchison. Mech. World, vol. 78, no. 2028, Nov. 13, 1925, pp. 382-383, 2 figs. Discusses design, developments and types.

F

FACTORIES

BUILDINGS. The Modern Manufacturing Plant, Mgmt. & Admin., vol. 10, no. 6, Dec. 1925, pp. 339-342, 3 figs. E. R. Squibb & Sons complete first unit of thoroughly planned new building program at Brooklyn plant.

PLANNING. Some Problems in Works Planning, A Whitehead. Mech. World, vol. 78, nos. 2028 and 2029, Nov. 13 and 20, 1925, pp. 387-388 and 406-407, 4 figs. Consideration of such problems as labor supply, space for extension, form of building, arrangement of machines, lighting and heating.

FANS

PROBLEMS. Fan Problems, H. Briggs. Colliery Eng., vol. 2, nos. 15, 16, 17, 18, May, June, July, and Aug., 1925, pp. 197-199, 245-248, 292-294 and 367-369, 13 figs. May: Notes on efficiency and cost of power; need for effective criticism; causes of exaggerated efficiencies; inaccuracies in measurement of volume; plea for manometrical efficiency; what happens when fan speed is varied. June: Characteristic curves; natural ventilation; mine characteristics and natural ventilation; measuring resistance of fan. July: Flow of air in converging and expanding channels; purpose of evasee, its shape and efficiency. Aug.: Power available for conversion by evasee; venturi blowers and velocity indicators.

FILTERS

DESIGN. Some Features of Filter Design. J. W. Armstrong. New England Water Wks. Assn.—Jl., vol. 39, no. 3, Sept. 1925, pp. 254-266 and (discussion) 266-271, 1 fig. Notes on water, watershed, mixing basins, coagulating basins, pipe galleries, concrete, economy in construction, principles of design, potentiometer for recording hydrogenion concentration of water, filter bottoms, filter sand, wash water, chemical feed devices, turbidimeter for reading low turbidities, sign glass for determining clarity of filter effluent.

FILTRATION PLANTS

MONTREAL, CANADA. The Filtration Works of the City of Montreal, F. E. Field. New England Water Wks. Assn.—Jl., vol. 39, No. 3, Sept. 1925, pp. 213-224. General description of municipal filtration works of city of Montreal, Quebec, Can., prior to Sept. 12, 1925.

FLOW OF AIR

ROTATING CYLINDER, AROUND. Flow of Air Around a Rotating Cylinder. E. N. Fales. Air Service Information Circular, vol. 6, no. 510, June 1, 1925, 4 pp., 6 fig. Test made as simple means of demonstrating change of air flow about cylinder when latter is rotating.

TRANSMISSION OF WAVES THROUGH PIPES. On the Transmission of Air-Waves through Pipes, L. F. G. Simmons and F. C. Johansen. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. Sci. vol. 50, no. 297, Sept. 1925, pp. 553-570, 8 figs. Results of experiments, conducted at Nat. Physical Laboratory on transmission of waves through rubber pipes, which deal with propagation of single wave resulting from sudden application of known pressure, at one end of pipe, and with waves generated by simple harmonic variation of pressure of displacement, applied at one end; results pertaining to closed pipes indicate relationship existing between pressures at any instant at two ends, and extent to which these are affected by size and length of pipe, and by type of gage used; measurements of displacement made at end of open pipes may be compared with calculations based on theory given by Rayleigh.

FLUE-GAS ANALYSIS

CO_2 AND CO RECORDERS. Developments in Flue-Gas Analysis. Power Engr. vol. 20. no. 236. Nov. 1925, pp. 430-432, 9 figs. Descriptions of Cambridge combined CO_2 and Co. instruments.

FLYWHEELS

INTERNAL-COMBUSTION ENGINES. Flywheels for Otto Cycle Horizontal Internal-Combustion Engines. Power Engr., vol. 20, no. 236, Nov. 1925, pp. 413-416, 9 figs. Presents reasonable basis for computation of weight of flywheels necessary for multi-cylinder engines.

FORGE SHOPS

ECONOMIES IN. Effecting Economics in a Forge Plant. Jos. Haas. Forging—Stamping—Heat Treating, vol. 11, no. 11, Nov. 1925, pp. 397-398. Cites several examples to show how production costs can be reduced; experienced foremen should be placed in charge of all departments.

FORGING

COLD HEADING. Cold Heading. Macky (Lond.) vol. 27, pp. 683, 684, 685 and 686, Oct. 24, Nov. 5, 12 and 19, 1925, pp. 126-134, 161-168, 193-196 and 225-226, 33 figs. Recent developments in cold-heading machines and cold-headed products; manufacturing practice in production of cold-headed parts.

The Physical Aspect of Cold Heading and Cold Heading Material. C. E. Hill, Macky (Lond.), vol. 27, No. 687, Nov. 26, 1925, pp. 265-269, 14 figs. Chemical analysis of material for cold heading; heat treatment, during manufacture; cold work during heading process; tests applicable to material.

FOUNDATIONS

UNDERPINNING. Inclined-Pile Underpinning for Special Condition. Eng. News. Rec., vol. 96, no. 23, Dec. 3, 1925, p. 916, 1 fig. Method devised to avoid disturbing mat foundation of 18-story building resting on wet fine sand and clay.

FOUNDRIES

CRUCIBLE COST REDUCTION. How to Cut Crucible Costs. Metal Iudustry (N.Y.) vol. 23, no. 11, Nov. 1925, pp. 448-450. Notes on unpacking, storage, storage oven, dampness, preheating, annealing, furnace tending, fuels, pouring, tongs and shanks; crucibles for various conditions and mixtures. Abstract from pamphlets published by Plumbago Crucible Assn.

FUELS

OIL. *See Oil Fuel.*

FURNACES, HEAT-TREATING

RECUPERATIVE. Recuperation in Carbonizing Steel, P. W. Hey, Forging—Stamping—Heat Treating, vol. 11, no. 11, Nov. 1925, pp. 403-404, 1 fig. Describes gas-fired carbonizing furnace which constitutes part of equipment in heat-treating department of Buda Co. of Harvey, Ill.; recuperators in each stack comprises 8 sections arranged in 2 tiers; results of tests made to ascertain results obtained with recuperators.

G

GAS PRODUCERS

OPERATION. Operation of Gas Producers, F. S. Bloom. Fuels & Furnaces, vol. 3, no. 11, Nov. 1925, pp. 1227-1229, 2 figs. Factors determining capacity of gas producer and quality of gas produced.

TIN-PLATE PLANT. Producer Gas Used in Tin House. Iron Trade Rev., vol. 77, no. 25, Dec. 17, pp. 1535-1537, 4 figs. Plant for gasifying and claening 3000 lb. of bituminous coal an hour is installed by tin-plate producer in Pittsburgh district; tar is extracted from raw gas and utilized beneath boilers. See also description by R. A. Fiske, in Iron Age, vol. 116, no. 25, Dec. 17, 1925, pp. 1665-1668, 6 figs.

GEAR CUTTING

MACHINES, SPECIAL USES FOR. Special Work on Gear-cutting Machines. Machy. (N. Y.), vol. 32, no. 4, Dec. 1925, pp. 289-292, 11 figs. Use of gear-cutting machines for drilling and milling, and application of gear generators for special operations.

SYKES GENERATOR. The Sykes Herringbone Gear Generator. Blast Furnace & Steel Plant, vol. 13, nos. 11 and 12, Nov. and Dec. 1925, pp. 456-458 and 497-498, 8 figs. Most interesting features connected with Sykes machines is method of cutting herringbone and double helical teeth, having right and left hand portions of teeth joined at centre of face without any clearance whatever for cutting tools; operations in production of Sykes double helical continuous tooth gears.

GEARS

HOUSINGS, MACHINING. Machining the Bevel-Gear Housing of the Mack Truck and Bus, F. W. Curtis. Am. Mach., vol. 63, nos. 22 and 23, Nov. 26 and Dec. 3, 1925, pp. 841-844 and 883-886, 20 figs. Methods adopted by Int. Motor Co. in its New Brunswick, N. J., plant for manufacturing of its bevel-gear housing; large trunnion drill jig; method of driving studs; inspecting work in group form; variety of gages used.

NORMAL PITCH. Normal Pitch—the Index of Gear Performance, G. M. Eaton. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 27 pp., 20 figs. Brings out certain departures from previously accepted practice which are useful in manufacture of heavy involute gearing, as they aese performance during breaking-in stage of operation; shows that material improvement in performance may be secured by adopting proper relation between normal pitches of driving and driven gears, measured at point of tooth engagement; outlines development of normal-pitch indicators.

SPUR, SPEED REDUCERS. Data for Selection of Spur Gear Speed Reducers, F. A. Emmons. Belting, vol. 27, no. 4, Oct. 1925, pp. 40, 42, and 44, 5 figs. Importance of carefully calculating actual torques on driven unit, as a basis of determining horsepower required to move load.

TEETH, WEAR EXPERIMENTS. Some Comparative Wear Experiments on Cast-Iron Gear Teeth, G. H. Marx, L. E. Cutter, and B. M. Green. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 37 pp., 22 figs. Results of experiments made in laboratories of Stanford Univ.; deductions indicated by tests are as follows: standard-depth 20-deg. involute tooth form appears to be better one to resist wear than standard-depth 14½-deg. involute form; stub-tooth, 20-deg. involute tooth form appears to be better than standard-depth 14½-deg. involute form; standard-depth 20-deg. involute tooth form appears to be better than stub-tooth 20-deg. involute form; etc.

VARYING-CENTER-DISTANCE. Varying-Center-Distance Gears, H. Walker. Am. Mach., vol. 63, no. 22, Nov. 26, 1925, pp. 853-856, 6 figs. Calculations for design of varying-center-distance gears; methods for avoiding undercutting; tooth-thickness and pressure-angle formulae.

GRAIN HANDLING

FLOATING PNEUMATIC PLANTS. Floating Pneumatic Grain Handling Plant at Cardiff. Indus. Mgmt. (Lond.), vol. 12, no. 11, Nov. 1925, pp. 507-511, 5 figs. Describes plant which has been installed at port of Cardiff, Wales; advantages are speedy, convenient, and dustless operation; capacity 120 tons per hour.

H

HEAT TRANSMISSION

CONVECTION. Film Effect and Influence of Wall Vibration on Heat Transmission by Convection (Etude sur l'effect de film et l'influence des vibrations des parois sur la transmission de la chaleur par convection), Ch. Roszak and M. Vernon. Société des Ingénieurs Civils de France—Mémoires et Compte Rendu des Travaux, vol. 78, nos. 7-8, July-Aug. 1925, pp. 584-618. Discusses mechanics of process of convection, including simultaneous mechanical flow and heat flow, film phenomenon, interior and exterior circulation, role of film; effect of wall vibration; experimental study of this effect on heat transmission between two fluids which it separates; concludes that wall vibration favors ebullition and vapor-bubble formation, accelerates turbulent flow and heat transmission at low flow, expecially in gaseous media, etc.

HEATING AND VENTILATION

SUPERPOWER PLANT. Heating and Ventilating a Superpower Plant, S. Sayward. Domestic Eng. (Chicago), vol. 113, no. 6, Nov. 7, 1925, pp. 22 and 24, 6 figs. Problems in connection with heating and ventilating of Weymouth power station of Edison Elec. Illuminating Co. of Boston, a steam station of most modern design.

HEATING, ELECTRIC

APPLIANCE FOR INDUSTRIAL USE. Types of Electric Heating Appliances for Industrial Use, Rob. M. Keeney. Chem. & Met. Eng., vol. 32, no. 17, Nov. 1925, pp. 855-859, 7 figs. Discusses various designs of heaters and their application, with some remarks on heating control and purchase of equipment.

HIGH-TENSION. Maximum Prices for Electric Heat (Höchstpreise für Elektrowärme), Windel. Elektrotechnische Zeit., vol. 46, nos. 46 and 47, Nov. 12 and 19, 1925, pp. 1721-1725 and 1771-1775, 2 figs. Develops formulae and gives examples of cost of high-tension current compared with gas, coal, and wood, and gives complete table of calculations for various uses of heat; explanation of table concludes that high-tension heating is quite capable of meeting competition.

INDUSTRIAL. General Application Data on Industrial Electric Heating. Nat. Elec. Light Assn., Serial Report of Power Committee, Nos. 25-54, Aug. 1925, 4 pp. Points out some of the steps in development of industrial electric heating, reasons for this work and what general plan of future development appears to be, dealing with resistance -type heating medium almost entirely.

HEATING, GAS

COSTS. Method of Comparing Cost of Central Heating by Anthracite and by Gas (Méthode de comparaison des prix de revient au chauffage central à l'anthracite et au gaze) G. Richard. Journal des Usines à Gaz. vol. 49, no. 20, Oct. 20, 1925, pp. 307-313, 7 figs. Discusses advantages of gas; develops alignment charts for graphic calculation of cost from price of fuel and its calorific value, efficiency of boilers, etc., time of operation and wages and depreciation of plant, showing superiority of gas, expecially in mild weather.

HOISTS

ELECTRIC LOCOMOTIVE. Portable Electric Locomotive Hoists. Engineering, vol. 120, no. 3124, Nov. 13, 1925, pp. 602-603, 27 figs. partly on p. 610. Details of type of power hoist made by Ransomes & Rapier, London.

HOUSES

CONCRETE-UNIT, EARTHQUAKE-RESISTANT. Earthquake-Resistant Concrete Unit Building. Concrete Products, vol. 29, no. 5, Nov. 1925, pp. 55-59, 15 figs. Describes a type of concrete unit construction which is earthquake-resistant, because of unit strength of product, extreme strength of joints in walls, method of reinforcing and lightness of structure, which has been classed by experts as being resistant to earthquakes up to ninth magnitude.

HYDRAULIC PRESSES

CONTROL VALVES FOR. Control Valves for Hydraulic Presses. Machy. (Lond.), vol. 27, no. 687, Nov. 26, 1925, pp. 273-275, 8 figs. Notes on control valves of screw-down type for operating presses from pump or accumulator.

HYRDAULIC TURBINES

DEVELOPMENTS. Progress in Design of Hydraulic Turbines Since the War (Progresos en la construccion de turbinas hidraulicas desde la guerra mundial), J. M. Voith. Energia Electrica, vol. 27, nos. 12, 13, 14, 15, 16, 17, 18, 19, and 20, June 25, July 10, 25, Aug. 10, 25, Sept. 10, 25, Oct. 10 and 25, 1925, pp. 157-162, 179-183, 192-195, 206-209, 225-228, 244-245, 258-259, 273-275, and 290-292, 44 figs. Details of turbine installations for small and medium heads built by Voith of Heidenheim; Francis turbines with vertical axis; lubrication; Kaplan turbines with vertical axis at Siebenbrunn central station; Kaplan turbines at Auerhammer central station; Amlezten Heller central station with somewhat larger head using high-speed Francis turbines coupled direct to generator; Francis turbines with horizontal axis; power plants of Froendenberg and Raanaasfoss; power plant at Mauer; Hirten Holzfeld central; Kaplan propeller turbines.

GOVERNORS. Hydraulic Turbine Governing—General Principles; S. L. Kerr. Power, vol. 62, no. 25, Dec. 22, 1925, pp. 976-979, 6 figs. Ourlines characteristics that good governor must possess, how these are incorporated in governor, and shows what takes place in various parts of hydraulic system when full load or half load is taken off the unit.

HIGH-SPEED. High-Speed Capacity and Efficiency of Modern High-Speed Turbines Schnelläugigkeit und Wirkungsgrade moderner Schnelläuferturbinen), W. Zuppinger. Schweiz, Elektrotechnischer Verein—Bul., vol. 16, no. 8, Aug. 1925, pp. 445-450, 7 figs. Discusses high-speed capacity of Francis Kaplan and other turbines, showing that, with regard to quantity of water, propeller turbines have a much lower efficiency, choke of favorable high-speed types; proposes new type of two-wheel turbine giving 85 per cent, 80 per cent, 70 per cent efficiency at full, half and quarter load.

IMPULSE. Hydraulic Impulse Turbines (Turbinas hydraulicas de Impulsão), Greenwood. Revista Brasileira de Engenharia, vol. 10, no. 4, Oct. 1925, pp. 117-131, 17 figs. Discusses developments in turbine design generally and that of impulse turbines in particular; speed regulation; vertical and horizontal arrangements, with examples.

KAPLAN. Kaplan Turbines or Propeller Turbines? (Kaplanturbin eller propellerturbin?), E. Englesson. Teknisk Tidskrift, vol. 55, no. 33, Aug. 15, 1925, pp. 67-111 (Mekanik), 23 figs. Discusses efficiency, performance and field of application of both turbines; details of tests carried out, water losses of propeller, Kaplan and Francis turbines; performances with various heads of water, safety in operation, etc.

Present state of Kaplan Turbines and Propeller Turbines (Der heutige Stand der Kaplanturbine und Propellerturbine). C. Reindl. Elektrotechnische Zeit., vol. 46, no. 42, Oct. 15, 1925, pp. 1581-1584, 9 figs. Compares efficiency and design of Kaplan propeller and Francis turbines; details of Kaplan-turbine installation at Siebenbrunn, Ulm, etc.; vertical and horizontal types; propeller turbines of Kachlet plant, etc., showing superiority of Kaplan type.

PELTON WHEELS. Design of Pelton Wheel by Means of Specific Speed, K. Minamioji and Y. Yokoyama. Soc. Mech. Engrs.—Jl., Tokyo, Japan, vol. 28, no. 100, Aug. 1925, pp. 471-488, 11 figs. Some practical notes on design of Pelton wheel by means of specific speed, ns expressing wheel ratio, number of buckets and ridge inclination as functions of ns and therefrom drawing standard jet diagram to determine chief dimensions of wheel. (In Japanese, with English abstract.)

TURGO. A New Design of Water Wheel. Elec. Rev., vol. 97, no. 2504, Nov. 20, 1925, p. 832, 4 figs. New jet arrangement for medium-capacity impulse wheel, designed by G. Gilkes & Co., and known as Turgo.

HYDRAULICS

DEVELOPMENT OF SCIENCE OF. The Development of the Science of Hydraulics, E. P. Hamilton. Boston Soc. Civil Engrs.—Jl., vol. 12, no. 8, Oct. 1925, pp. 344-354, 4 figs. Résumé of early investigations; hydraulic measuring devices; modern developments of the science.

HYDRO-CARBONS

INORGANIC ORIGIN. On the Inorganic Origin of the Hydro-Carbons, J. W. Young. Can. Inst. Min. & Metallurgy — Bul., no. 162, Oct. 1925, pp. 952-956. Author believes undue stress has been laid on conception of organic origin of hydrocarbon compounds, and not sufficient thought given to alternative hypothesis, that of their magmatic derivation; he presents notes under headings of gas, petroleum, coal, carbon, and diamond, which may help to elucidate his point of view.

HYDRO-ELECTRIC DEVELOPMENTS

CALIFORNIA. Klamath River Plant Completed by the California Oregon Power Company. Jl. Electricity, vol. 55, no. 10, Nov. 15, 1925, pp. 364-371, 7 figs. Copco No. 2 hydraulic plant is 30,000-kva. development, and has largest wood-pipe line in the country; details of dam, intake structure, tunnels, wood-stave pipe, surge chamber, penstocks, power house, generating equipment and electric arrangements.

CANADA. Some Economic Aspects of Hydro-electric Development in Canada. Contract Rec., vol. 39, no. 46, Nov. 18, 1925, pp. 1108-1110. Discussion answering questions: Has Canada unlimited water power? How soon will she require all of it? Would it be good business to allow export? Could exported power be recovered?

GOLD AND SILVER MINES, ONTARIO. Hydro-Electric Development for Gold and Silver Mines in Northern Ontario, A. R. Webster. Ont. Dept. Mines, vol. 33, part 7, 1925, pp. 99-119, 20 figs. Power development of Northern Ontario Light & Power Co.; Northern Canada Power Co.; Great Northern Power Co.; Gowganda and South Bay companies; Canadian Associated Goldfields.

NEW BRUNSWICK, CANADA. Generating Power in New Brunswick, S. R. Weston. Power House, vol. 18, no. 20, Oct. 20, 1925, pp. 70-73, 4 figs. Details of New Brunswick Elec. Power Commission's project at Grand Falls; few power developments offer an equal opportunity to industry, in so far as supply is concerned.

NORTHERN ONTARIO, CANADA. Power Development in Northern Ontario, A. R. Webster. Power House, vol. 18, no. 20, Oct. 20, 1925, pp. 73-75, 1 fig. Particulars of hydro-electric development in mining districts of northern Ontario which, with substantial increases in production looming, is of unsual interest.

NOVA SCOTIA. Generating Power in Nova Scotia in 1925, H. A. Hatfield. Power House, vol. 18, no. 20, Oct. 20, 1925, pp. 76-77, 2 figs. Despite coal miners' strike in Nova Scotia in first half of 1925, interesting work was done at several power plants in province, and developments in hydro-electric field were quite extensive.

SAGUENAY RIVER, CANADA. Saguenay River Developments from the Standpoint of Power, Pulp and Paper Electro-metallurgy, L. E. Westman. Can. Chem. & Met., vol. 245-250, 6 figs. Review of what has been done and outline of what is in promise, from industrial standpoint.

HYDRO-ELECTRIC PLANTS

BONNINGTON FALLS, CANADA. Power Plant at Lower Bonnington Falls. Elec. News, vol. 33, no. 21, Nov. 1, 1925, pp. 37-39, 9 figs. First unit of ultimate group of three, each 20,000 hp., has been placed in operation.

BRITISH COLUMBIA. Some Further Interesting Views of Stave Lake Power Plant. Elec. News, vol. 33, no. 22, Nov. 15, 1925, pp. 35-37, 7 figs. Shows phases of development work of Brit. Columbia Elec. Ry. Co.

Some Further Interesting Views of Stave Lake Power Plant. Contract Rec., vol. 39, no. 46, Nov. 18, 1925, pp. 1096-1098, 7 figs. Stave Lake total capacity now 87,500 hp.; Brit. Columbia Elec. Ry. Co. total for all plants 212,200 hp.

Stave Falls Power Development, W. G. Murrin. Power House, vol. 18, no. 20, Oct. 20, 1925, pp. 80-82 3 figs. Plant has capacity of 87,500 hp.; Stave Lake has a storage capacity of 471,000 acre feet, and plant has an annual capacity of 250,000,000 kw. hr.

ICE MANUFACTURE

ENGINE-ROOM COSTS. Engine Room Costs in Ice Making, J. H. Howell. Power House, vol. 18, no. 21, Nov. 5, 1925, pp. 20-21, 2 figs. Necessity of having accurate information on engine-room costs, in ice-making and cold-storage plants, is daily becoming more apparent; calculations on a theoretical basis being useless to operating engineer. Abstract of paper read before Pacific Coast Cold Storage Warehousemen's Assn.

INDUSTRIAL MANAGEMENT

FLOW-OF-WORK REGULATION. Effecting Economies by Regulating Work Flow, A. Whitehead. Indus. Mgmt. (Lond.), vol. 12, nos. 3 and 9, Mar. and Sept. 1925, pp. 191-192 and 441-442, 1 fig. Factors which influence economy; how economies have been effected by eliminating losses arising from a poor or irregular flow of work.

PRODUCTION CHECKING. A Policy That Catches Errors Before Production Begins, B. J. Dowd. Am. Mach., vol. 63, no. 25, Dec. 17, 1925, pp. 975-976, 3 figs. Checking, re-checking, and checking again as practised in typewriting plant has made tool and product losses occasioned by mistakes practically negligible.

PRODUCTION CONTROL. Production Control in the Newsprint Industry, Geo. D. Bearce. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 18 pp., 10 figs. Outlines manufacturing processes and production methods of majority of mills in North America making "standard" newsprint paper; describes general production controls used in groundwood, sulphite and paper departments; manufacturers have adopted standard methods of calculating 3 "operating reports" and 4 "conversion cost reports" covering important operations in pulp and paper departments; former are described in detail and illustrated by forms.

SALES PROGRAM. How We Inject the Operating Point into the Sales Program, A. M. Williamson. Factory, vol. 35, no. 6, Dec. 1925, p. 899. By system in plant, in which author is superintendent, sales department is able to forecast with surprising accuracy demand for product several months in advance. (Abstract.) Paper before Production Executives Division, Am. Mgmt. Assn.

SUCCESSFUL. Successful Industrial Management, J. S. Gray. Machy. (N. Y.), vol. 32, no. 4, Dec. 1925, pp. 303-304. Lack of information as cause of much dissatisfaction; foreman's place in organization; encouraging loyalty and co-operation; all-important matter of wages; rules and regulations around factory; avoiding cost of labour turnover; importance of understudies; need of accurate records.

INSULATING MATERIALS, ELECTRIC

DIELECTRIC ABSORPTION. Dielectric Absorption in Fibrous Insulating Materials, R. E. Marbury and E. R. Le Ghait. Elec. Jl., vol. 22, no. 11, Nov. 1925, pp. 526-534, 15 figs. Describes device developed for studying absorption and discusses results obtained; device, known as dielectric lag meter, makes possible a measure of absorption where transient takes place very quickly.

INSULATING MATERIALS, HEAT

TESTING. Guaranties for Heat Insulation Material and Their Verification (Wärmeschutztechnische Garantien und ihre Nachprüfung), J. S. Camerer. Zeit. für die gesamte Kälte-Industrie, vol. 32, no. 11, Nov. 9, 1925, pp. 157-164, 9 figs. Discusses development of technical guaranties and examines methods of testing for acceptance generally used, showing that temperature drop in a hot or cold transmission line and so-called coefficient of heat saved are entirely unsuitable as criteria of quality and efficiency of material supplied; gives practical examples.

INTERNAL-COMBUSTION ENGINES

ROMEISER. The Romeiser Two-Stroke Reaction Motor and Compressor (Der Romeiser Zweitakt-Reaktionsmotor mit Kompressor), Wirtschafts-Motor, vol. 7, no. 6, June 1925, pp. 1-7, 9 figs. Details of ballistic principle and design of engine with pistons, combustion in cylinder taking place purely adiabatically, all water or air cooling being dispensed with, energy hitherto taken up by cooling water being also converted into mechanical work; fuel consumption reduced to 50 per cent.

SWEDISH. Swedish Internal-Combustion Engines (Schwedische Verbrennungskraftmaschinen), E. Hubendick. Zeit. des Vereines deutscher Ingenieure, vol. 69, no. 45, Nov. 7, 1925, pp. 1403-1408, 22 figs. Description of engines now employed in Sweden; data on dimensions, working performance and characteristics in ourboard, carburetor, hot-bulb, ignition-chamber, and Diesel engines.

See also Airplane Engines; Automatic Engines; Diesel Engines; Oil Engines.

IRON CASTINGS

CLEANING. Reducing the Cost of Cleaning Ferrous Castings, J. H. Hopp. Am. Metal Market—Monthly Rev. Section, vol. 32, no. 222, Nov. 17, 1925, pp. 14-15. Facing and molding sand character; fins; effects of gates and risers; composition of cores; cleaning-department factors; mills; sand blasting vs. milling; determining cleaning method; estimating costs, grinding; rubber bonded grinding wheels. Paper presented on behalf of Chicago Foundrymen's Club.

IRON, PIG

MERCHANT, FUTURE OF. The Future of Merchant Pig Iron, C. E. Wright. Iron Age, vol. 116, no. 25, Dec. 17, 1925, pp. 1657-1659, 3 figs. Points out that high freight rates, large imports of foreign iron and economic changes have put many furnaces on inactive list; by-product coke ovens considered as possible remedy.

IRRIGATION

CO-ORDINATION OF POWER AND. Co-Ordination of Irrigation and Power, Wm. Kelly. Am. Soc. Civ. Engrs.—Proc., vol. 51, no. 10, Dec. 1925, pp. 1946-1984, 16 figs. General presentation of factors entering into problem, illustrating difficulties, and pointing out certain solutions by describing special cases that have come before Federal Power Commission.

L

LABOUR

DAY LABOUR IN PUBLIC CONSTRUCTION. Day Labour in Public Construction, J. H. Ellison. Pub. Wks., vol. 56, no. 11, Nov. 1925, pp. 407-410. Arguments against practice from point of view of contractor, presented by an officer of Associated General Contractors of America; government should not compete with private business; day labour more expensive to taxpayers than contract work; declaration of Hennepin County Taxpayers' Assn. Paper read before Am. Soc. for Mun. Improvements.

LATHES

SINGLE-SPINDLE. Single-Spindle Automatic. Machy. (Lond.), vol. 27, no. 687, Nov. 26, 1925, p. 278, 2 figs. Machine made by firm of Boehringer, Goeppingen, Germany, has single pulley drive and self-selecting speeds.

LIGHTING

FACTORIES. Ways of Obtaining the Best Lighting, A. G. Anderson. Mgmt. & Admin., vol. 10, no. 6, Dec. 1925, pp. 345-348, 5 figs. How to plan factory illumination and upkeep of equipment.

LIQUID AIR

PLANT CALCULATION. Calculation of Air Liquefaction Plants on the Basis of New Measurements of the Thomson-Joule Effect (Ueber die Berechnung von Luftverflüssigungsanlagen auf Grund neuer Messungen des Thomson-Joule-Effektes), H. Hausen. Zeit. für die desamte Kälte-Industrie, vol. 32, nos. 7 and 8, July and Aug. 1925, pp. 93-98 and 114-122, 16 figs. Calculation of diagrams of state for up to 200 atmos. and —175 deg. cent. on known thermodynamic relations; calculation of liquefaction plants from diagrams of state liquefaction by Linde process; liquefaction by Claude and Heylandt processes; comparison of the three processes.

LIQUIDS

VISCOSITY UNDER PRESSURE. The Viscosity of Liquids under Pressure, P. W. Bridgman. Nat. Acad. Sciences—Proc., vol. 11, no. 10, Oct. 1925, pp. 603-606. Method developed by which relative viscosity of liquids may be determined over wide range of pressures at various temperatures.

LOCOMOTIVE BOILERS

LAYING OUT OF. Laying Out Locomotive Boilers, W. E. Joynes. Boiler Maker, vol. 24, nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12, Jan., Feb., Mar., Apr., May, June, Aug., Sept., Oct., Nov., and Dec. 1925, pp. 1-5, 40-44, 72-75, 99-102, and 108, 129-134, 166-168, and 170, 235-238, 261-267, 292-296, 324-326, and 350-351, 49 figs. Jan.: Longitudinal seams; firebox design; plates; development of one-piece crown and side sheets. Feb.: Development of backhead and roof sheet of boiler. Mar.: Method of finding outline of one-piece crown and side sheet. Apr.: Spacing of rivets; outline of one-piece roof and side sheet; locating radial stays and staybolts on roof sheet. May: Practical suggestions to follow in boiler development; triangulation development of one-piece crown and side sheets and three-piece roof and sides. June: Combustion-chamber development; radial stays and staybolts; roof-sheet development. Aug.: Flanged-sheet development; backhead and firebox back sheet; tapering flange radius. Sept.: Firebox tube, inside throat, outside throat and front tube-sheet plate developments. Oct.: Finding developed size of plain ring course, laying out dome course. Nov.: Smokebox-shell development, laying out fire-holes; method of locating flexible staybolts. Dec.: Tapering backhead and firebox back-sheet flange radii; arch tubes.

LOCOMOTIVES

COALING PLANTS. Coal and Sand Facilities Embody Novel Features. Ry. Age, vol. 79, no. 22, Nov. 28, 1925, pp. 982-983, 5 figs. Santa Fe is now using new stations of unique design at Argentine, Kan., and Shopton, Ia.

ELECTRIC. *See Electric Locomotives.*

LEHIGH-VALLEY-RAILROAD, DEVELOPMENT OF. The Motive Power of the Lehigh Valley Railroad, P. T. Warner. Baldwin Locomotives, vol. 4, no. 2, Oct. 1925, pp. 14-36, 59 figs. Development from 1896 to present time; weights and dimensions of locomotives now in service, as given in paper, conform to official records of Railroad Co.

LIMA 2-8-4. The 2-8-4 Lima Locomotive. Cent. Ry. Club of Buffalo, N.Y.—Official Proc., vol. 33, no. 4, Sept. 1925, pp. 1867-1878 and (discussion) 1879-1880, 11 figs. Practical tests prove it has 30 per cent increased operating capacity; features of construction; improved design of cylinders and high steam pressure giving great horsepower output backed up with boiler producing greater energy.

MECHANICAL FEATURES. Ideas and Suggestions for Future Locomotive Development, Wm. A. Newman. Boiler Maker, vol. 24, no. 12, Dec. 1925, pp. 337-341, 3 figs. General outline of mechanical features of proposed steam locomotive with special reference to boiler details.

STEAM-TURBINE. Steam Turbine Locomotives, C. S. Darling. Ry. Engr., vol. 46, no. 551, Dec. 1925, pp. 435-439, 1 fig. Consideration of problems involved in design of efficient steam-turbine locomotive.

WHISTLES. A Study of Locomotive Whistles, A. L. Foley. Ry. Age, vol. 79, no. 23, Dec. 5, 1925, pp. 1043-1047, 7 figs. Points out that more effective warnings can be obtained when whistle is located in front of stack.

LUBRICATING OILS

RESEARCHES. Laboratory Researches on Mineral and Lubricating Oils (Le ricerche di Laboratorio sugli olii minerali e di lubrificazione), C. A. Bertella. Ingegneria, vol. 3, no. 12, Dec. 1, 1924, and vol. 4, no. 8, Aug. 1925, pp. 408-415 and 283-291, 40 figs. Discusses tests as to acidity, viscosity, and other physical properties, calorimetry, temperature of combustion, flash-point, chemical properties; behavior of oil in contact with metal; lubricating power of oil, etc.

LUBRICATION

JOURNAL. A Graphical Study of Journal Lubrication (Part III), H. A. S. Howarth. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 23 pp., 48 figs. Continuation of investigation reported to Society under same title in 1923 and 1924; friction curves are presented for central and offset bearings whose curvature radius exceeds that of journal; characteristics of fitted partial bearings are then studied, including their carrying capacities and friction.

M

MACHINE TOOLS

PUNCHING-SLOTTING MACHINES. The "Butler" Puncher Slotter. British Machine Too Eng., vol. 3, no. 34, July-Aug. 1925, pp. 290-292, 3 figs. Heavy costs of forging or stamping many large pieces used in locomotive and car building and in fact in almost every branch of engineering trade, may be now enormously reduced by use of Puncher Slotting Machines; puncher slotters will remove steel of good quality at rate of 4-5 lb. per min.; suitable for all kinds of slotting and shaping work within their capacity, and by reason of their extreme rigidity, work produced is of exceptional finish and accuracy.

RAILWAY SHOPS. Some New Machine Tools at North Road Works, Darlington, London & North Eastern Railway. Ry. Engr., vol. 46, nos. 550 and 551, Nov. and Dec. 1925, pp. 392-398 and 425-430, 20 figs. Deals with developments at Company's locomotive works at Darlington; describes vertical drilling and boring machine, slot drilling machine, machine for manufacture of staybolts, etc.

MAGNETIC FIELD

AIR-GAP. The Air-Gap Magnetic Field in Non-Salient Pole Machinery, B. Hague. World Power, vol. 4, no. 23, Nov. 1925, pp. 264-271, 10 figs. Theory of field due to currents in uniform air gap with plane iron boundaries; magnetic field due to linear currents.

MALLEABLE CASTINGS

BLACK-HEART PROCESS. Malleable Iron Castings, R. Micks. Can. Foundryman, vol. 16, no. 11, Nov. 1925, pp. 11-13. Points out that of the two processes of manufacturing malleable iron castings, black heart, or American process, produces better malleable iron in shorter time and with less expense.

MASONRY

CALCULATION. Calculation of Solid Masonry (Calculo de massicos de alvenaria), O. Nunes. Revista Brasileira de Engenharia, vol. 10, no. 3, Sept. 1925, pp. 77-81, 6 figs. Develops a simple formula for determining dimensions of base of trapezoidal masonry, conveniently applicable to other profiles; calculation of joints, etc., and examples.

MATERIALS HANDLING

ACCIDENT PREVENTION. Safety in Materials Handling, D. S. Beyer. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 30 pp., 15 figs.; also (abstract) in Am. Mach., vol. 63, no. 23, Dec. 3, 1925, pp. 890-891. After demonstrating seriousness of materials-handling accident hazard, author computes yearly economics loss to be $250,000,000; analyses such accident hazards in general broad classifications and points out few methods of prevention; calls attention to necessity for including in construction drawings and specifications means for prevention of such accidents.

HIDDEN COSTS. The Hidden Costs in Handling Bulk Materials. Factory, vol. 35, no. 6, Dec. 1925, pp. 896-899, 966, 968. and 970, 972, 974, 976 and 978, 6 figs. Contains following contributions: Handling Coal and Ashes Is a Simple Matter Now, C. H. Kirkpatrick; Conveyors Pave the Way to Lower Handling Costs, E. T. Cristiani; A Monorail Conveyor Cut Our Handling Costs 29%, H. H. MaComber; $7,805.47 Saved Annually by Improved Handling Methods, F. A. Ory.

MEASURING INSTRUMENTS

HIGH SPEED BY SOUND VIBRATION. Measuring High Speed by Sound Vibration, C. R. Alden. Machy. (N. Y.), vol. 32, no. 4, Dec. 1925, pp. 286-288, 3 figs. Device invented by author is arranged so that pitch of sound emitted by high-speed spindle is compared with sound or note emitted by speed-measuring device; latter is so calibrated that it indicates directly revolutions per minute corresponding to given note in musical scale, which, in turn, is equivalent to certain of vibrations per second.

STRESS RECORDERS. Fereday-Palmer Stress Recorder, F. Johnstone Taylor. Can. Engr., vol. 49, no. 20, Nov. 17, 1925, pp. 557-558, 2 figs. Notes on an instrument designed for measuring stresses on bridges; employes a beam of light.

METALS

CORROSION. Wear and Corrosion in Metal Work (L'usure et la corrosion dans les ouvrages métalliques), J. Jacquart. Annales des Ponts et Chaussées, vol. 95, no. 4, July-Aug. 1925, pp. 5-66, 13 figs. Theory of corrosion, sublimation and dissolution of metal; chemical action, precipitation of ions, galvanic action, electrolytic action, theory of stray currents; wear of ferrous metals, oxidation and rust formation, errosion; non-ferrous metals, protection of metals, coatings, etc.

FATIGUE OF. High-Frequency Fatigue Tests, C. F. Jenkin. Roy. Soc.—Proc., vol. 109, no. A749, Sept. 1, 1925, pp. 119-143, 8 figs. Experiments on high-frequency fatigue in copper, Armco iron, and mild steel carried out in Engineering Laboratory, Oxford, for Fatigue Panel of Aeronautical Research Committee; results show that mechanism of fatigue requires time.

MILLING CUTTERS

SIZES OF STANDARD. Sizes of Standard Milling Cutters (Simplified Practice). Am. Mach., vol. 63, no. 23, Dec. 3, 1925, p. 907. Reference book sheet.

STANDARDIZATION. Standardizing Milling Cutters, T. R. Jones. Am. Mach., vol. 63, no. 23, Dec. 3, 1925, p. 916, 1 fig. Revised design of shell-end mills; suggests that still further simplification of end mills can be had by adopting uniform design.

MILLING MACHINES

DIVIDING HEADS. Dividing Head Designed for Heavy Work, O. S. Marshall. Machy. (N. Y.), vol. 32, no. 4, Dec. 1925, pp. 305-306, 3 figs. New type of dividing head designed to cover wider range of precision indexing and to handle heavier work than ordinary type.

MINERALS

HARDNESS, QUANTITATIVE STANDARDS FOR. Quantitative Standards for Hardness of the Ore Minerals, S. B. Talmage. Economic Geology, vol. 20, no. 6, Sept.-Oct. 1925, pp. 531-553, 4 figs. Variation in results obtained by different workers, of tests on minerals adopted as standard for Mohs scale; instruments for quantitative measurements; new scale of hardness; quantitative data; etc.

MINES

ONTARIO. The Creighton Mine, W. E. Bawden. Can. Inst. Min. & Metallurgy—Bul., no. 163, Nov. 1925, pp. 1054-1068, 10 figs. Mine is situated 12 mi. west of Sudbury, Ont., on Algoma Eastern railway, and is owned and operated by Int. Nickel Co.; ore is smelted at Copper Cliff, and matte is refined at Port Colborne, Ont., on Lake Erie; mining methods; pillar development and recovery; chute drawing and tramming; elimination of sub-levels.

MINING INDUSTRY

MANITOBA. Recent Mining Developments in the Central Manitoba Mining District, H. A. Wentworth. Can. Inst. Min. & Metallurgy—Bul., no. 162, Oct. 1925, pp. 941-951, 3 figs. District embraces two known mineralized belts: gold area in north, a zone 8 or 10 mi. wide and about 40 mi. long; and Bird River copper and copper-nickel deposits.

MOULD

CONCRETE-UNIT, FIRE TESTS OF. Building Inspector Conducts Fire Test on Concrete Unit House, L. F. Morgan. Concrete Products, vol. 29, no. 5, Nov. 1925, pp. 41-45, 5 figs. Particulars of fire test made on concrete units as result of inquiries on part of members of Connecticut Valley Concrete Products Assn. as to what way they collectively could at one time get their products before eyes of public, architects, builders, engineers and prospective home builders; building was erected, filled up with combustible material, fire set to it and then hose turned on it; results obtained.

MOULDING METHODS

CAST-IRON PISTONS. Pistons for Internal Combustion Engines, A. J. Richman and J. L. Francis. Metal Industry (Lond.), vol. 27, nos. 17, 19, and 21, Oct. 23, Nov. 6 and 20, 1925, pp. 389-390, 437-438 and 489-491, 16 figs. Authors describes what they have found to be best moulding and metallurgical practice in production of cast-iron pistons of various types; moulding and allied processes for pistons of small gasoline and paraffin engines are first considered; followed by discussion of larger-type pistons and also chief metallurgical problems involved.

DRY-SAND. Dry-Sand Moulding, C. H. Brown. Foundry Trade Jl., vol. 32, no. 482, Nov. 12, 1925, pp. 415-416 (including discussion). Milling of sand; ramming a dry-sand mould; venting; effects of bat gating; loam cores.

MOULDS

PERMANENT. Production of Castings in Permanent Moulds. Brit. Cast Iron Research Assn.—Bul., no. 10, Oct. 1925, pp. 9-10. Bibliography covering more important papers and patent specifications since 1911 dealing with production of castings in permanent moulds.

MOTOR BUSES

DEVELOPMENT. Motor Bus Developments. Motor Transport (Lond.), vol. 41, no. 1081, Nov. 16, 1925, pp. 665-666. A survey of conditions responsible for production of present-day light, high-speed public service vehicles. Résumé of paper read by L. G. Wyndham Shire at C.M.U.A. Road Traffic Conference, Nov. 5, 1925.

ENGINES. The Prospects of the Six-cylinder Engine, E. Reeve. Motor Transport (Lond.), vol. 41, no. 1083, Nov. 30, 1925, pp. 711-713, 7 figs. Advantages of 6-cylinders for commercial vehicles, particularly for passenger carrying.

N

NICKEL STEEL

IMPACT VALUES. Impact Values of a Nickel Steel, F. T. Sisco. Iron Age, vol. 116, no. 23, Dec. 3, 1925, pp. 1513-1514, 2 figs. Effect of quenching and drawing temperatures on Izod results. Published by permission of Chief of Air Service, U. S. War Dept.

MACHINERY. Nickel Steels in Machinery, J. W. Urquhart. Mech. World, vol. 78, no. 2028, Nov. 13, 1925, pp. 383-384. Machining qualities of nickel steel; case-carburizing qualities; primal cause of nickel-steel strength; finer "grain" in nickel steels; outstanding advantage; simplified heat treatment.

O

OIL

ENGINEERING DEVELOPMENTS. Progress in Petroleum Engineering. Mech. Eng., vol. 47, no. 12, Dec. 1925, pp. 1126-1132. Report contributed by Petroleum Division of Am. Soc. Mech. Engrs. Need for co-operative research; trends in production of petroleum; leading problems of storage; transportation; marine transportation; refining and manufacturing; materials of construction; lubricating oils; physical properties of petroleum and its products; testing of petroleum products; research work in progress; economics; opportunities for engineers in petroleum industry. Bibliography.

OIL ENGINES

INDUSTRIAL PLANTS. Some Uses for Oil Engines. Power, vol. 62, no. 22, Dec. 1, 1925, pp. 840-841, 5 figs. Suitability of oil engines for oil plants needing process hot water; comparative operating expenses and first cost of Diesels and steam engines.

PLENTY-STILL. The Plenty-Still Oil Engine. Mar. Eng. & Motorship Bldr., vol. 48, no. 578, Nov. 1925, p. 397, 1 fig. Preliminary particulars of latest adaptation of Still principle in engine undergoing tests at Newbury; single-cylinder heavy-oil engine intended to be applied to trawlers.

OIL FUEL

CENTRIFUGES FOR PURIFYING. Centrifuges for Diesel Fuel (Zur Reinigung der schweren Brennöle durch Zentrifugen), H. Wittmaack. Wirtschaftsmotor, vol. 7, no. 8, Aug. 1925, pp. 11-13. It has been found that Diesel fuel oils of 24 to 36 deg. B. gravity can be used without disadvantage in Diesel engine after ordinary filtration; impurities can be centrifuged out especially if fuel oil is heated; centrifuges involving gas-proof containers have been developed and heavier fuels should be treated in these.

ECONOMICAL APPLICATION. Research in Liquid Fuel Economy, M. Sklovsky. Am. Iron & Steel Inst.—advance paper, for mtg. Oct. 23, 1925, 19 pp., 11 figs.; also (abstract) in Fuels & Furnaces, vol. 3, no. 11, Nov. 1925, pp. 1247-1252, 4 figs. Discussion is limited to application of liquid fuel to metallurgical operations in industrial production furnaces; points out that three distinct directions of effort may be applied for obtaining better fuel economy: (1) by proper combustion efforts; (2) by better furnace adaptation and construction; (3) by better attention to furnace.

OIL SHALES

TESTING. The Development of a Standard Canadian Laboratory Distillation Method for Examination of Oil Shale, R. E. Gilmore and A. A. Swinnerton. Can. Chem. & Metallurgy, vol. 9, nos. 10 and 11, Oct. and Nov. 1925, pp. 215-217 and 235-239, 2 figs. Reviews comparative results of distilling a standard oil shale by different methods, and discusses factors to be considered in selection of a simple and reliable laboratory, which authors hope may be adopted as a Canadian standard laboratory distillation method. Paper read at Dominion Convention of Chemists, Guelph, Ont., June 4, 1925.

OIL TANKS

STEEL, STANDARDIZATION. Report of Special Committee on Standardization of Steel Storage and Production Tanks as Applied to the Production of Oil. Am. Petroleum Inst.—Bul., vol. 6, no. 51, Sept. 4, 1925, pp. 101-104. Recommendations from manufacturers of small bolted and riveted tanks; recommendations for storage tanks of capacity of 30,000 bbl. or greater; recommendations for field tanks.

OIL WELLS

PUMPING EQUIPMENT. Special Committee on Standardization of Pumping Equipment and Engines as Applied to the Production of Oil—Report of Status of Work. Am. Petroleum Inst.—Bul., vol. 6, no. 51, Sept. 4, 1925, pp. 92-98. Digest of discussion on tubing; letter of transmittal on tubing recommendations sent to Pipe Manufacturers' Subcommittee; etc.

VERTICALITY, CHECKING OF. Method of Checking Verticality of Wells, V. Svimonoff. Petroleum Wld., vol. 22, no. 300, Sept. 1925, pp. 382-383, 3 figs. Recent research disclose that in case of even shallow wells vertical direction of a well is purely a product of imagination and that hole of a well follows every conceivable form of deviation from vertical; deep drilling; start is important; disadvantages of crooked wells.

OSCILLOGRAPHS

CATHODE-RAY. The Use of the Cathode-Ray Tube as a Wattmeter and Phase-Difference Measurer for High-Frequency Electric Currents, J. A. Fleming. Instn. Elec. Engrs.—Jl., vol. 63, no. 347, Nov. 1925, pp. 1045-1046, 1 fig. Account of manner in which cathode-ray tube can be employed to measure high-frequency power, that is, as wattmeter, by delineation and measurement of ellipse formed on phosphorescent screen by cathode-ray spot, which is oscillated in two directions at right angles by current and voltage of circuit under test.

ELECTROMECHANICAL SYSTEMS, FOR SOLVING. Oscillographic Solution of Electromechanical Systems, C. A. Nickle. Am. Inst. Elec. Engrs.—Jl., vol. 44, no. 12, Dec. 1925, pp. 1277-1288, 16 figs. Simple and practical method has been developed for investigating certain important classes of dynamic systems, as represented by power system comprising synchronous or induction generating units, with prime movers, connected through transmission lines to receiving apparatus of same character; behavior of individual units can also be investigated; describes method and its application to few of possible cases; method is to have "equivalent electrical circuit" solve problem, and oscillograph plot solution. See also (discussion) pp. 1341-1342.

OXY-ACETYLENE CUTTING

METALS. Advancement in the Gas Cutting of Metals, A. S. Kinsey. Am. Welding Soc.—Jl., vol. 4, no. 9, Sept. 1925, pp. 20-22. Tests show that there is saving of from 10 to 20 per cent in oxygen consumption, and equivalent saving in time when purity of oxygen is increased from 99 to 99.5 per cent.

STEEL FOUNDRY. Steel Industry Uses Acetylene Gas to Advantage. Iron Trade Rev., vol. 77, no. 22, Nov. 26, 1925, pp. 1345-1346. Review of paper read before Int. Acetylene Assn., by R. W. Thomas, on influence of oxy-acetylene cutting on steel-foundry practice.

OXY-ACETYLENE WELDING

BRONZE WELDING OF LOCOMOTIVE CYLINDERS. Bronze Welding of Locomotive Cylinders. Acetylene Jl., vol. 27, no. 4, Oct. 1925, pp. 174-176, 7 figs. Describes operation in welding broken parts of locomotive after collision; advantages of bronze welding over welding with cast iron or steel rods.

P

PATTERNS

ALUMINUM-PAINTED. Protecting Patterns with Paints. J. D. Edwards and R. I. Wray. Iron Age. vol. 116, no. 24, Dec. 10, 1925, p. 1568. Advantages of aluminum paint recently developed by Aluminum Co. of Am.; various mixtures compared; savings claimed by their use; appreciable advantages in ease, with which patterns may be withdrawn from mold.

PILES

CONCRETE. Determining Factors in Selection of Piling for Waterfront Structures, G. F. Nicholson. World Ports, vol. 13, no. 11, Sept. 1925, pp. 34-46 and (discussion) 46-47, 5 figs. General causes of failure of concrete in sea water; outline of methods used in conducting piling tests, Los Angeles harbour; etc.
Concrete Jacketed Piles, F. G. White. World Ports, vol. 13, no. 11 Sept. 1925, pp. 89-98 and (discussion) 98-102, Discusses the various types of jacketed piles which have been used most extensively and presents some evidence as to relative merits of the different types.

PHOTOMETERS

UNIVERSAL PORTABLE. A New Form of Universal Portable Photometer, A. Blondel. Illuminating Engr., vol. 18, Sept. 1925, pp. 237-238, 4 figs. Particulars of new photometer based on a modification of method of Lord Rayleigh; has wide range of application, especially in connection with scientific research.

PIPE

BENDS. Notes on the Expansion of Pipe Bends, Wm. Chas. Rowe, Commonwealth Engr., vol. 12, no. 22, July 1, 1925, pp. 449-450, 4 figs. Gives results of tests of bent and straight pipes, according to Kent, no thorough attempt has been made to determine maximum amount of expansion which a U-loop or quarter bend would take up in a straight run of pipe, having both ends anchored, graphs of tests given; states that it is desirable to make bend pipes of as reasonably large radius as is practicable and not to depend upon length of straight pipe, which transfers an enormous load to flanges. Paper read before Victorian Inst. of Engrs.

PLATES

STRESSES AROUND RECTANGULAR OPENINGS. The Effect of the Radius of the Fillets on the Stresses Around Rectangular Openings in Plates, T. H. Frost, P. E. Pihi and O. D. Colvin. Soc. Nav. Architects & Mar. Engrs.—advance paper, no. 2, for. mfg. Nov. 12-13, 1925, 4 pp., 6 supp. plates. Outline of investigation, objects of which was to experimentally determine relation which exists (1) between stresses at various points on corners of square openings in flat plate and ratio of width of plate to width of opening, and (2) between stresses at these points and radius of curvature of fillet at corners. See (abstract) in Mar. Eng. & Shipp. Age, vol. 30, no. 12, Dec. 1925, pp. 690-691, 1 fig.

POLES, WOODEN

PRESERVATION. Methods of Preserving Poles and Economies of Pole Treatment, L. R. Gamble, Jl. Electricity, vol. 55, no. 9, Nov. 1, 1925, pp. 325-329, 5 figs. Describes methods and their application; economies of pole treatment. (Extracts). Paper read before Northwest Elec. Light & Power Assn.

POWER

INDUSTRIAL LOCATION, EFFECT ON. Power—and the Industrial Map. J. A. Piquet. Indus. Mgnt. (N.Y.), vol. 70, no. 6, Dec. 1925, pp. 355-361, 7 figs. How power development is changing, not only industrial location, but whole structure of industrial production.
WASTE ELIMINATION IN GENERATION AND TRANSMISSION. Spotting and Stopping the Wastes in Power Generation. Transmission and Application. Indus. Mgmt. (N.Y.) Supp. Plate, vol. 70, no. 6, Dec. 1925. Chart as noted by F. Juraschek and visualized by F. H. Peard.

POWER FACTOR

CORRECTION, COAL MINES. Good Power Factor Conditions Always Serve to Lower Capital Charges and Energy Costs, E. J. Gealy, Coal Age, vol. 28, no. 21, Dec. 10, 1925, pp. 801-806, 11 figs. Careful selection of apparatus is most necessary; corrective equipment now available permits power devices to carry larger loads and reduces bills; applications of synchronous and static condensers.

POWER TRANSMISSION

LUBRICATION IN. Reducing the Friction Tax on Power Transmission, A. F. Brewer, Indus. Mgmt. (N.Y.) vol. 70, no. 6, Dec. 1925, pp. 350-375, 11 figs. Modern lubrication and cost of power.
MECHANICAL CONTROL OF. The Control of Mechanical Power Transmission, Wm. Staniar, Indus. Mgmt. (N.Y.) vol. 70, nos, 3, 4, 5 and 6, Sept., Oct., Nov. and Dec. 1925, pp. 135-140, 7 figs.; 218-222, 5 figs.; 272-276, 4 figs.; 338-343, 9 figs. Discusses means of increasing profits through proper belting and transmission installation and control. Sept. Average methods which involve tremendous waste. Oct.: Direct influence of correct belting on profits. Nov.: Belting standardization. Dec.: Transmission applications.
ROPE DRIVE. Rope Drives. P. W. Pell. Colliery Eng. vol. 2, no. 21, Nov. 1925, pp. 519-520, 2 figs. Merits and weaknesses relative; merits of manilla and cotton; factors influencing efficiency and long life; systems compared, over-roping.

PULLEYS

BELT. Tests on Air Friction on Belt Pulleys (Versuche über die Luftreibung un Riemenscheiben. H. Cranz. Maschinenbau, vol. 4, no. 19, Sept. 17, 1925, pp. 927-931, 6 figs. Describes method followed in experiments; concludes that at usual velocities of about 25 m. per sec. losses due to air friction are exceedingly small but with further increase of velocity they increase rapidly.

PULVERIZED COAL

BOILER FIRING. Pulverized Fuel for Boilers and Furnaces, W. R. Chapman. Fuel vol. 4. nos. 8. 9, 10 and 11, Aug., Sept., Oct. and Nov. 1925, pp. 340-343, 396-400, 420-424 and 486-492. Aug.: Drying coal; pulverization; transport of powdered fuel; feeders, mixers and burners; combustion chamber. Sept.: Combustion-chamber lining; disposal of ash; suitability of fuels. Oct.: Efficiency comparison with other methods of firing. Nov.: Includes summary of principal points in these articles.
CONVEYING. Coal Dust Conveying (Kohlenstaub-förderung), Walther, Braunkohle, vol. 24, no. 20, Sept. 26, 1925, pp. 599-601. Deals with mixing dust with air or gas (1/49 to 1/25), for better conveying, and using compressed air for conveying from railway cars and bunkers.
PLANTS. Powdered Coal Installation at The Baldwin Locomotive Works, C. C. Bailey, Baldwin Locomotives, vol. 4, No. 2, Oct. 1925, pp. 37-46, 13 figs. Description of installation which comprises a main station with seven auxiliary or substations handling full requirements of 160 furnaces, 4 Babcock & Wilcox boilers of 600 hp. each, and 3 pile heating furnaces; main station; wherein is housed equipment necessary for crushing, drying, pulverizing and ejecting coal to substations, has maximum capacity of 10 tons per hour.

PUMPING STATIONS

DIESEL. Diesel Pumping Station. Portage, Wis. Power, vol. 62, no. 24, Dec. 15, 1925, pp. 924-926, 5 figs. Oil-engine plant shows estimated annual saving of $3362 over purchased electric power at prevailing rates and gasoline engine standby; when earnings have paid for plant, annual saving will exceed $7000.

PUMPS

GASOLINE. The Shell Kerbside Petrol Pump. Engineering, vol. 120, no. 3128, Dec. 11, 1925, pp. 752-754, 3 figs. Describes improved design of pump constructed to design of Shell-Mex. Ltd. in this type required quantity of fuel is delivered from actual measuring vessel, which is in full view of customer.
TROUBLES AND THEIR DETECTION. What to do when the pump Stops. Wm. S. Jones. Power, vol. 62, no. 25, Dec. 22, 1925, pp. 966-968, 3 figs. Common causes of failure of direct-acting pumps; how to put pump back into service.
TURBO, DEVELOPMENT OF. Development of the Steam Turbo-pump as a Water Works Machine (Die Entwicklung der Dampfturbopumpe als Wasserwerksmaschine), B. Rosenfeld, Gas- u. Wasserfach, vol. 68, no. 41, Oct. 10, 1925, pp. 639-644, 9 figs. Discusses its development from coaling water pump of steam turbine plants and describes the various stages of this development.

PUMPS, CENTRIFUGAL

BOILER FEED PLANT. Centrifugal Pumps as Feed Apparatus for High-Pressure Boiler Plants, G. Weyland, Eng. Progress, vol. 6, no. 11, Nov. 1925, pp. 353-354, 4 figs. Discusses use of centrifugal pumps as feed pump for high-pressure plants.
GLAND SEALS FOR. Improvement in Gland Seals for Centrifugal Pumps, J. C. Hobbs. Power, vol. 62, no. 24, Dec. 15, 1925. pp. 935-936, 3 figs. Notes on operating characteristics and proper way to seal shaft bearings from leakage.

R

RADIO COMMUNICATION

RAILWAYS. How the Railroads can use Radio, G. Y. Allen. Can. Ry. Club. Official Proc., vol. 24, No. 6, Sept. 1925, pp. 22-39 and (discussion) 39-43, 12 figs. Most obvious application of space radio communication is to supplement present wire communicating systems in case of emergencies; describes types of telegraph transmitters and receiving equipment; carrier-current communicating system.

RAILWAY CONSTRUCTION

WINTER WORK. Is Winter Work Profitable ? A. M. Bouillon. Ry. Age, vol. 79, no. 23, Dec. 5, 1925, pp. 1033-1036, 5 figs. Answer to question based on extended experience with construction at low temperatures.

RAILWAY ELECTRIFICATION

FRANCE. Main Line Railway Electrification, P. Dawson and S. Parker Smith. Engineer, vol. 140, nos. 3640 and 3643, Oct. 2 and 23, 1925, pp. 341-344 and 423-426, 11 figs. Electrification in France. Oct. 2. Historical: reasons for electrification; choice of system; Paris-Orleans railway. Oct. 9: Paris-Lyons-Mediterranean Ry.; electrification on lines in neighborhood of Nice; results of electrification.
SOUTHERN RAILWAY, ENGLAND. The World's Greatest Suburban Electrification. Ry. Engr. vol. 46, nos. 550 and 551, Nov. and Dec. 1925, pp. 383-391 and 398 and 413-424, 35 figs. Technical details of Southern Ry.'s electrified service.

RAILWAY MANAGEMENT

SIMPLIFICATION OF OPERATION. A Plan to Simplify Railroading, T. C. Powell. Ry. Rev. vol. 77, no. 21, Nov. 21, 1925, pp. 768-770. Pooling of trains, unification of terminals, extensive use of automotive facilities suggested. (Abstract). Address delivered before West. Ry. Club.

RAILWAY MOTOR CARS

DIESEL-ELECTRIC. Diesel Electric Cars, Canadian National Railway. Can. Ry. & Mar. Wld., no. 332, Oct. 1925, pp. 501-503, 5 figs. Particulars of articulated oil-electric cars, equipped with Diesel engines, and 60-ft. oil-electric cars also equipped with Diesel engines, being built at Montreal Shops of Can. Nat. Ry.
GASOLINE. Self-Propelled Cars on Steam Railways. Ca. Ry. & Mar. Wld., no. 330, Aug. 1925, p. 368, 1 fig. Describes new Brill model gasoline cars of Can. Nat. Ry.; overall length 43 ft. 5 5/16-in., length over end sills 42 ft. 7 5/16-in., width over side sills 8½ ft., extreme height 10 ft. 5 1/16-in., gasoline engine is of 4- cylinder 4-cycle type with 4¼-in. bore by 6-in. stroke with a 3-in. crankshaft carrier on 3 main bearings.

RAILWAY REPAIR SHOPS

COSTS AND OUTPUT. Shop and Output. J. W. Kennedy. Can. Ry. Club—Official Proc., vol. 24, no. 8, Nov. 1925, pp. 20-34 and (discussion) 34-41, 7 figs. Describes contract wage system employed at Can. Pac. Angus Shops, Montreal, with guaranteed hourly rate; method employed to control and record locomotive and repair costs and output.

RAILWAY SIGNALLING

APPROACH LIGHTING. Track circuits and Approach Lighting of Signals (Circuiti di binario e illuminazione d' approccio del segnali), S. Dorati. Rivista Technica delle Ferrovie Italiane, vol. 28, no. 3, Sept. 15, 1925, pp. 88-95, 13 figs. Details of system in which signals are only lighted on approach of train, either by electromechanical devices actuated by train, or by a track circuit, and its application at Sette Bagni Station, where it has been in operation since July 1924.
TRACK CIRCUITING. Direct-Current Transient Track-Circuits for Special Locations. Ry. Engr., vol. 46, no. 551, Dec. 1925, p. 431, 1 fig. Instructive particulars of experimental track circuit installed on Lond. & North Eastern Ry.

RAILWAY TRACK

WELDING. Report of Committee on Way Matters, Elec. Traction, vol. 21, no. 10, Oct. 1925, pp. 529-533, 4 figs. Standardization of frogs, tongue switches and hard center for special track work; welded rail joints; surface hardening of rails at mill and on street; "Bary" process; arc-welding processes for repairs, to rails and manganese steel; rail-joint welding; welding cupped rail end; welding manganese steel; recommendations; design of substitute ties; reduction of noise in car operation. Committee report to Am. Elec. Ry. Assn.

RAILWAYS

ECONOMICAL FORCE, AS. The Railway as an Economic Force, R. S. Binkerd. Mech. Eng., vol. 47, no. 12, Dec. 1925, pp. 1101-1102. Discusses important place of railroads in structure of modern economic society.

REDUCTION GEARS

INVOLUTE TEETH AND. Reduction Gearing and Involute Teeth, M. Delaporte. Shipbldg. & Shipg. Rec., vol. 26, no. 23, Dec. 3, 1925, pp. 594-595 and 598, 8 figs. Remarks based on earlier paper by author in which conclusions was reached that conservation in service of teeth profile demands that they should be devoid of flexibility and compressibility as far as possible. Translated from paper read before Assn. Technique Maritime & Aeronautique.

REFRIGERANTS

CRITICAL CONSTANTS. Problem of the Intermediate Fluid to Refrigerating Machines (Il problema del fluido intermediario bnelle macchine frigorifere), E. Foa. Industria, vol. 39, no. 20, Oct. 31, 1925, pp. 532-537, 3 figs. Discusses method of studying influence of choice of intermediary liquid on work and volume of liquid; application to sulphur anhydride, carbon anhydride and ammonia.

REFRIGERATING MACHINES

ABSORPTION. Absorption Refrigerator, Elec. World, vol. 86, no. 23, Dec. 5, 1925, p. 1161, 2 figs. Domestic electric refrigerator operates on continuous-absorption principle; no moving parts required; total pressure in system always same.

COMPRESSORS. High Revolution Compressors for Marine Refrigeration, E. Markham. Refrig. Eng. vol. 12, no. 4, Oct. 1925, pp. 111-116. Essentials of good refrigeration compressor; reasons for making machine vertical in preference to horizontal; reliability; efficiency, safety in operation and low initial cost; silence in operation and easy overhaul.

REFRIGERATING PLANTS

CORROSION IN. Corrosion in the Refrigerating Industry. W. G. Whitman, E. L. Chappell and J. K. Roberts. Refrig. Eng., vol. 12, no. 5, Nov. 1925, pp. 158-165, 11 figs. Survey of previous work; laboratory study of important factors, and of various methods for corrosion prevention. Condensation of report submitted to Committee on Corrosion of Am. Soc. Refrig. Engrs.

REFRIGERATION

COOLING APPARATUS. The Production of Low Temperatures, B. Von Platen and C. G. Munters. Refrig. Eng. vol. 12, no. 5, Nov. 1925, pp. 143-148, 9 figs. Describes principles for two kinds of refrigerating apparatus, one being especially suitable as to efficiency for relatively greater difference in temperature of condenser and cooler and other for relatively smaller difference. Translated from Teknish Tidskrift, Mar. 21, 1925, pp. 80-95, 11 figs.

RESERVOIRS

CONCRETE. A New Concrete Reservoir with Unusual Features. Waldo E. Smith. Fire & Water Eng., vol. 78, no. 23, Dec. 2, 1925, pp. 1233-1234, 1 fig. Reservoir is of ring-tension type; floor slab constructed monolythically with column footings; concrete poured continuously; method of construction.

RETAINING WALLS

CALCULATION. Calculation of inclined retaining walls. (Die Berechnung der Winkelstützmauern), E. Mörsch. Beton u Eisen, vol. 24, no. 20, Oct, 20, 1925, pp. 327-339, 42 figs. Results of tests carried out at institute for testing materials of Stuttgart technical highschool; treating in detail pressure conditions on inclined wall; showing that same component is reached whether starting with vertical or with inclined plane, provided angle of earth pressure and normal is properly chosen.

RETAINING WALLS

CONCRETE. River Walls of the Miami Conservancy District. Eng. & Contracting (General Contracting), vol. 64, no. 6, Nov. 18, 1925, pp. 1113-1118, 5 figs. Methods and costs of constructing gravity and semi-reinforced concrete retaining walls.

RIVERS

DEPTH AND CURVATURE OF CHANNELS. Relation of Depth to Curvature of Channels, E. C. Ripley. Am. Soc. Civ. Engrs.—Proc., vol. 51, no. 10, Dec. 1925, pp. 1907-1938, 10 figs. Results of writer's investigations into law of river hydraulics; two empiric formulae have been devised by means of which cross-profile of channel may be computed; some characteristics of law were also disclosed, which are believed to be most important discoveries in that law in more than 50 years; practical applications of these formulae are given which furnish solution to problems that heretofore have been considered not susceptible of solution.

RIVETS

HIGH TEMPERATURE, EFFECTS OF. High Temperatures Hurt Rivets. A. L. Spencer, Jr. Iron Age, vol. 116, no. 23, Dec. 3, 1925, pp. 1521-1522, 1 fig. Tests show that heating above 1950 deg. fahr. produces structure which will not withstand rapid alternate compression and tension. (Abstract). Paper read before Am. Inst. Steel Constr. See also Iron Trade Rev. vol. 77, no. 22, Nov. 26, 1925, pp. 1341-1344, 2 figs.

ROAD CONSTRUCTION

EFFICIENCY. Efficiency in Construction Operations, T. J. Wasser. Eng. & Contracting (Roads & Streets), vol. 64, no. 5, Nov. 4, 1925, pp. 1017-1021. Factors that effect efficiency of contractors organization and influence of specification interpretation on unit cost of highway construction. Paper presented at Assn. Highway Officials of North Atlantic States convention.

ROADS

EFFECT OF SIX-WHEEL TRUCKS ON. Effect of Six-Wheel Trucks on Pavements. Pub. Wks., vol. 56, no. 11, Nov. 1925, pp. 400-403, 6 figs. Tensile stress about half as great as that produced by a four-wheel truck of same gross load, practically independent of axle spacing; maximum stress occurs in bottom of slab and along edge of slab; and fiber deformation is twice as great when outer wheel is 9 in. from edge as when 21 in.

RESURFACING. Resurfacing Work Improved by Heating the Base, G. H. Lutz. Can. Engr., vol. 49, no. 20, Nov. 17, 1925, pp. 559-560, 1 fig. Not necessary to rely solely on weight of top for stability of bituminous paving surfaces; thin wearing costs can be applied to old pavements; concrete base coated and allowed to cool before applying surface.

TRAFFIC CONTROL, MECHANICAL DEVICES FOR. Traffic Control by Mechanical Devices, A. H. Blanchard, Eng. & Contracting (Roads & Streets), vol. 64, no. 5, Nov. 4, 1925, pp. 995-1000. Safety devices and regulations at railroad grade crossings for promotion of highway safety.

ROADS, ASPHALT

FOUNDATIONS. Various Foundations for Asphalt Pavements, G. C. Warren, Can. Engr., vol. 49, no. 20, Nov. 17, 1925, pp. 551-554. Black base, portland cement concrete, Macadam and other types as viewed by bituminous paving contractor; drainage, subsoil, location and other factors. Paper read at Detroit before Asphalt Paving Conference.

ROADS, CONCRETE

ASPHALTIC CONCRETE. Perth Streets Modernised with Asphaltic Concrete, R. W. Parkhurst. Commonwealth Engr., vol. 13, no. 2, Sept. 1, 1925, pp. 73-76, 3 figs. Factors influencing selection of asphalt details of construction of the different roads; comparaison of traffic records; foundations and metal available; classification of asphalt surfaces; advantages of proper asphaltic concrete; details of foundation construction; asphaltic mixture employed.

DESIGN. The Design of Cement Concrete Pavements, A. T. Goldbeck. Concrete, vol. 27, no. 4, Oct. 1925, pp. 19-21, 3 figs. Forces to be resisted by a concrete pavement.

S

SAND

FILTER. A Fineness Modulus for Filter Sands, R. G. Tyler, New England Water Wks. Assn.—Jl., vol. 39, no. 3, Sept. 1925, pp. 239-248 and (discussion) 248-253, 5 figs. Particulars of investigation undertaken to find, if possible, a more definite and a more accurate method of designing size of filter sands, since method of Hazen's at present in use seems in need of modification. References.

SAND, MOULDING

STEEL CASTINGS. Steel Moulding Sands and Their Behaviour Under High Temperature, A. L. Curtis, Iron & Steel Inst.—Carnegie Scholarship Memoirs, 1925, 89 pp., 67 figs., partly on supp. plates and folders. Deals with natural argillacerous sands, and artificial "steel facing sands" or proprietary mixtures; method adopted and apparatus used for testing steel molding sands under high temperatures; permeabilities of steel molding sands; photomicographs. See also (abstract) in Foundry Trade Jl., vol. 32, nos. 473, 475, 482, 483 and 484, Sept. 10, 24, Nov. 12 and 26, 1925, pp. 213-214, 263-269, 409-412, 423-426, and 443-447, 26 figs.

SAWS

SAFETY IN USE AND CARE. Safety in the Use and Care of Saws, S. H. Disston. Safety, vol. 4, no. 4, Sept.-Oct. 1925, pp. 101-105, 8 figs. Notes on development of saws; what manufacturer is doing to promote cause of safety with saws.

SEWAGE DISPOSAL

SEWAGE, SPRINKLER NOZZLES. Characteristics of Sewage-Sprinkler Nozzles, R. B. Wiley, F. W. F. W. Greve and M. J. Zucrow. Purdue Univ., Eng. Exper. Station, Bul. No. 20, June 1925, 57 pp. 23 figs. Notes on trickling filters; particulars and results of investigation to determine: co-efficient of discharge for each nozzle, effect of rotation of cone upon distribution of discharge, effect of a change in elevation of orifice, distribution of spray under different heads, maximum height of spray, and comparison of performance of supposedly identical nozzles.

SEWAGE TREATMENT. Sewage Treatment Plants in the United States. Pub. Wks., vol. 56, nos. 7, 8 and 9, July, Aug. and Sept. 1925, pp. 255-265, 297-306 and 345-347. July: Sewage treatment plants in several hundred cities, with details of construction and operation; percentages of residences sewered; pumping plants and amount of sewage pumped. Aug. and Sept.: Lists of plants in the several states, with information as to their type, size and other details, furnished by engineers or other officials of State Boards of Health.

TREATMENT. Normalcy in Chemical Treatment of Sewage, J. F. Jackson. Pub. Wks., vol. 56, nos. 10 and 11, Oct. and Nov. 1923, pp. 379-382 and 397-399. Tendency toward use of it as supplementary to biological processes in treatment of both sewage and sludge; no longer being installed as sole or main treatment; experiments with use of acids, saltpetre and other agents; description of experimental work at South Manchester and conclusions arrived at; necessity of co-operation in intensive study of effects of chemicals other than precipitation.

Methods Used in Sewage Purification, F. W. Harris. Can. Engr., vol. 49, no. 21, Nov. 1925, pp. 573-574. Principal features of activated sludge process; bio-aeration process; experiences at Dalmarnock and Shieldhall works. Paper read at Royal Sanitary Assn. of Scotland convention.

SEWERS

CONCRETE ARCH. Building 29-Ft. Concrete Arch Sewer at Richmond, Va. Eng. News Rec., vol. 95, no. 25, Dec. 17, 1926, pp. 996-997, 5 figs. Heavy invert for flat arch; tile liners; deep trench dug in three lifts.

SHAFTS

TORSIONAL STRESS CONCENTRATIONS. Torsion-Stress Concentrations in Shafts of Circular Cross-Section and Variable Diameter. L. S. Jacobsen. Am. Soc. Mech. Engrs.—advance paper for mfg. Nov. 30-Dec. 4, 1925, 22 pp. 13 figs. Points out electrical, experimental method for finding torsional-stress, distribution in cylindrical shafts of circular cross-section and of any axial outline method has been applied to problem considered by F. A. Willers, and paper includes series of curves that will enable designer to find; at glance, maximum torsional stress in shaft of 2 diameters for various diameter and fillet proportions.

VIBRATIONS. Torsional Vibrations in Reciprocating Shafts, G. R. Goldsbrough, Roy. Soc.—Proc., vol. 109, no. A749, Sept. 1, 1925, pp. 99-119. Analytical investigation of vibration about steady motion of elastic shaft having engine at one end and mass operating against resistance at other end; results are applicable only to relatively low-speed engines.

Vibration Phenomena of a Loaded Unbalanced Shaft while Passing Through Its Critical Speed, A. L. Kimball, Jr. and E. H. Hull. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 3, Dec. 4, 1925, 18 pp., 13 figs. Presents in clear manner, with experimental demonstration, discussion of peculiar vibration phenomena to which unbalanced loaded shaft is subject while passing through its critical speed; basic theory is given from somewhat new viewpoint, after which experimental demonstration, which gives quantitative check on theory is described.

SILICON STEEL

PROPERTIES AND TYPES. Silicon Steel, W. E. Ruder, Am. Iron & Steel Inst.—advance paper for mtg. Oct. 23, 1925, 8 pp.; also (abstract) in Iron Age, vol. 116, no. 18, Oct. 29, 1925, pp. 1170-1171. Constitution, mechanical properties, magnetic uses, and magnetic properties; thickness of steels; effect of punching strains; mechanical condition of sheets; testing.

SLIDE RULES

A. E. G. Special Slide Rules (Sonder-Rechenschieber), F. Bahlcke, Werkstattstechnik, vol. 19, no. 20, Oct. 15, pp. 726-730, 11 fig. Details of design and application for approximate calculation of loads and velocities of belting, weight of sheet iron of a given thickness and surface, and other problems connected with machine tool work; numerical examples.

SPRINGS

CORROSION RESISTING COATING. Recent progress in Coating Steel Springs to Resist Corrosion. Jos. K. Wood. Am. Mach., vol. 63, no. 25, Dec. 17, 1925, pp. 981-984. Application of non-corrosive metallic coatings to steel spring surfaces; effect of processes on spring characteristics. Madsen process and its promise for successful solution of problem.

ELASTIC AND FATIGUE PROPERTIES. An Outline for the Application of Fatigue and Elastic Results to Metal Spring Design. T. M. Jasper, Am. Soc. Mech. Engrs. —advance paper for mtg. Nov. 30-Dec. 4, 1925, 11 pp., 9 figs. Deals particularly with steel springs used for shock-absorbing purposes and for recuperating machinery; problem of design of springs may be divided into parts; first: question of static elastic and fatigue properties of material to be used in their construction and, second, shape of springs desired, together with distribution of stresses developed in their use for given deformation; results of investigation of static properties of steel carried out. Eng. Experiment Station of Univ. of Ill.

HELICAL. Formulae for the Design of Helical Springs of Square or Rectangular Steel. C. T. Edgerton. Am. Soc. Mech. Engrs.—advance paper for mtg. Nov. 30-Dec. 4, 1925, 15 pp. Author points out lack of formulas for calculating any except springs of square-bar steel and then develops formulas for rectangular-bar steel based on work at St. Venant; for solution of these formulae he gives tabulated values for two variables which depend on ratio of bar's cross-sectional dimensions; appendix contains 4 examples in which application of formula is illustrated.

PHOSPHOR BRONZE HELICAL SPRINGS, from the Standpoint of Precision Instruments. W. G. Brombacher, Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 16 pp., 8 figs. Results of tests made on springs investigated at Bur. of Standards to obtain knowledge useful in design of springs for precision instruments; characteristics of spring material; method of construction of springs; apparatus in which springs were tested, and procedure followed are set forth; results relate to stiffness, maximum fiber stress, hysteresis, after-effect, drift, and buckling.

STANDARDIZATION

NATIONAL NEED FOR. Why Standardization, C. R. Skinner, Factory, vol. 35, no. 5, Nov. 1925, pp. 723-724, 748, 750 and 752. Author shows clearly need for national standards movement, amd nakes plain the difference between standardization and simplification. On p. 722 are given statements by G. Swope J. W. Lieb, L. F. Loree, G. B. Cortelyou and J. A. Farrell, on why theyb elieve in standardization.

STANDARDS

GERMAN N. D. I. REPORTS. Report of the German Industrial Standards Committee (Normenaussebuss der deutschen Industrie). Mascbinenbau, vol. 4, no. 21, Oct. 15, 1925, pp. 1063-1066, 2 figs. Proposed standards for spur and bevel gear tectb and riveted steel tubes.

Report of tbe German Industrial Standards Committee (Neue Dinormblätter), Werkstattstechnik, vol. 19, no. 18, Sept. 15, 1925, pp. 681-683, 1 fig. Details of proposed standards for threaded square units for spindles, cam wheels, and sbafts; also gages.

Report of the German Industrial Standard Committee (Neue DINormblätter), Werkstattstechnik, vol. 19, Oct. 1, 1925, pp. 715-717, 2 figs. Proposed standards for round nuts with four grooves, and round nuts witb cross holes.

Report of the German Industrial Standard Committee (Neue DINormblätter), Werkstattstechnik, vol. 19, no. 20, Oct. 15, 1925, pp. 747-749, 2 figs. Proposed standards for plates for welding of quadrilateral and trilateral profiles.

Report of the German Industrial Standards Committee (Normenausschuss der deutschen industrie). Gas- u. Wasserfach, vol. 68, no. 39, Sept. 26, 1925, pp. 615-617. Proposed standards for a nomenclature of technical gases, covering gases from liquid and solid fuels.

STEAM

HIGH-PRESSURE. The Production of High-Pressure Steam. Eng. Progress, vol. 6, no. 10, Oct. 1925, pp. 313-314, 1 fig. Higb-pressure steam plant of 100-atmos. pressure erected at Wiener Lokomotivfabrik at Vienna, Austria, according to designs of Prof. Löffler, for purpose of testing his new metbod of generating high-pressure steam for permanent service.

Tbe Value of Higher Steam Pressures in the Industrial Plant, Wm. F. Ryan. Am. Soc. Mech. Engrs.—advance paper, for mtg. Nov. 30-Dec. 4. 1925, 21 pp., 9 figs. Points out value of higher steam pressures; sbows tbat gains from high pressure are greater than in central station and except for question of suitable feedwater for high-pressure boilers, problems involved are less difficult; relative cost of power for varying initial pressures is estimated; relative efficiency of turbine and engine prime movers, and application of higher pressure to manufacturing equipment, are discussed; it is indicated that pressures up to present commercial limit, about 1200 lb. per sq. in. may be used advantageously under given conditions.

REHEATING. Steam Economy, W. D. Wylde. Indus. Mgmt. (Lond.), vol. 12, no. 11, Nov. 1925, pp. 528 and 530. Discusses steam reheating; including metbod and economy of reheating, lowering of fuel consumption, and saving of steam.

STEAM ENGINES

ISOLATED PLANTS. Tbe Steam Engine Still in Favor in the Isolated Plant. Power, vol. 62, no. 22, Dec. 1, 1925, pp. 834-835, 4 figs. Kinds of service to watch steam engine is especially adapted and factors that are reacting in its favor.

LUBRICATION OF CYLINDERS. Practical Instructions on Lubrication of Steam Engine Cylinder, P. B. Jensen. Nat. Engr., vol. 29, no. 12, Dec. 1925, pp. 595-597. Cylinder should be examined after engine stops; point of introduction of oil; amount of compounding necessary; effect of load and type of engine on lubrication; classification of steam-cylinder oils.

STEAM GENERATORS

PULVERIZED-COAL-BURNING. New Steam Generator. Iron Age, vol. 116, no. 25, Dec. 17, 1925, p. 1707. Evaporates 35 lb. of water to 1 sq. ft. of heating surface per hr.; installation in plant of Taylor Bros. in England, developed by Combustion Eng. Corp, New York.

STEAM METERS

CONSTRUCTION. Industrial Measuring of Steam (La mesure industrielle de la vapeur), J. Welter. Chaleur et Industrie, vol. 6. no. 66, Oct. 1925, pp. 451-458, 9 figs. Discusses placing of steam meters at various points of a plant, defects of steam meters generally; calculates diaphragms, orifices and other parts of steam meters, enumerates conditions that an efficient steam meter must fill.

STEAM PIPES

POWER-PLANT. Steam Piping System in Modern Power Plants, W. Tallmadge. Universal Engr., vol. 42, no. 4, Oct. 1925, pp. 22-24. Discusses strength of pipe, supports, flexibility, joints, valves, etc. Paper read before Progressive Council No. 12, Universal Craftmen's Council of Engrs.

STEAM POWER PLANTS

COMBINED HEATING AND POWER. Surplus Energy (Ueberschussenergie), F. Niethammer, Wärme, vol. 61, nos. 35 and 36, Aug. 28 and Sept. 4, 1925, pp. 446-449 and 460-463, 2 figs. Gives leading particulars concerning equipment and operating conditions in large number of installations where power and beating loads are operated conjointly; examples are cited from following industries: sugar refineries, textile works, chemical, paper and leather plants, briquette factories, and electricity works operating in conjunction with district heating schemes; reviews use of mixed-pressure turbines, steam storages, back-pressure regulators, waste-heat boilers and otber equipment; outlines difficulties in dispensing of surplus energy from and in industrial concerns.

COSTS. Cost of Energy of Power Plants With Heat Engines (Energikostnad vid kraftanläggningar med värmemotorer), M. T. Lindhagen, Teknisk Tidskrift, vol. 55, no. 31, Aug. 1, 1925, pp. 129-133 (Electroteknik), 7 figs. Discusses installation and running cost of large steam power plant, also smaller plant run with gas engines, Diesel engines, steam engines, and turbines; cost of power alone and combined with heating.

HOTELS. Economics of Heat and Power Production in Modern Hotels, E. Douglas. Nat. Engr., vol. 29, no. 12, Dec. 1925, pp. 591-594. Data on hotel power-plant service requirements and bow they can be most economically provided.

OFFICE BUILDINGS. Office-Building Plant Saves by Studying Costs; Wm. R. Goodwin. Power, vol. 62, no. 25, Dec. 22, 1925, pp. 962-966, 7 figs. As result of study motor-generator sets were installed for purchase of power in excess of tbat capable of being generated from heating steeam, in bomeoffice building of Conn. Mutual Life Insurance Co., Hartford.

RATING SYSTEM FOR SMALL. Getting Best Results from the Small Power Plant. R. S. Twogood, Indus. Mgmt. (N. Y.), vol. 70, no. 6, Dec. 1925, pp. 323-330, 5 figs. Practical rating system and how it belps efficiency.

RECORDS. An Unfailing Way to Reduce Costs of Steam, H. E. Collins, Mgmt. & Admin., vol. 10, no. 6, Dec. 1925, pp. 333-337, 2 figs. Points out tbat all factors entering into power-plant operation can be measured; instruments are available to produce records, from which accurate costs can be determined and deficiencies in operation corrected before tbey amount to serious losses.

STEAM TURBINES

BLEEDER. Bleeder Turbines for Industrial Heating (Les turbines à soutirage de vapeur pour les chauffages industriels). Génie Civil, vol. 87, no. 20, Nov. 14, 1925, pp. 413-416, 5 figs. Details of design and operation of bleeder or back-pressure turbines; power available and cost per kw-hr.; witb examples of installation.

Steam Bleeding and Turbine Performance, C. D. Zimmerman. Mech. Eng., vol. 47, no. 12, Dec. 1925, pp. 1144-1148, 20 figs. Results of tests sbowing effect of steam bleeding on total power-plant efficiency, also effect of cbanges in vacuum and superheat on turbine and condenser performance.

BUCKET VIBRATION. Tangential Vibration of Steam-Turbine Buckets, W. Campbell and W. C. Heckman. Am. Soc. Mech. Engrs—advance paper, for mtg. Nov. 30-Dec. 4, 1925, 25 pp., 15 figs. Describes how research dealt with in paper before Society in 1924 was extended to include tangential vibration; substantially same testing apparatus was used and same methods of protection adopted; in unsymmetrical reaction buckets compound vibration lying most nearly in plane of wbeel is, by definition, treated as tangential vibration; methods described suffice for protection against any combined or intermediate type.

COMBINED POWER AND HEATING PROCESSES. Higb Efficiency in the Use of Steam. Power, vol. 62, no. 22, Dec. 1, 1925, pp. 846-847, 2 figs. Discusses combined power and heating process and cites examples of practical applications tbat are earning dividends for their owners.

INTERMEDIATE SUPERHEATING. Intermediate Superheating. K. Thielsch. Elecn., vol. 95, no. 2477, Nov. 6, 1925, pp. 524-526 and 533, 6 figs. Its employment in power stations with condensing turbines; general principles; temperature and pressure limits; possible metbods. Abstract, translated from AEG. Mitteilungen.

STEEL

ALLOY. *See Alloy Steels.*

SILICON. *See Silicon Steel.*

STAINLESS. Recent Developments in Stainless Steel, D. G. Clark. Am. Iron & Steel Inst.—advance paper, for mtg. Oct. 23, 1925, 28 pp., 7 figs.; also (abstract) in Iron Age, vol. 116, no. 18, Oct. 29, 1925, pp. 1172-1173. Deals with steels wherein chromium is pre-dominant alloy; history and patents; processes; types of stainless steel; standard cutlery type; physical properties; resistance to heat; heat treatment; bard cutlery type; high-carbon, soft-steel and stainless iron types; physical properties of stainless iron for turbine blades; valve-steel and nickel types; effect of various corrosive reagents.

TOOL. *See Tool Steel.*

VANADIUM. *See Vanadium Steel.*

STEEL CASTINGS

CLEANING. Clean Steel Castings Economically, F. B. Jacobs. Foundry, vol. 53, no. 22, Nov. 15, 1925, p. 922, 1 fig. Methods employed at West Steel Castings Co., Cleveland.

HEAT TREATMENT. Heat Treatment. Data on Quality Steel Castings, A. E. White, Am. Soc. Mech. Engrs.—advance paper for mtg. Nov. 30-Dec. 4, 1925, 15 pp., 7 figs. Summarizes study wbicb has been made on beat-treatment practice for quality steel castings; gives results of laboratory tests on dendritic and dentrite-free steels after annealing, normalizing, drawing, and spheroidizing treatment; records large number of plant tests; results show tbat normalizing and drawing treatment gives superior results to those obtainable by annealing or spheroidizing.

OBSTRUCTED CONTRACTION, EFFECT OF. Effects of Obstructed Contraction on Steel Castings (Folgeerscheinungen der gehinderten Scbwindung an Stahlformgussetücken), H. Malzacher, Giesserei-Zeitung, vol. 22, no. 21, Nov. 1, 1925, pp. 653-657, 13 figs. Notes on contraction and forces resisting it; bot cracks stresses; practical examples.

STEEL, HEAT TREATMENT OF

HARDENING AND TEMPERING. Heat Treatment and Metallograpby of Steel, H. C. Kneer. Forging—Stamping—Heat Treating, vol. 11, no. 11, Nov. 1925, pp. 386-390; 11 figs. Hardening and tempering.

STEEL MANUFACTURE

OPEN-HEARTH BOILS. Differences in Open-Hearth Boils, H. D. Hibbard. Iron Age, vol. 110, nos. 23, 24 and 25, Dec. 3, 10 and 17, 1925, pp. 1511-1513, 1605-1606, and 1671-1672. Classification according to degree and violence; consideration of uses and cbaracters of 10 recognized types; causes and effects of boils. Dec. 10: Dead bath and almost dead bath; incipient, gentle and moderate boil. Dec. 17: Decarbonizing effects and Talbot reaction; effervescing steels; Martin and Siemens process.

CRUCIBLE PROCESS. Making Higb Grade Steel. J. A. Coyle. Iron Trade Rev., vol. 77, no. 24, Dec. 10, 1925, pp. 1457-1459, 2 figs. European and American adaptations of Huntsman crucible process differ; coke-hole furnace, discarded in United States, survives in England.

STOKERS

FUEL PREPARATION FOR. Fuel Preparation for Chain-Grate Stokers, F. C. Duennes. Power, vol. 62, no. 21, Nov. 24, 1925, pp. 798-799, 2 figs. Discusses two distinct operations involved in fuel preparation, namely, sizing and wetting.

SELECTION. Mechanical Stokers Offer Savings to Many Hand-Fired Plants. Power vol. 62, no. 22, Dec. 1, 1925, pp. 844-845, 5 figs. Proper selection of stoker necessary; size of plant an influencing factor.

STREET RAILWAYS

LOCOMOTIVES. Hanomag Street Railway Locomotives ((Hanomag-Strassenbabn-Lokomotiven). Hanomag Nachrichten, vol. 17, no. 142, Aug. 1925, pp. 129-130, 1 fig. Advantages of steam locomotives and their field of application; design and specifications of various types used in Holland, Germany, and Colombia, with and without housing.

METER-TESTING CAR. Preventing Power Waste, E. W. Anger. Elec. Traction, vol. 21, no. 11, Nov. 1925, pp. 577-581, 7 figs. Chicago surface lines has completely equipped meter-testing car and system of inspection.

STRUCTURAL STEEL

F-STEEL. A new German Steel (Ein neuer deutscher Stabl), Schaper, Bautechnik, vol. 3, no. 45, Oct. 16, 1925, pp. 631-632, 2 figs. Describes F-Steel, produced by Berlin A. G. Eisengiesserei und Mascbinenfabrick in a Bosshardt furnace in which iron melt is completely deoxidized, resulting in a steel greatly superior to St. 37; its C content is no greater than that of St. 37; average breaking strength: 5300 kg-cm2, limit of elongation 4670 kg-cm; elongation 27.2 per cent.

SHEAR IN COMPRESSION MEMBERS. Notes on Shear in Compression Members, R. E. Goodwin. Am. Soc. Civ. Engrs.—Proc., vol. 51, no. 10, Dec. 1925, pp. 1939-1945, 3 figs. Applies principles of mechanics to subject of shear in compression members; presents method by which given conditions can be analyzed and those which produce greatest shear can be determined, thus enabling engineer to design for most dangerous conditions that be considers it advisable to assume.

TESTING. Distribution of Elongation Over the Gauge Length of Tensile Test Bar and Some Notes on the Measurement of Ductility of Structural Steel by Tensile Breaking Test, K. Minato, Soc. Naval Architects—Jl., vol. 36, Apr. 1925, pp. 23-62, 19 figs. partly on supp. plates. Investigates distribution of elongation and reduction of sectional area over gage length of test bars, subject to tensile breaking; analyzes ultimate elongation into general uniform elongation and local extra elongation; relations between total elongation, general uniform elongation, local extra elongation, reduction of sectional area at point of rupture, and ultimate tensile strength; discusses several existing methods of measuring ductility; proposes simple, yet sound method of measuring cost probable general uniform elongation of structural steel by tensil breaking tests.—(In English).

STRUCTURES

DESIGN. Report on Effects of Tornado of March 18, 1925, West Soc. Engrs.—Proc., vol. 30, no. 9, Sept. 1923, pp. 373-396, 19 figs. Results of study on part of officers of Bridge & Structural Section of West. Soc. Engrs. who were designated a special committee to visit tornado-swept section of Southern Illinois and if possible to draw up some suggestions for better building construction; points out certain structural weaknesses that could be corrected at small cost and would add to stability and safety of buildings.

SUBSTATIONS

BROOKLYN EDISON CO. Kings Highway Substation of the Brooklyn Edison Company, C. M. Gilt, Elec. Jl., vol. 22, no. 11, Nov. 1925, pp. 521-525, 8 figs. Details of 3-phase substation built to replace old 2-phase substation; it will be fed by four 10,000-kva. transformers, connected to 3-conductor lead-covered incoming cables without any high-tension circuit breakers at substation; feeder regulators and control board; station diagram and floor plan; protection and operation.

SURVEYING

GEODETIC. The Geodetic Survey of Canada, J. L. Rannie. Eng. Jl., vol. 8, no. 12, Dec. 1925, pp. 483-487, 8 figs. Necessity for geodetic surveys and scope of this work in Canada.

STEREOPHOTOGRAMMETRIC. Stereo-Photo-Grammetric Surveying, B. J. Woodruff and D. H. Nelles. Engineer, vol. 140, nos. 3644, 3645 and 3646, Oct. 30, Nov. 6 and 13, 1925, pp. 454-455, 481-483 and 515-517, 19 figs. Describes methods employed in surveying area in vicinity of Ottawa, Can.; field operations.

T

TANKS

WATER. Standardized Elevated Steel Water Tanks, J. E. O'Leary. Am. Water Wks. Assn.—Jl., vol. 14, no. 3, Sept. 1925, pp. 190-198. Deals with size and capacity of tanks; one of the real premises on which a standardization program is justified is quality of product.

TELEPHONY

BELL SYSTEM. General Engineering Problems of the Bell System, H. P. Charlesworth. Bell System Technical Jl., vol. 4, no. 4, Oct. 1925, pp. 515-541, 18 figs. Discusses character and scope of important problems involved in caring for growth and operation of Bell system; plant extension necessary to meet service requirements and necessity of advanced planning; uses of "Commercial survey," "Fundamental Plan" and engineering cost studies are analyzed to illustrate how an engineer attacks problem of furnishing satisfactory telephone service to public; discussion of New York-Chicago toll cable and telephone problem in New York City, as illustrative of specific engineering problems.

TERMINALS, LOCOMOTIVE

DROP PITS FOR WHEEL REMOVAL. Drop Pits for Removing Wheels at Engine Terminals, J. D. Rogers. Baldwin Locomotive, vol. 4, no. 2, Oct. 1925, pp. 54-57, 8 figs. Describes drop pit for removing wheels and how they are used.

TEXTILE MILLS

WATER SUPPLY. Water Supply for Textile Mills, C. L. Hubbard. Textile Wld., vol. 68, no. 19, Nov. 7, 1925, pp. 71 and 73-74, 5 figs. General survey of methods employed to purify water for boiler feedings and process work; impureties commonly found; removal by means of filters, settling tanks, heat, lime, soda, combined lime and soda, and zeolite; boiler compounds; water softening apparatus.

THERMIT WELDING

DEVELOPMENTS. Thermit Welding Development, J. H. Deppeler, Am. Welding Soc.—Jl., vol. 4, no. 10, Oct. 1925, pp. 58-64. Description of process; developments; work which has been done in improvement of physical qualities of Thermit Steel.

THERMO-DYNAMICS

THIRD LAW. New Edition of Nernst's Monograph on Third Heat Law (Zur Neuanflage der von W. Nernst, veröffentlichten Monograpline über den 3, Wärmesatz), Schmolke. Dinglers polytechnisches Journal, vol. 340, no. 16, Aug. 1925, pp. 181-186, 2 figs. Develops scientific and mathematical bases of Nernst theorem and gives examples of its application.

TRANSFORMERS

LOADING ON TEMPERATURE BASIS. Loading Transformers on a Temperature Basis, E. G. Reed and W. A. Sumner. Elec. Jl., vol. 22, no. 11, Nov. 1925, pp. 550-553, 5 figs. For given condition of load on transformer one of main points to be considered is temperature gradient between cooling oil and hot test part of winding, as well as change in gradient as load varies; temperatures resulting from two main classes of loads need to be investigated—first a given continuous load, and second, a particular load cycle.

TAP CHANGING UNDER LOAD. Transformer Tap Changing Under Load, H. C. Albrecht. Am. Inst. Elec. Engrs.—Jl., vol. 44, no. 12, Dec. 1925, pp. 1331-1335. Attention is called to need for voltage and power-factor regulating equipment on lines used for tying together large generating stations and for interconnection of systems; discusses and compares important characteristics of three principal methods for voltage regulation on interconnecting lines, namely, synchronous condensers, tap changing under load, and induction regulators; describes three installations (2 of tap changing under load, and 1 of induction regulators) for voltage regulation and power-factor control on lines of Phila. Elec. Co.

TEMPERATURES, PREDETERMINATION OF. Predetermination of Self-Cooled Oil-Immersed Transformer. Temperature Before Conditions are Constant, W. H. Cooney. Am. Inst. Elec. Engrs.—Jl., vol. 44, no. 12, Dec. 1925, pp. 1324-1330, 10 figs. It is shown that while winding-temperature rises over room of self-cooled oil-immersed transformers follows given law only after certain time has elapsed, quite accurate results may be obtained by calculating time-temperature curves of top oil-temperature rises above room, and winding-temperature rise above top oil separately, then adding them together to get winding-temperature rise above room at any time before conditions are constant.

TREATMENT. Sewage Treatment by Septic Tanks, C. C. Halkyard. Civil Eng. Rec., vol. 2, nos. 2, 3 and 4, Aug. 15, Sept. 15 and Oct. 15, 1925, pp. 50-52, 104-106 and 118-121, 8 figs. Solution of sewage problem for small communities; science of sewage treatment is based on principle of providing suitable living conditions for certain organisms which break down sewage into more stable non-putrescible components; present status of small septic tank in Australia.

V

VANADIUM STEEL

HARDNESS. Vanadium Steels (Zur Kenntnis der Vanadinsthäle), E. Maurer. Kruppsche Monatshefte, vol. 6, Sept. 1925, pp. 165-169, 2 figs. Shows that vanadium hardenite does not exist, nor a point similer to pearlite; carbide dissolves gradually with increasing temperature like secondary cementite; on basis of mainly physical tests formula of carbide Va_4C_3.

VIBROSCOPES

HIGH-SPEED MECHANISMS, OBSERVATION OF. Observation of High-speed Mechanisms. Machy (Lond.), vol. 27, no. 687, No. 26, 1925, pp. 270-272, 3 figs. Use of apparatus that causes rapidly moving parts to appear stationary at any point in cycle of movements; arrangement of vibroscope and examples illustrating its use; determining lubrification troubles; locating cause and extent of excessive vibration.

VOLTAGE REGULATION

REGULATORS. The Extended Broad-Range Voltage Regulator, J. H. Ashbaugh. Elec. Jl., vol. 22, no. 11, Nov. 1925, pp. 559-561, 4 figs. Extended broad-range regulator functions exactly like broad-range regulator except that it operates generator field rheostat automatically, cutting it in or out as conditions warrant; thus it is possible for this regulator to control machine without any assistance on part of operator, from maximum exciter demands to minimum.

W

WAGES

ANALYSIS OF. The Meaning of Wages, L. Grier, Nature (Lond.), vol. 116, no. 2921, Oct. 24, 1925, pp. 613-617. Discusses certain aspects of wages and reviews from those aspects certain payments made to or on behalf of employees.

BARTH STANDARD SCALE. The Barth Standard Wage Scale, C. G. Barth. Mgmt. & Admin., vol. 10, no. 6, Dec. 1925, p. 357. Method is application of fundamental of Weber's law of discrimination, which declares that for sensations or responses in arithmetical relationship, corresponding stimuli form geometric series.

WALLS

SAND-LIME BRICK. Strength of Sand-Lime Brick Walls, H. L. Whittemore. Contract Rec., vol. 39, no. 46, Nov. 18, 1925, pp. 1099-1106, 7 figs. Results of compressive tests of 18 walls and 18 wallettes, built of medium grade sand-lime brick in lime, cement-lime and cement mortars.

WATER POWER

ONTARIO, CANADA. Developing Ontario's Water Power. Power House, vol. 18, no. 20, Oct. 20, 1925, pp. 89-90. With water-power resources of Ontario, including potential power of Niagara River, permitting of an installation of 9,000,000 hp. resources of province are but from 18 to 25 per cent developed.

SMALL, DEVELOPMENT BY FACTORY OWNERS. The Development of Small Water-powers by the Factory Owner. F. Johnstone Taylor. Mech. Wld., vol. 78, no. 2030, Nov. 27, 1925, p. 425. Points out that if factory is located near any appreciable volume of running water it behoves owner in his own interest to have its potential value investigated; machinery for medium and for low falls; waste water, storage, selling power.

STEAM POWER IN ITS RELATION TO. Steam-Power in Its Relation to the Development of Water-Power, R. C. Powell. Am. Inst. Elec. Engrs.—Jl., vol. 44, no. 12, Dec. 1925, pp. 1291-1295, 8 figs. Draws attention to desirability of development of water-power resources of country on comprehensive economic basis and discusses some of features of steam power in connection with economic development of water power; points out limitations of cost curves frequently used in comparing costs of water and steam power, and gives simple method whereby minimum cost of power may be found for assumed water-power development with auxiliary steam power.

WATER SUPPLY

DEVELOPMENT IN SMALL CITIES. Water Supply Development in Small Cities, C. M. Ladd. Am. Water Wks. Assn.—Jl., vol. 14, no. 4, Oct. 1925, pp. 337-342. General idea of results to be obtained in design and construction of a complete water works system, some of the things to be avoided, and done.

SMALL SERVICE PIPES. Experiences With Small Services Pipes, J. E. Gibson, Am. Water Wks. Assn.—Jl., vol. 14, no. 4, Oct. 1925, pp. 295-305, and (discussion), 305-308. A plea for better service pipes; author's efforts and experiences in eliminating mechanical difficulties with service pipes at Charleston, S. Carolina.

WATER TREATMENT

LIME-SODA PROCESS. Lime and Soda Ash Method, O. T. Rees. Pac. Ry. Club—Jl. vol. 9, no. 5, Aug. 1925, pp. 5, 7, 9, 11, 13, 15, 17 and 19. Discusses types of equipment for lime-and-soda method of treating water and systems employed by Santa Fe Railway.

STERILIZATION. Sterilization of Water by Liquid Chlorine, J. M. Mathew, Commonwealth Engr., vol. 13, no. 1, Aug. 1, 1925, pp. 31-33. Outlines experiments which are believed to represent first use of liquid chlorine for sterilization of domestic water supplies in Australia; chlorimating mechanisms; cost considerations.

WATERWAYS

LAKE MICHIGAN. The Withdrawal of Water From Lake Michigan by the Sanitary District of Chicago and the Consequent Lake Lowering Controversy, M. Knowles. Engrs. Soc. West. Pa., vol. 41, no. 6, July 1925, pp. 221-250 and (discussion) 251-258, 7 figs. Popular idea is that Chicago, by diverting a large volume of water from Lake Michigan, has lowered lake levels, with consequent damage to navigation, harbors, power, and water-supply interests in general; geological history of region; geography and recent history; early plans for a waterway from Great Lakes to Mississippi; Chicago's development; authorization of drainage canal; cause of controversy; etc.

WATER WORKS

ECONOMICS. Economics in Water-Works Engineering, R. O. Wynne-Roberts. Am. Water Wks. Assn.—Jl. vol. 14, no. 3, Sept. 1925, pp. 226-234. Discusses money value of purity hard water problem, losses due to disease; loss of head pumping station control, small water mains, and serious fire losses, municipal taxation, pumping plants, water fittings, covering water tanks.

WELDING

ELECTRIC, *See Electric Welding, Arc; Electric Welding, Resistance.*

HEAT EFFECT ON STEEL. The Effect of Heat on Steel, Especially During Fusion Welding and Cutting, S. W. Miller. Am. Welding Soc.—Jl., vol. 4, no. 9. Sept. 1925, pp. 29-45, 35 figs. It is concluded that effect of welding heat on low-carbon steel of good quality is small, but effect on high-carbon steel is great; therefore as low carbon steel should be used as possible; there is a point of maximum ductility and minimum strength at distance from weld, depending on process used, and this is point at which rupture occurs with clean steel.

OXYACETYLENE. *See Oxyacetylene Welding.*
RAILS. *See Railway Track Welding.*
THERMIT. *see Thermit Welding.*

WIRE. Welding Wire a Factor in Good Welding. C. A. McCune. Am. Welding Soc.—Jl., vol. 4 no. 10, Oct. 1925, pp. 32-36. Suggests test methods as further means of determining qualities of wire.

WOOD PRESERVATION

A. E. R. A. REPORT. Report of the Committee on Wood Preservation. Elec. Traction, vol. 21, no. 10, Oct. 1925, pp. 533-535. Specifications for open-tank treatment of wooden poles; specifications for brush treatment of wooden poles—treatment of poles in place; specifications for pressure treatment of wooden poles; methods of increasing life of timber by means other than application of preservatives. Report to Am. Elec. Ry. Assn.

WROUGHT IRON

MECHANICAL PUDDLING. The Ely Process of Mechanical Puddling, for the Production of Wrought Iron, R. H. Dechant. Am. Iron & Steel. Inst.—advance paper, for mtg., Oct. 23, 1925, 11 pp. 3 figs. Describes Ely furnace, first designed and built for purpose of busheling scrap iron mechanically; its adaptation for puddling of pig iron was started about 4 years ago and modifications, which have been promoted by experience through this period, have resulted in practical mechanical puddling machine; in author's opinion, this furnace occupies position in field of mechanical puddling of being adaptable and flexible in its application to wrought-iron works and therefore of practical and economic worth.

X

X-RAYS

RADIOLOGICAL RESEARCH. Radiological Research, V. E. Pullin, Roy. Soc. Arts—Jl., vol. 73, nos. 3800 and 3801, Sept. 18 and 25, 1925, pp. 956-970 and 974-986, 6 figs. Two Cantor lectures. Development of theory of X-Rays, and development of apparatus.

ENGINEERING INDEX—Supplementary List

A

AERONAUTICAL INSTRUMENTS

CALIBRATION. An Altitude Chamber for the Study and Calibration of Aeronautical Instruments, H. J. E. Reid and O. E. Kirchner. Nat. Advisory Committee Aeronautics—Tech. Notes, no. 229, Nov. 1925, 13 pp., 7 figs. Design and construction of altitude chamber in which pressure and temperature can be varied independently, carried out at Langley Memorial Aeronautical Laboratory, Va.; temperatures ranging from +20 deg. to —50 deg. cent. are obtained by the expansion of CO_2 from standard containers, used for calibrating research instruments under altitude conditions simulating those up to 45,000 feet.

AERONAUTICS

DEVELOPMENTS, U. S. A. Eleventh Annual Report. Nat. Advisory Com. for Aeronautics—Administrative Report, 1925, 59 pp. Organization and activities of National Advisory Committee; presents stages of aviation including aerodynamics, trend of airplane design, structural materials, airships, aeronautical research in U. S. A. and its relation to national defence, etc. See also abstract in Aviation, vol. 19, no. 25, Dec. 21, 1925, pp. 873-874.

AIR COMPRESSORS

TYPES. A New Form of Air Compressor, H. S. Hele-Shaw and T. E. Beacham. Colliery Guardian, vol. 130, no. 3385, Nov. 13, 1925, pp. 1159-1161, 13 figs. Describes Hele-Shaw Beacham compressor showing almost perfect balance at all speeds, owing to fact that reciprocity movement between cylinder and piston is really relative and not absolute, and fact that the oil which is necessarily employed for lubrication acts as packing not only for the pistons, but as a seal for central valve.

AIR CONDITIONING

HUMIDITY CHART. A New Humidity Chart, V. A. Nekrassoff. Heat. & Vent. Mag., vol. 22, no. 12, Dec. 1925, pp. 65-68, 6 figs. Effective use of the nomographic method of presentation in simplifying air-conditioning calculation.

AIRCRAFT CONSTRUCTION MATERIALS

METALS, TESTING. Testing Metals for Aircraft, N. S. Otey. Iron Age, vol. 116, nos. 25 and 26, Dec. 17 and 31, 1925, pp. 1660-1664 and 1797-1800, 21 figs. Selecting representative samples; proper design of test specimens and methods of loading them. New proposed standard specifications and methods for testing light alloys.

AIRPLANE ENGINES

FLOW THROUGH VALVE. Potential Flow in Engine Valves, B. Eck. Nat. Advisory Committee Aeronautics—Tech. Memo., no. 343, Dec. 1925, 20 pp., 25 figs. Attempts to determine by exact methods the nature of flow in valves under various restricted conditions, distinguishing two kinds of flow in simple flat-seated valves, for small valve lift and for greater valve lift.

FUELS STRAINERS, CLOGGING OF. The Clogging of Fuel Strainers, A. C. Zimmerman and E. R. Irwin. Air Service Information Circular, vol. 6, no. 542, Oct. 1, 1925, 3 pp., 4 figs. Report prepared from study of data contained in several isolated reports; concludes that clogging of fuel strainers is attributable: to accumulation of a jelly-like precipitate of hydrated aluminum oxide, caused by corrosion of aluminum parts of fuel system by water, to accumulation of a fibrous material, either asbestos or cotton fibers, on the screen, etc.

FUELS. Fuels for High-Compression Engines, S. W. Sparrow. Nat. Advisory Committee Aeronautics—Report, no. 232, Jan. 15, 1925, 20 pp., 13 figs. Report based on results of tests made by Bureau of Standards emphasizing fact that there may be a difference between fuel's ability to resist detonation and its ability to resist preignition; also discusses properties essential to a satisfactory fuel for high compression engines; certain fuels, benzol and alcohol in particular, are discussed in some detail.

RATING. The Horse Power Rating Formula for Aero Engine, O. Sugimoto. Soc. Mech. Engrs.—Jl., vol. 28, no. 101, Sept. 1925, pp. 609-615. Discusses formulas for calculating brake horsepower, assuming brake mean effective pressure as constant; i.e., expressing brake horsepower as a function of cylinder bore, piston speed, and number of cylinders; recommends three rating formulas for vertical and vee, radial and rotary engines.

TEST REGULATIONS. England Prescribes Difficult Tests for Airplane Engines. Automotive Industries, vol. 53, no. 25, Dec. 17, 1925, p. 1012. Review of revised test regulations issued by British Air Service.

AIRPLANES

AIRFOILS. An Investigation of the Air-Flow Pattern in the Wake of an Airofoil of Finite Span, A. Fage, L. F. G. Simmons. Roy. Soc. of Lond.—Philosophical Trans., vol. 225, no. A632, 1925, pp. 303-330, 13 figs. Investigation to obtain more complete picture of disturbance beyond an airfoil of infinite span and to map out changes which occur in extent and distribution of vorticity in wake as it passes downstream.

AUTOROTATION MEASUREMENT. Autorotation Measurements on a Model Aeroplane with Zero Stagger, F. B. Bradfield and L. P. Coombes. Aeronautical Research Committee—Reports and Memoranda, no. 975, April, 1925, 7 pp., 4 figs. Measurements up to 52-deg. incidence; autorotation commenced with 17 deg. and continued to beyond 52 deg., curve was then flattened off; large range and rates of autorotation seemed to depend on biplane arrangement rather than on any peculiarity of the wing section.

COMMERCIAL. The Lessons of Six Years' Experience in Air Transport, S. Brancker. Roy. Aeronautical Soc.—Jl., vol. 29, no. 179, Nov. 1925, pp. 552-585. Discusses experience with airplanes and seaplanes to evolve therefrom most important problems to be placed before scientists and designers interested in aviation, including safety, reliability, economy; aircraft specifications of the British government, etc.

STRENGTH CALCULATION. Strength Calculations on Airplanes, A. Baumann. Nat. Advisory Aeronautics—Tech. Memo., no. 341, Dec. 1925, 23 pp. Discusses allowable stresses and safety factor in airplanes, yield point of materials, value of elongation, etc.

WIND-TUNNEL TESTS. Wind Tunnel Test of Transport Study, C. E. Archer. Air Service Information Circular, vol. 6, no. 533, Sept. 1, 1925, 13 pp., 18 figs. Details of testing to determine aerodynamic characteristics of proposed transport propeller, drawing M-4012.

Wire Suspensions in Wind Tunnel Experiments, J. Kerneis. Nat. Advisory Committee Aeronautics—Tech. Memo., no. 342, Dec. 1925, 14 pp., 7 figs. Discusses substitution of wire balance for rigid supports of the models, principal advantages and drawbacks of wire balance; shows importance which errors inherent in wire suspension may assume, and under what conditions accuracy may be obtained.

WINGS. Model Tests with a Systematic Series of 27 Wing Sections at Full Reynolds Number, M. M. Munk and E. W. Miller. Nat. Advisory Committee Aeronautics—Report, no. 221, Dec. 23, 1925, 18 pp., 27 figs. Results of tests of wing sections characterized by small travel of the center of pressure, tested at 20-atmos. pressure in variable-density wind tunnel of the Natl Advisory Committee on Aeronautics, giving consistent results and showing that for stable sections a small effective camber, a small effective S-shape and thickness of 8 to 12 per cent lead to good aerodynamic properties.

ALLOY STEEL

PRODUCTION, UNITED STATES, 1925. Alloy Steels Gain Recognition, J. D. Knox. Iron Trade Rev., vol. 78, no. 1, Jan. 7, 1926, pp. 15-18, 1 fig. Production, exclusive of sheets, exceeds 1,000,000 tons annually; automotive and machine-tool industries absorb 85 per cent of national output; includes partial list of alloy-steel applications.

ALLOYS

ALUMINUM. *See Aluminum Alloys.*
BRASS. *See Brass.*
LEAD. *See Lead Alloys.*

ALUMINUM ALLOYS

PISTON CASTINGS. Aluminum Alloys for Piston Castings Must Meet Varied Requirements, R. J. Anderson. Automotive Industries, vol. 53, no. 25, Dec. 17, 1925, pp. 1030-1034, 6 figs. Points out that they must be low in cost, of ingredients easily alloyed, handle well in foundry, be easy to machine, have good mechanical and physical properties and proper microstructure.

AMMONIA COMPRESSORS

NOMOGRAPHIC CHARTS FOR. Nomographic Chart for the Refrigerating Engineer, W. H. Motz. Ice and Refrigeration, vol. 69, nos. 2, 3, 4, 5 and 6, Aug., Sept., Oct., Nov. and Dec. 1925, pp. 104-106, 160-161, 211-212, 273-274 and 381-382, 5 figs.

AMMONIA CONDENSERS

OPERATION. Operation and Care of Ammonia Condensers, H. R. Halterman. Refrigeration, vol. 37, no. 4, Oct. 1925, pp. 48-50. Discusses specification of condensers; atmosphere, double pipe, surface, and submerged, etc.; condenser water supply, cooling pumps and cooling towers; non-condensable gases.

ARCHES

SKEW. Progress Report of Skew Arch Tests, G. W. Davis. Pub. Roads, vol. 6, no. 9, Nov. 1925, pp. 185-193, 12 figs. Discusses tests made by Division of Tests, U. S. Bur. of Pub. Roads, made necessary by skew arches proposed for federal and highway system; method of tests; tests of 60, 30, 45 and 15-deg. skew arches.

ASH HANDLING

MACHINERY, OPERATION OF. Operation of Ash Handling Machinery. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 76-77, 3 figs. Discusses care of various types of equipment in use and method of testing for combustible in ash.

AUTOMOBILE ENGINES

Crankcase-Oil Dilution. Dilution Effects on Friction Coefficients and Bearing Temperatures, A. Le Roy Taylor. Soc. Automotive Engrs.—Jl., vol. 18, no. 1, Jan. 1926, pp. 41-45, 10 figs. Describes tests made to ascertain degree of crankcase-oil dilution beyond which it is unsafe to run engine bearing, and analyzes data obtained, details of apparatus used being specified; results of tests indicate that dilution of oil up to 50 per cent has no bad effect upon engine as regards increased friction and temperatures of bearings, although dilution may be injurious from other standpoints.

AUTOMOBILE FUELS

Alcohol. The Power Alcohol Problem, H. Langwell. Indus. Chemist, vol. 1, no. 1, Feb. 1925, pp. 14-16. Describes from an economical standpoint possibilities of production of power alcohol from enormous quantities of cellulosic material at our disposal, not only at home in form of waste straw and fibrous material, but also abroad in form of tropical vegetation; shows that alcohol as a fuel for internal-combustion engines is not necessarily inferior to gasoline.

Synthetic. The Production of Synthetic Liquid Fuels, A. P. Sachs Combustion, vol. 13, no. 6, Dec. 1925, pp. 358-360. Discusses absolute necessity of having gasoline or a substitute as motor fuel, storage-battery drive being limited; production of synthetic fuels by the Badische and Bergius processes.

AUTOMOBILE INDUSTRY

Bureau of Standards Research. Bureau of Standards Builds New Brake Lining Testing Machines. Automotive Industries, vol. 53, no. 25, Dec 17, 1925, pp. 1016-1018, 2 figs. Closer readings obtained with apparatus now in use; study of linings has resulted in production of higher quality; Bureau has worked out standard test for fuels; other work under way.

AVIATION

Canada. Report on Civil Aviation. Dominion of Canada, Dept. of Nat. Defence, 1924, 56 pp., 10 figs. Review of progress made in 1923, including commercial flying, Canadian air forces and operations, aircraft industry of Canada, aerial photographic mapping, etc.

Report on Civil Aviation. Dominion of Canada, Dept. of Nat. Defence, 1925, 110 pp., 33 figs. Discusses progress in aviation during 1924 in Canada and other countries; control of civil aviation, commercial flying, Canadian air-force operations, aircraft industry, etc.

Civil. Civil Aviation. Soc. Automotive Engrs.—Jl., vol. 18, no. 1, Jan. 1926, pp. 46-47. Legal status and control; Government program regarding civil and industrial uses of aircraft; public and business support; operations abroad; operations in United States.

B

BEAMS

Vibration. The Transverse Vibration of Uniform Beams, David M. Smith. Engineering, vol. 120, no. 3130, Dec. 25, 1925, pp. 808-810, 2 figs. Establishes and applies new formula which simplifies calculation of periods of vibration of multi-span beams, and also enables rational calculations to be made for case of considerable practical importance hitherto little treated, viz., that of beam held at ends in elastic fixings which imperfectly constrain its direction.

BEARINGS

Oil-Ring. Some Limitations of Oil Ring Bearings, E. G. Gilson. Am. Mach., vol. 63, no. 26, Dec. 24, 1925, pp. 1005-1007, 3 figs. Why oil-ring bearings fail at high speeds; lubricating and cooling functions of oil; how oil-ring bearings may be made successful by correct grooving.

BLAST FURNACES

Practice, 1925. Ironmakers Study Quality of Product, R. H. Sweetser. Iron Trade Rev., vol. 78, no. 1, Jan. 7, 1926, pp. 20-22, 4 figs. Blast-furnace practice in 1925; carbon in pig iron; oxidizing of pig iron; blast-furnace capacity; new stacks are shorter and broader.

BOILER FEEDWATER

Deaeration. Feed-Water Deaeration Increases Plant Economy, J. R. McDermet. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1268-1270, 3 figs. Deaerators are insurance against corrosion and replace other equipment.

Systems. Feed Water Systems. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 45-49, 4 figs. Methods of purification, hot and cold chemical treatment, evaporation, deaeration, recirculation and filtering; methods of heating; boiler-feeding arrangements, pumps, methods of control, economizer operation.

BOILER FIRING

Cleaning Fires. Method of Cleaning the Boiler Fires at a Pumping Station. Eng. & Boiler House Rev., vol. 39, no. 6, Dec. 1925, pp. 270 and 272, 1 fig. Particulars of principal features of station pumping capacity of which was 5,000,000 gal. per day; operating routine, with particular reference to method of cleaning fires.

Hand Firing. Hand Firing for Power Boilers. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 31-36, 12 figs. Points out that personal element is more of deciding factors in fuel saving than with power stokers.

BOILER FURNACES

Cass Type. The "Cass" Sprinkler Stoker and Self-Cleaning Furnace. Iron & Coal Trades Rev., vol. 111, no. 3014, Dec. 4, 1925, pp. 918-919, 6 figs. Design and construction of stoker and furnace introduced by Thos. Cass & Co., Bolton; furnace is arranged so that each channel bar has a slow two-and-fro motion of about 3 in. in either direction, which motion is transmitted by cams from a pair of driving shafts under front of furnace, operated through a worm wheel.

Secondary Air Supply. Modern Furnaces and Secondary Air Supply. Eng. & Boiler House Rev., vol. 39, no. 6, Dec. 1925, pp. 267-268, 1 fig. Deals with method and apparatus for securing and maintaining higher average furnace temperature; use of ventilated or perforated firebrick; furnace-arch design; use of preheated air.

Wood-Waste-Burning. Special Furnaces Required for Wood Waste. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 36-40, 5 figs. Means for handling wood waste; requirements for combustion; features of furnace and grates.

BOILER OPERATION

Fuel and Draft Control. Automatic Control of Fuel and Air to Boilers, H. M. Hammond. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1259-1261, 4 figs. Steam pressure shows relation of inflow and outflow of B.t.u. and controls regulate amount and proportions of fuel and air for balance.

BOILER PLANTS

Fulham Borough, Great Britain. Vickers Boilers at Fulham. Power Engr., vol. 20, no. 237, Dec. 1925, pp. 468-470, 3 figs. New generating and boiler plant recently placed in commission at Fulham Borough electricity works; boiler plant is self-contained and comprises three 40,000-lb. units, each complete with its own economizer, forced-draft fan and Prat induced-draft fan and stock.

Pulverized-Coal-Fired. Pulverized Coal to Replace Hand Firing. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1279-1280, 2 figs. Demand for increased economy and capacity has led Lambert Tire & Rubber Co. to build new boiler plant.

BOILERS

Design. Boilers and Boiler Auxiliaries. Power, vol. 63, no. 1, Jan. 5, 1926, pp. 4-8, 2 figs. Air preheating and water-cooled walls prominent in furnace design; improved metals give preference to high temperatures over high pressures; present limitations and status of various auxiliaries.

Feeding Equipment, Operation of. Operation of Boiler Feeding Equipment. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 52-59, 15 figs. Arrangements of piping and valves; operation of pumps; pump governors and feed-water regulators; priming and water level.

Fireless. Fireless Boiler Generates Steam at 1,500-lb. Pressure. Power, vol. 62, no. 26, Dec. 29, 1925, pp. 1007-1009, 2 figs. Evaporation produced by superheated steam blown through water in steel drum; hot gases come in contact with superheater and economizer tubes only, steam-generating drums being located outside of boiler setting; experimental plant successfully tried out in Vienna, Austria; 1000-kw. plant under construction and 18,000-kw. plant started.

Heat Balance. The Daily Heat Balance, W. H. Wood. Combustion, vol. 13, no. 6, Dec. 1925, pp. 351-354. Discusses introduction of recording steam-pressure gages, CO_2 recorders, etc.; advocated employment of a fuel and combustion supervisor for large steam plants whose duty would be to see that fuel is burned as economically as possible; chief preventable losses are: heat carried away in flue gases, carbon in ash pit, unburned combustible gases, unburned solid carbon deposited in boiler or carried out of stack.

Internal-Combustion. Another Internal Combustion Boiler. Eng. & Boiler House Rev., vol. 39, no. 5, Nov. 1925, pp. 220 and 216, 1 fig. Principles of Weir proposal, which is to burn fuel under high pressure, when products of combustion are mixed with certain proportion of water which is vaporized by heat of combustion.

Joints for Air-Leakage Prevention. Preventing Air Leakage on Cylindrical Boilers Eng. & Boiler House Rev., vol. 39, no. 5, Nov. 1925, pp. 228 and 230, 2 figs. Describes Bramwell expansion joints for keeping front and back ends of boilers air-tight.

Patents, 1925. Boiler and Auxiliary Patents of 1925, N. Frucht. Power, vol. 63, no. 1, Jan 5, 1926, pp. 26-29, 4 figs. Patent-office records reveal trend in boiler designs; new baffle arrangements; mercury-boiler developments; superheater and accumulator claims.

Scale Prevention. A New Process for Boiler Scale Prevention. Eng. & Boiler House Rev., vol. 39, no. 5, Nov. 1925, pp. 232-233, 2 figs. Describes filtrator apparatus, and principle upon which it works.

Strains in. Experiments on Strains in Boilers, C. E. Stromeyer. Engineer, vol. 140, no. 3650, Dec. 11, 1925, pp. 649-650, 6 figs. Measurements were carried out which throw light on nature and intensity of bending strains, which up to now have not been measured; results of tests on small locomotive portable boiler; donkey boiler dished crown plate; lap-joint bending; stresses near lap joints; shell-extension experiments. Memorandum of Manchester Steam Users' Assn.

Waste-Heat. Results of Questionnaire on Waste Heat Boilers, C. H. Wilcox. Gas Age-Rec., vol. 56, no. 22, Nov. 28, 1925, pp. 777-778. Details of statistics supplied by 22 different companies in answer to a question blank containing 17 questions.

Water-Level Gages A New Boiler Water Level Indicator. Eng. & Boiler House Rev., vol. 39, no. 5, Nov. 1925, p. 235, 2 figs. New design, put on market by Ferguson Superheaters, Ltd., is capable of either indicating or recording or both.

See also Steam Generators.

BORING MACHINES

Traversing Spindle. Pearn-Richards Machine with Traversing Spindle. Brit. Machine Tool Eng., vol 3, no. 36, Nov.-Dec., 1925, pp. 343-346, 4 figs. Design and operation of improved traversing spindle machine and provision of various attachments further extending varied operations that may be performed at one setting of the work.

BRAKES

Reducing Valve for Vacuum. Reducing Valve for the Vacuum Automatic Brake. Engineer, vol. 140, no. 3650, Dec 11, 1925, p. 645, 1 fig. New type of reducing valve made by Gresham & Craven, Manchester, Eng., for use with vacuum automatic brake being tested on railways in England and in India.

BRASS

High-Tensile. Notes on High Tensile Brasses, Thibaud. Foundry Trade Jl., vol. 32, no 486, Dec. 10, 1925, p. 498. Practical summary of all information already collected on subject of high tensile brasses; influence of constituents; incorporation of metal additions; melting high-tensile brass; moulding.

BRIDGES, STEEL

Demolition of Cantilever. Demolition of Niagara Falls Cantilever Bridge, H. Ibsen. Eng. News-Rec., vol. 95, no 27, Dec. 31, 1925, pp. 1058-1063, 5 figs. Expeditious fieldwork in unusual undertaking complicated by difficult location; 3-truss bridge taken down by reversal of cantilever erection method.

BRIQUETTING

Binders. Binders for Briquetting, with Special Reference to "Pulp Binders", C. J. Goodwin. South Wales Inst. of Engrs.—Proc. vol. 41, no. 5, Dec. 12, 1925, pp. 443-461. Details of experience with binders other than pitch, including starches, such as cassava or sago, sea-weed extract, mixed with pitch or bitumen, and sulphite liquor; production and cost of pulp binders.

BUILDING CONSTRUCTION

Steel. Structural Development During 1925, C. R. Young. Contract Rec., vol. 39, no. 52, Dec. 30, 1925, pp. 43-47, 4 figs. Discusses recent advance in steel frame construction, structural welding, reinforced concrete buildings, further adoptions of specifications of Am. Inst. of Steel Constr.

C

CABLES, ELECTRIC

Faults, Locating of. Locating Underground Cable Faults. Elec. World, vol. 86, no. 26, Dec. 26, 1925, pp. 1297-1300, 8 figs. Apparatus used by United Elec. Light & Power Co. traced through various stages of development; modern equipment and test methods show reliable results under all conditions.

Vibration. Overcoming Vibration in Transmission Cables, G. H. Stockbridge. Elec. World, vol. 86, no. 26, Dec. 26, 1925, pp. 1304-1305, 4 figs. Experience of Southern California Edison Co. shows necessity for damping vibration in transmission spans; special device to be installed on new line.

CABLEWAYS

Aerial Tramways. Fordson Engineers "Span" Their Difficulties, J. H. Edwards. Coal Age, vol. 28, no. 26, Dec. 24, 1925, pp. 887-888, 7 figs. Methods employed by Fordson Coal Co., at Stone, Ky., of disposing of mine refuse by aerial tram; double cable is used to support aerial hanger.

CANALS

Welland. Welland Canal Construction Progress. Can. Engr., vol. 49. no. 26, Dec. 29, 1925, pp. 667-673, 11 figs. Details of progress made in construction of Welland ship canal; locks, their location, size of gates; bridges and piers; rock drilling, breakwaters, etc.

CAST IRON

Engineering Practice and. Cast-Iron and Modern Engineering Practice, J. G. Pearce. Engineering, vol. 120, no. 3129, Dec. 18, 1925, p. 781. (Abridged.) Paper read before (Brit.) Inst. Mech. Engrs.

Graphite in. Graphite in Cast Iron. Metal Industry (Lond.), vol. 27, nos. 18 and 22, Oct. 30 and Nov. 27, 1925, pp. 411-414 and 511-513, 10 figs. Nature and influence of graphite in structure; solubility of carbon in iron and effect of other constituents; effect of mass on graphite separation and rate of cooling effects, particularly in respect to how some resulting difficulties can be overcome, as by use of low-carbon metal; photomicrographs. Nov. 27: Forging cast iron; crucible cast iron; special cases of nodular graphite.

Gray, Influence of Special Elements on. The Influence of Special Elements on Grey Cast Iron, J. W. Donaldson. Foundry Trade Jl., vol. 32, no. 489, Dec. 31, 1925, pp. 553-555 and (discussion) 555-556. Investigations of influence of manganese, chromium, nickel, tungsten, molybdenum, vanadium, copper, tin, aluminum, titanium; heat treatment of alloy cast irons; conclusions.

Growth. The Growth of Cast Iron. Metallurgist (Supp. to Engineer), Nov. 27, 1925, p. 161. Review of studies on this subject.

Research, Application of. Some Applications of Research to Modern Foundry Practice, J. E. Fletcher. Engineering, vol. 120, no. 3129, Dec. 18, 1925, pp. 781-783, 8 figs. Author seeks to illustrate in some detail a few examples of type of work and method of attack used in applying results of research to current foundry practice; skin defects, shrinkage and contraction; trend of future developments in cast iron. (Abridged.) Paper read before (Brit.) Instn. Mech. Engrs.

Silicon, Influence of. Practical Points from Published Papers, B. Rogers. Foundry Trade Jl., vol. 32, no. 489, Dec. 31, 1925, pp. 547-548. Sulphur prints; influence of silicon upon carbon in cast iron; Hamasumi's experiments on influence of silicon upon cast iron; whirling graphite; influence of silicon upon combined carbon; ratio of silicon to combined carbon; further experiments by Hamasumi.

CASTING

Centrifugal. Notes on the centrifugal Casting Process with Special Reference to the Hurst-Ball Process, J. E. Hurst. Foundry Trade Jl., vol. 32, nos. 480 and 481, Oct. 29 and Nov. 5, 1925, pp. 361-365 and 381-384, 12 figs. Oct. 29: Commercial application of centrifugal casting method; axis of rotation; method of pouring; rotating mold. Nov. 5: Life cf metal molds; typical defects; surface depressions and pinholes; inside surface defects; characteristic roughening of inside surface; chemical composition and other properties of molten metal; application and advantages of centrifugal casting process. Bibliography.

CASTINGS

Sand Blasting. Sandblasting Castings, H. Orr. Abrasive Industry, vol. 6, no. 12, Dec. 1925, pp. 367-370, 3 figs. Discusses methods of preparing surfaces and sand blasting; direct-pressure, suction, and gravity system; determination of velocity of air, abrasive materials, nozzles, etc.

CEMENT, PORTLAND

Manufacture. Calcium-Sulphate Retarders for Portland Cement. E. E. Berger, U. S. Bur. of Mines—Reports of Investigation, no. 2705, Sept. 1925, 20 pp., 9 figs. on supp. plates. Discusses reaction of Portland cement with calcium-sulphate and form or mixture of forms best adapted for retarder; determination of time of set and of tensile strength; effect of different retarders on consistency and plasticity of clinker.

CENTRAL STATIONS

Centralized Management. Record Trend to Centralized Management. Elec. World, vol. 87, no. 1, Jan. 2, 1926, pp. 24-28. Gives table of mergers of central-station systems during 1925, involving 560 companies.

Construction 1925. A Year of Intensive Construction. Elec. World, vol. 87, no. 1, Jan. 2, 1926, pp. 53-56. Statistical data on steam and hydro-electric generating plants under way in United States and Western Canada during 1925; total of 7381 mi. of high-tension transmission line erected during year.

Interconnection. Interconnection Saves South. Elec. World, vol. 87, no. 2, Jan. 9, 1926, pp. 91-94, 7 figs. Water shortage of unprecedented magnitude is met by utility executives through pooling generating resources and interconnecting their systems; details of operations future plans.

Statistics 1925. 1925 a Record Year. Elec. World, vol. 87, no. 1, Jan. 2, 1926, pp. 7-10, 3 figs. Energy generated during year totaled 59,517,000,000 kw-hr.; gross revenue is estimated at $1,470,000,000; distinct trends which were established during year.

CLAY

China. China Clay and Silica Sand in Kipling Township, Ontario, S. Hancock, Jr. Can. Min. Jl., vol. 46, nos. 51 and 52, Dec. 18 and 25, 1925, pp. 1149-1151 and 1178-1179, 4 figs. Describes properties situated in Timiskaming Mining Division; discusses discovery, exploration by bore holes, origin of deposits, uses of china clay or kaolin, comparison with Cornis china clay, market for china clay, silica sand, fireclay, timber, water power fuel; transportations, etc.

COAL

Analysis. Commercial Methods of Coal Analysis, R. P. Hudson. Modern Min., vol. 2, no. 12, Dec. 1925, pp. 382-384, 1 fig. Points out that coal cannot be properly evaluated in any way except by chemical analysis; few impurities removable; analysis alone tell how well coal is cleaned; determination of moisture ash and sulphur.

Ash. Coal Ash and Clean Coal, R. Lessing. Gas Jl., vol. 172, no 3265, Dec. 9, 1925, pp. 650-654. Chemical and physical behavior in combustion process, fusibility of coal ash, ash as inert matter, influence of ash composition and catalytic influence of mineral constituents; hydrogenation and total conversion into oils.

Carbonization. The Carbonization Plant of the Midland Coal Products, Limited. Engineering, vol. 120, no. 3129, Dec. 18, 1925, pp. 757-758, 4 figs. Review of report of test by Director of Fuel Research on carbonizing plant of Midland Coal Products, Netherfield, Nottingham; carbonizing process is effected by burning part of charge in neighborhood of tuyeres, combustion being maintained by air and steam passing through them; hot gas on its way up to off-take services to head briquettes as they find their way down the retort.

Preparation. Preparation of Commercial Coal, Thos. Fraser. Modern Min., vol. 2, no. 12, Dec. 1925, pp. 395-398. Commercial coal is defined as coal to be sold on open market as domestic, steam and general-purpose-fuel, in contra-distinction to that intended for metallurgical and other special purposes requiring special qualifications; object of preparation; sizing; method of cleaning; requisites of cleaning plant; feasibility of hand picking; washer loss or shrinkage; impurity separation and adjustment. Paper delivered before W. Va. Coal Min. Inst. See also Coal Trade Bul., vol. 54, no. 3, Jan. 2, 1926, pp. 113-116.

Pulverized. *See Pulverized Coal.*

COAL HANDLING

Equipment. Modern Coal-Handling Equipment, E. Zeuthen, Elec. World, vol. 87, no. 2, Jan. 9, 1926, pp. 87-89, 3 figs. Designed to cut labor cost for power stations and insure continuous coal supply; describes electrical equipment used in modern station.

Peck Carrier. Coal Handling with Overlapping Buckets, F. Dawson. Eng. & Boiler House Rev., vol. 39, no. 5, Nov. 1925, pp. 222-223, 2 figs. Describes principal features of Beck Carrier, adopted almost universally in United States.

COAL INDUSTRY

Nova Scotia. Marketing Nova Scotia Coals, H. A. Hatfield. Eng. Jl., vol. 9, no. 1, Jan. 1926, pp. 19-21. Suggested investigation and educational campaign to promote wider use of these fuels.

COAL MINES

Code of Standards. Union Pacific Coal Co.'s Code of Standards. Coal Age, vol. 28, nos. 26 and 27, Dec. 24 and 31, 1925, pp. 892-893 and 928-929, 17 figs. Code of standards put into effect by Union Pac. Coal Co. at its operations in Wyoming. Dec. 24: Lighting and light wires; cables and power lines; signal and phone lines; rules for wiring underground stations; hoists; switchboards. Dec. 31: Transformers and transformer values; wiring of surface buildings and tipples; overhead distributing lines; instructions to persons inspecting electrical equipment; safety standards.

Nova Scotia. No. 1-B Colliery of the Dominion Coal Company, Limited, A. L. Hay. Eng. Jl., vol. 9, no. 1, Jan. 1926, pp. 12-18, 3 figs. Describes new colliery of Dominion Coal Co. at Glace Bay, N. S., which contains features new to coal-mining practice in that province.

Permissible Equipment. Permissible Mining Equipment Approved Prior to January 1, 1925, L. C. Ilsley, U.S. Bur. of Mines, Tech. paper, no. 376, 1925, pp. 17-25. Details of permissible explosion-proof equipment approved prior to Jan. 1, 1925, including motors, electric switches, portable electric lamps, flame safety lamps; methane indicators, etc. with explanatory notes and specifications.

COAL MINING

Shot Firing. Improved Blasting Methods Increase Proportion of Lump Coal in Output, J. E. Tiffany. Coal Age, vol. 28, no. 26, Dec. 24, 1925, pp. 881-886, 16 figs. Points out that standard shooting practice should be adopted; shot-hole placement, size of cartridge, kind of stemming, all exert non-cumulative influences. (Abstract.) Paper read before West. Va. Coal Min. Inst.

COKE OVENS

By-Product. By-Product Coke-Oven Practice, R. A. Mott. Fuel, vol. 4, no. 12, Dec. 1925, pp. 528-546, 33 figs. Coke quality as related to coal used; fractures in coke; path of travel of gases in oven.

COLUMNS

Underpinning by Girders. First-Story Columns Cut Away in Building Enlargement. Eng. News-Rec., vol. 95, no. 24, Dec. 10, 1925, pp. 950-953, 5 figs. Extension of 12-story bank building required underpinning two volumns by girders at second and third floor levels.

COMBUSTION

Control. Automatic Combustion Control. Eng. & Boiler House Rev., vol. 39, no. 5, Nov. 1925, pp. 213-216, 4 figs. Describes principal features of Bailey meter control as applied to recent American superpower stations.

CONCRETE

Aggregates. Weighing vs. Measuring Aggregate for Concrete, E. E. Glass. Rock Products, vol. 28, no. 24, Nov. 28, 1925, pp. 59-61, 1 fig. Discusses advantages of weighing, and a new rule for designing concrete mixtures by weight.

Aggregate Specifications. Standardization of Specifications for Sand, Rock and Gravel, C. L. McKesson. Rock Products, vol. 28, no. 24, Nov. 28, 1925, pp. 62-63. Details of standard specifications adopted by California Highway Engineers for sand and gravel, screened sizes; demonstrates feasibility of local specification standards.

CONCRETE CONSTRUCTION, REINFORCED

Calculation. Combined Bending and Direct Force, C. E. Reynolds. Concrete & Constr. Eng., vol. 20, no. 12, Dec. 1925, pp. 673-684, 4 figs. Discusses pratical and comparatively simple method of designing and analysing reinforced-concrete members of rectangular section that are subjected to bending moments and direct thrusts or pulls.

Slabs. Tests of Hollow Tile and Concrete Slabs Reinforced in one Direction, D. E. Parsons and A. H. Stang. U.S. Bur. of Standards Technologic Papers., no. 291, Aug. 12, 1925, pp. 465-514, 19 figs. Discusses tests of beams which represented sections of typical combination hollow tile and concrete floor slabs for resisting bending and shearing stresses; concludes that for beams without topping each hollow tile and concrete rib in the combination beams is equivalent in strength to a rectangular concrete beam having a width at least equal to width of concrete rib plus $1.3 (s/w) \frac{ET}{Ec}$ where EC equals 2,000,000 lbs. /in.2, s= thickness of one vertical tide shell, inches, w= thickness of one vertical tile web, inches and Et= modulus of elasticity of the tiles, lbs. /in.2.

CONCRETING

Cold-Weather. Heating of Aggregates Necessary When Placing Concrete in Winter, A. M. Bouillon. Ry. Eng. & Maintenance, vol. 21, no. 12, Dec. 1925, pp. 485-487, 4 figs. Comparison of methods to be followed when carrying on work at extremely low temperatures.

CONDUITS

PRESSURE. The Drac-Romanche Water Power Undertaking. Engineering, vol. 140, no. 3652, Dec. 25, 1925, pp. 692-693, 7 figs. partly on p. 696. Details of pressure pipe of 6-m. internal diam. constructed in connection with power station near Grenoble in French Alps; built of reinforced concrete; construction methods.

CONNECTING RODS

MILLING. Milling Motor Lorry Connecting Rods, Machy. (Lond.), vol. 27, no. 692, Dec. 31, 1925, pp. 446-448, 6 figs. Complete tooling equipment for milling operations on connecting rods for motor trucks.

CORROSION

METALLIC. Metallic Corrosion, W. S. Patterson. Inst. Marine Engrs.—Trans. vol. 37, Nov. 1925, pp. 437-447. Discusses modern theories of mechanism of corrosion, especially electrochemical theory and its primary value in study of corrosion; type of corrosion which persists in acid and in neutral media, water-line corrosion; effect of corrosion deposits and debris.

COST ACCOUNTING

FACTORY. Business Methods, J. Craig. Can. Mfrs., vol. 45, no. 12, Dec. 1925, pp. 15-17. Cost accounting as aid to factory production and executive control.

CRANES

FLOATING. 300-Ton Floating Crane for Handling Concrete Blocks. Engineering, vol. 120, no. 3130, Dec. 25, 1925, pp. 797-798, 9 figs. partly on supp. plate. Details of 300-ton crane built by N. V. Internationale Scheepsbouw, Maatschappj de Maas, Holland, to be used for harbor work in Spain.

STANDARDIZATION. The Standardization of Crane Essentials, E. C. Fiegehen. Engineer, vol. 140, no. 3649, Dec. 4, 1925, pp. 600-602, 1 fig. Summary of chief objects which might be attained by uniformity in practice proposed, namely (1) to secure uniform basis for tendering; (2) to increase efficiency of crane inspection and testing; (3) to protect public against dangerous construction and conditions; (4) to secure undoubted economies resulting from greater uniformity in demand and manufacture; discusses technical aspects of standardization.

UNDERHUNG TRAVELLING JIB. Underhung Travelling Jib Crane. Engineer, vol. 140, no. 3650, Dec. 11, 1925, p. 648, 2 figs. One-ton, four-motor, overhead electric travelling cranes with underhung revolving jibs, constructed by Vaughan Crane Co., Manchester, Eng., for Kilindini Harbor, on Uganda Ry.

CRUSHERS

OPERATION. Notes on Grinding and Crushing Machinery, F. Lane. Ceramic Soc.,—Trans., vol. 24, part 4, 1925, pp. 310-324, 13 figs. Discusses gyratory breakers, dry grinding by edge runner mills, grinding by rolls; getting rid of reduced sizes in order to bring surfaces of material to action of the machine; arranging feed in regular and sufficient quantities to suit output of machine; limit size of largest pieces fed; limit water content of feed; and keeping discharge clear.

CUPOLAS

SUCCESSFUL PRACTICE. Successful Cupola Practice. Metal Industry (Lond.), vol. 27, no. 24, Dec. 11, 1925, pp. 561-562. In author's opinion, state of cupola practice at present time is below that which would be expected from the considerable amount that has been written on subject; he believes this is due more to impractical nature of advice than to disinterestedness of foundryman to act upon it; describes chief essentials to successful cupola practice.

TUYERES. The Tuyere Problem. Metal Industry (Lond.), vol. 27, no. 23, Dec. 4, 1925, pp. 539-540. Author consideres that there is much needless controversy about shape of tuyeres; within reasonable limits tuyere shape is relatively unimportant compared with other items in cupola practice; discusses question as to whether more than one row of tuyeres should be used, and points out that, in few cases where this might be desirable, extra rows should not be designed similarly to first.

Tuyere Arrangement. Metal Industry (Lond.), vol. 27, no. 25, Dec. 18, 1925, pp. 583-584, 1 fig. Gives experimental evidence to show that use of two rows of tuyeres can give very definite advantages over use of one row of tuyeres of same total area.

CUTTING METALS

BUTANE TORCHES. The Production of Butane and the Butane Torch. Natural Gas, vol. 6, no. 9, Sept. 1925, pp. 12, 2 figs. Production of butane and its application to cutting metals with a blow torch, especially designed to use butane.

CYLINDERS

DRAWN. The Production of Deep Drawn Cylinders, W. J. Guyer. Forging—Stamping—Heat Treating, vol. 11, no. 12, Dec. 1925, pp. 427-429, 3 figs. Discusses importance of selecting proper stock, lubrication, annealing and pickling; life and wearing properties of die steels.

D

DAMS

ARCH. Arch Dam Repaired by Fills Above and Below Structure, J. E. Field. Eng. News-Rec., vol. 95, no. 24, Dec. 10, 1925, pp. 953-954, 3 figs. Repair methods on Colorado dam designed to reduce water seepage and to relieve thrust forces on arch.

CONCRETE. Study on Reinforced Concrete Dams, E. G. Harris. Univ. of Minn. School of Mines and Metallurgy, vol. 8, no. 3, May, 1925, pp. 1-53, 16 figs. Discusses four types of dams trapezoidal gravity, arched, horizontal beam and vertical beam types; spacing of columns; expansion joints; advantages and disadvantages of each type.

DIE CASTING

PROCESS AND MACHINES. Die Casting, N. F. Budgen. Engineering, vol. 120, no. 3129, Dec. 18, 1925, pp. 777-778. Advantages of die-casting process; disadvantages of die castings; die-casting machines, their design and working; dies for die casting; metals and alloys for die castings.

DIES

STEERING-WHEEL SPIDERS. Dies for Steering-Wheel Spiders, Jas. M. Acklin. Machy (N. Y.), vol. 32, nos. 4 and 5, Dec. 1925, and Jan. 1926, pp. 283-285, 9 figs. and 388-390, 7 figs. Construction of dies used in stamping hub for spiders of automobile steering wheels.

DIESEL ENGINES

DEVELOPMENTS. Growth of the Diesel Engine Field, R. C. Paul. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1277-1278, 1 figs. Building units of both larger and smaller sizes has opened new fields for Diesel engines during past year.

DRILLING

ROTARY. Mechanical Safeguards in Roraty Drilling. H. C. Miller. U.S. Bur. of Mines—Tech. Paper no. 369, 1925, 39 pp., 30 figs. Discusses safety in oil fields and safeguards used on rotary draw-works, rotary table and drilling engine in oil fields of California; methods of care and safeguards used to protect life and limb; encourages installation of safeguards at drilling wells to reduce machinery hazards to a minimum.

DRILLING MACHINES

AUTOMATIC FEED. Automatic Feed on Sensitive Drilling Machines. Machy. (Lond.), vol. 27, no. 692, Dec. 31, 1925, pp. 411-445, 13 figs. Self-starting and quick-starting mechanisms.

RADIAL, TRANSMISSION AND CONTROL. Transmission and Control on Radial Drilling Machines. Machy. (Lond.), vol. 26, nos. 653, 7671 and 678, Apr. 2, Aug. 6, and Sept. 24, 1925, pp. 1-5, 580-584 and 809-813, 35 figs. Deals with methods of conveying power to spindles of radial drilling machines and arrangements for controlling positions and effecting locking.

E

ECONOMIZERS

OPERATION AND MAINTENANCE. Economizer Operation and Maintemance. Power Plant Engr., vol. 30, no., Jan. 1, 1926, pp. 62-64, 5 figs. Cleanliness of tubes and keeping of water and gas at proper temperatures are of great importance; soot removed by scraping; occasional explosions due to vapor pressure; cast-iron or steel tubes may be used.

TYPES. General Types of Fuel Economizers, W. F. Keenan, Jr. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 60-62. Higher steam pressures and temperatures have created increased demand for economizers.

EDUCATION, ENGINEERING

GRADUATES. A Study of Engineering Graduates and Former Students, Non-Graduates. Jl. Eng. Education, vol. 16, no. 4, Dec. 1925, pp. 259-268. Details of report based on questionnaire replies as to occupation and earnings of graduates and their opinion on engineering education.

TEACHING PERSONNEL. A Study of Teaching Personnel of the Colleges of Engineering. Jl. Eng. Education, vol. 16, no. 4, Dec. 1925, pp. 299-311, 2 figs. Details of report based on circular inquiry concluding that real problem is to secure right type of teachers for engineering faculties, and that this constitutes a major problem in engineering education.

EDUCATION, INDUSTRIAL

BALTIMORE PLAN. The Baltimore Plan of Industrial Education, E. B. Luce. Am. Gas Jl., vol. 123 no. 26, Nov. 28, 1925, pp. 583-584 and 598, 3 figs. Describes plan as developed and applied by Consolidated Gas, Electric Light & Power Co. of Baltimore.

ELASTICITY

MODULUS OF. Relations between Young's Modulus and Other Physical Quantities, J. P. Andrews. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. of Sci. vol. 50, no. 298, Oct. 1925, pp. 665-674, 4 figs. Discusses attempts made to connect Young's modulus with other physical constants and shown that among those only that of Clemens Schaefer between temperature coefficients and melting point is borne out by experiments.

ELECTRIC DISTRIBUTION SYSTEMS

TRENDS IN DEVELOPMENT. Trends in Distribution, A. M. Kehoe. Elec. World, vol. 87, no. 1, Jan. 2, 1926, pp. 51-52, 1 fig. All systems seek to improve service reliability; increased load densities have introduced a.c. netnorks; multiple-feed systems popular; light and power supply from common mains.

ELECTRIC FURNACES

BRASS AND BRONZE. The S.B.N. Simplex Electric Furnace (Four électrique S.B.N. "Simplex"). Jl. du Four Electrique, vol. 34, no. 16, Nov. 15, 1925, pp. 219-222, 2 figs. Details of design and operation of the Nolly furnace, of special interest for brass and bronze foundries; may be worked by a.c. one, two or three phase, or even by d.c.; has two water-cooled electrodes of large cross section.

STEEL. Electric Furnace Steel, F. T. Sisco. Am. Soc. Steel Treating—Trans., vol. 8, no. 6, Dec. 1925, pp. 748-770 and (discussion) 771-781 1 fig. Basic electric process is used for manufacture of high-grade alloy and tool-steel ingots, occasionnally for castings; acid process is used principally for castings; advantages of electric process are: (1) extreme flexibility and (2) high-quality steels produced in tonnage lots; direct arc furnace with non-conducting hearth is used almost exclusively in United States; charging, melting, chemistry of oxidation, control of oxidation in melting; slagging off and carburization; deoxidation period; deoxidizing slag; deoxidation of slag and metal; desulphurization and degasification.

ELECTRIC-GENERATORS, A.C.

SELF-EXCITATION. Self-Excitation of Alternators connected to High Voltage Tranmission Lines, M. Takahashi. Electrotechnical Lab.—Researches, (Tokyo, Japan), no. 155, April, 1925, pp. 1-31, 35 figs. Discusses graphic solution of self-excitation of alternators when charging a no-load transmission line; usually explained by line-charging characteristics and saturation curve excited by armature current; proposes new exact method based on knowledge of armature leakage reactance.

ELECTRIC MOTORS

CURRENT LOCUS. General Criterion for the Circular Locus of the Current Vector in A.C. Circuits and Machinery, V. Karapetoff. Nat. Acad. Sciences,—Proc., vol. 11, no. 11, Nov., 1925, pp. 683-687, 2 figs. Deduces general equation of the circle; electromagnetic vectorial equations of stationary circuit and of revolving electrical machine at voltage E, are written, and it is shown how to eliminate one of the variables v and to reduce the resulting equation for current I to that of a circle.

ELECTRIC MOTORS, A.C.

COMPENSATED INDUCTION. Compensated Induction Motor, T. Torda. Elec. World, vol. 86, no. 24, Dec. 12, 1925, pp. 1205-1206, 4 figs. European motor uses Leblanc principle with one rotor having separate compensating winding in separate slots; design data and operating characteristics.

ELECTRIC POWER

PACIFIC NORTHWEST. Electric Power in the Northwest. Elec. World, vol. 86, no. 25, Dec. 12, 1925, pp. 1194-1199, 4 figs. Review of recent construction, with comments on future developments, interconnection, load building and market possibilities.

ELECTRIC SWITCHES

AIR-BREAK. Essential Qualities in Air-Break Switch, J. E. Reynolds. Elec. World, vol. 86, no. 24, Dec. 12, 1925, pp. 1200-1210, 1 fig. Design of switches discussed from operating standpoint, giving necessary features for successful service describes proposed quick-break air switch.

ELECTRICAL APPARATUS

DEVELOPMENTS. Developments in Electrical Apparatus, E. C. Stone. Elec. World, vol. 87, no. 1, Jan. 2, 1926, pp. 41-44, 3 figs. Outlines utility systems and their developments and surveys status of apparatus for use on three systems; indicates new developments of year.

PROGRESS, 1925. No Radical Changes in Electrical Apparatus. Power, vol. 63, no. 1, Jan. 5, 1926, pp. 24-26, 3 figs. Minor improvements, moderate increase in size of units, hydrogen as cooling medium and new types of synchronous motors mark progress during year.

ELECTRICITY SUPPLY

INDUSTRIAL LOAD, UNITED STATES. Industrial Load of the United States, R. M. Davis. Elec. World, vol. 87, no. 1, Jan. 2, 1926, pp. 44-49. Potential industrial field of central stations only 44 per cent developed; rating of generators in private plants totals 5,913,462 kva.; Mountain-Pacific states lead in degree of industrial electrification.

ELEVATORS

Machining of Units. Making Elevator Units in the Otis Plant, F. W. Curtis. Am. Mach., vol. 63, nos. 26, and 27, Dec. 24 and 31, 1925, pp. 999-1002 and 1039-1042, 19 figs. Dec. 24: Method of machining sheaves; milling magnet-frame covers; drilling and planing operations; miling and boring gear cases. Dec. 31: Type of trunnion drill jig used for various parts; procedure followed in producing laminations; details of dies used; special burring machine.

EMPLOYMENT MANAGEMENT

Absenteeism. Controlling Absenteeism in Factories, E. J. Clary. Can. Mfr., vol. 45, no. 10, Oct. 1925, pp. 18-19. Gives suggestions and remedies, to secure regular attendance of employees.

ENERGY

Forms and Classes. Energy, A. M. Boyce. Instn. Elec. Engrs.—Jl., vol. 64, no. 348, Dec. 1925, pp. 42-44. Discusses different forms of energy ,and points out that energy can be divided into two classes, viz., potential and kinetic energy.

ENGINEERS

Civilization and. The Engineer and Civilization, W. F. Durand. Mech. Eng., vol. 48, no. 1, Jan. 1926, pp. 1-5 and 66. Notes on beginnings of material civilization; arrow-head maker as prototype of industrialist and engineer; primitive utilization of mechanical laws; great antiquity of engineering profession; modern material civilization a product of the engineering guild; how engineer may best serve cause of advancing civilization; part engineering societies have played in developments signalizing last half-century; duty of engineer as regards conservation of natural resources; renewal of personnel in engineering profession through technical education; engineering method and its application to public questions.

EVAPORATION

Water. On the Influence of Thin Surface Films on the Evaporation of Water, E. K. Rideal. Jl. of Physical Chem., vol. 29, no. 12, Dec. 1925, pp. 1585-1588, 1 fig. Rates of evaporation of water and of water covered with unimolecular films of various fatty acids; the latter are found to be much slower than from a clean water surface.

EVAPORATORS

Problems in Use of. Technical Notes on Evaporators, H. Seymour. Indus. Chemist, vol. no. 5, pp. 254-258, 8 figs. Discusses problems that arise in use of evaporators.

EXPLOSIONS

Gaseous. Gaseous Explosions, Geo. G. Brown. Indus. & Eng. Chem., vol. 17, no. 12, Dec. 1925, pp. 1229-1232, 2 figs. Homogeneous and heterogeneous reactions defined and classified.

EXPLOSIVES

Detonation Gases. An Apparatus for Studying Gases of Explosives Detonated Under Confinement, J. E. Crawshaw and G. W. Jones. Eng. & Min. Jl.-Press, vol. 120, no. 25, Dec. 10, 1925, pp. 965-967, 1 fig. Describes an experimental apparatus whereby gaseous products of detonation may be obtained from explosives under confinement, and in a way approximate conditions under which explosives are used in mines. Mines investigations cover a period of 50 years.

F

FANS

Centrifugal, Motor Drives for. Motor Drives for Centrifugal Fans and Blowers, G. Fox. Power Plant Eng., vol. 30, no. 2, Jan, 15, 1926, pp. 141-144, 6 figs. Selection of motors for driving centrifugal fans requires close study of fan characteristics.

FILTRATION PLANTS

Wheeling, W. Va. The Wheeling (West Virginia) Filtration Plant and some Operating Results, J. F. Laboon. New England Water Works Assn.—Jl., vol. 39, no. 4, Dec., 1925, pp. 291-319, 12 figs. Details of new filtration plant of 20,000,000 gal. per 24 hours capable of being enlarged to 40,000,000 gal., so designed in regard to chemical equipment and mixing facilities that filtration works may serve as softening plant; details of grit chamber, mixing chamber settling basins, filters, coagulant house, results of tests and operation.

FLOW OF FLUIDS

Measurement. Measurement of the Rate of Flow of Fluids by the Rotameter, W. H. Simmons and F. C. Sutton. Indus. Chemist, vol. 1, no. 10, Nov. 1925, pp. 473-474, 3 figs. Describes flow meter known as Rotameter, which consists essentially of a vertical transparent tube with bore tapering towards lower end; some industrial processes in which Rotameters are being used.

FLUE-GAS ANALYSIS

CO Determination. Determining Carbon Monoxide in Flue Gas by Iodine Pentoxide, J. F. Anthes. Gas Age Rec., vol. 56, nos. 22 and 23, Nov. 28 and Dec. 5, 1925, pp. 769-770 and 809-810, 1 fig. Details of method and apparatus for determining carbon monoxide as followed by the laboratory of Brooklyn Union Gas Co. Determination of CO by iodine pentoxide; potassium iodide; preparation of starch solution; preparation of 0,001 N sodium thiosulphate and 0.001 N potassium dichromate.

FORGE SHOPS

Fuel Oil and Storage. Furnace Fuels and Oil Storage, C. C. Hermann. Machy. (N. Y.), vol. 32, no. 5, Jan. 1926, pp. 385-387, 3 figs. Fuel-oil system for small plant; oil-pipe intakes; oil-pressure control; atomizing system; oil-storage tanks

FORGING

Machine Dies. Pointers on Forging Machine Dies. Ry. Mech. Engr., vol. 99, no. 12, Dec. 1925, pp. 783-787, 9 figs. Die design and construction; cooperation between forge shop and tool room desirable. (Abstract.) Report of Committee presented before Am. Ry. Tool Foremen's Assn.

Machines. Universal Forging Machine. Engineering, vol. 120, no. 3129, Dec. 18, 768-769, 7 figs. Consists essentially of mechanical press with connecting rod of variable length; this combination makes it possible to forge work of any desired thickness by series of quick squeezes, effect coming between blows of hammer and prolonged pressure of press; manufactured by B. and S. Massey, Manchester, Eng.

FOUNDRIES

Methods and Equipment, 1925. Foundrymen Refine Equipment and Methods in 1925, D. M. Avey. Iron Trade Rev., vol. 78, no. 1, Jan. 7, 1926, pp. 23-24. Conditioning, handling and conservation of sand have engaged much attention; advance in permanent-mold casting practice; development of oil-cooled molding machine; lengthening life of mold; progress in die-mold or pressure-type casting machines; simplification of high-frequency induction-type electric furnaces; other improvement.

Research, Applications of. Some Applications of Research to Modern Foundry Practice, J. E. Fletcher. Engineer, vol. 140, no. 3652, Dec. 25, 1925, pp. 703-704, 6 figs. Author seeks to illustrate a few examples of type of work and method of attack used in applying results of research to current foundry practice. Paper read before Instn. Mech. Engrs.

Testing of Materials. Physical Testing of Foundry Materials, J. S. C. Primrose. Foundry Trade Jl., vol. 32, no. 487, Dec. 17, 1925, p. 506. Brief review of paper read before Lancashire Junior Section of Inst. Brit. Foundrymen; explains differences between proof tests, such as are applied to finished article, and specification tests employing test bars or coupons.

FOUNDRY EQUIPMENT

Mechanical Sand-Handling. Reducing the Cost of Production in Iron, Steel, Malleable and Brass Foundries, R. H. Heisserman. West. Machy. World, vol. 16, no. 10, Oct. 1925, pp. 418-419. Notes on substitution of mechanical handling for manual labor; sand-handling machinery; advantages of mechanical sand conditioning.

FUELS

Developments, 1925. Fuels and Combustion. Power, vol. 63, no. 1, Jan. 5, 1926, pp. 8-12. Coal, oil and other fuels, development in stoker field, trend in pulverized-coal burning and status of low-temperature carbonization of coal with by-product recovery.

Smokeless. Glasgow and Solid Smokeless Fuel. Indus. Chemist, vol. 1, no. 10, Nov. 1925, pp. 481-488, 12 figs. Description of Maclaurin plant at Dalmarnock Gas Works, Glasgow, and methods employed.

Smokeless Solid Fuel Conference, W. E. Davies. Gas. Jl., vol. 172, no. 3266, Dec. 16, 1925, pp. 723-724. Discusses coal-ash content, plasticity and coking, physical and chemical characteristics of coke, combustibility and reactivity test, principles of carbonization.

Testing Plant. Sensible Heat Distillation. Gas Jl., vol. 172, no. 3265, Dec. 9, 1925, pp. 654-656, 2 figs. Describes plant of Sensible Heat Distillation, Ltd., used as demonstration unit for mixing various kinds of carbonaceous material, from caking and noncaking coals and lignites to town sewage.

See also Coal; Oil Fuel; Pulverized Coal.

FURNACES

Protecting Metal Parts from Oxidation. Protecting Furnace Metal Parts from Oxidation, H. E. Weightman. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1276-1277. Process developed by author for treating metal parts, which consists in treating metals with slip made of aluminum-iron-titanium mixture with sodium-metasilicate; no spraying apparatus is needed.

G

GASOLINE ENGINES

Exhaust-Gas Analyses. Chemical Equilibrium in Gases Exhausted by Gasoline Engines, W. G. Lovell and T. A. Boyd. Indus. & Eng. Chem., vol. 17, no. 12, Dec. 1925, pp. 1216-1219, 4 figs. With purpose of getting further knowledge of combustion reaction, which occurs so speedily in gasoline engines, authors have closely examined number of exhaust-gas analyses, with interesting results, as outlined.

GEOLOGY

Economic. Economic Geology and the Mining Industry, H. C. Boydell. Inst. of Min. & Metallurgy—Bul., no. 254, Nov. 1925, pp. 1-12. Discusses inadequate geological control by mining companies in their operations, owing to absence of physical and chemical research directed to solution of existing problems of ore deposits and economic geology.

GRINDING MACHINES

Internal. Rivett Motor-Driven Internal Grinder No. 104. Am. Mach., vol. 63, no. 26, Dec. 24, 1925, pp. 1027-1028, 2 figs. For grinding small and accurate holes on production basis; machine is driven by two independent motors.

Roll. Large Roll Grinding Machine. Iron Age, vol. 116, no. 27, Dec. 31, 1925, p. 1805, 2 figs. Equipment for Carnegie Steel Co.'s Munhall plant has capacity for work 54 in. in diam. and 21 ft. long; four driving motors used.

GEARS

Ground. Characteristics and Use of Ground Gears, H. F. L. Orcutt. Engineering, vol. 120, no. 3126. Nov. 27, 1925, pp. 691-694, 2 figs.; also Engineer, vol. 140, nos. 3648 and 3649, Nov. 27, and Dec. 4, 1925. pp. 589-591 and 618-619, 4 figs. Characteristics, use, and research. (Abridged.) Paper read before Instn, Mech. Engrs.

Idler, Bearing Loads on. Bearing Loads on Idler Gears, F. W. Halliwell. Machy. (Lond.), vol. 27, no. 692, Dec. 31, 1925, pp. 461-462, 3 figs. Shows that reduction of 50 per cent or more in load can often be achieved by transposing idler gear from one side to other.

Internal. Internal Gears, H. Walker. Machy. (Lond.), vol. 27, no. 692, Dec. 31, 1925, pp. 455-457, 5 figs. Nature of internal interference; presents example showing that it is possible to obtain a 100 to 102 ratio without interference.

Normal Pitch. Normal Pitch the Index of Gear Performance, G. M. Eaton. Mech. Eng., vol. 48, no. 1, Jan. 1926, pp. 27-32, 13 figs.

Spur. An Investigation of the Efficiency and Durability of Spur Gears, C. W. Ham and J. W. Huckert. Univ. Ill. Bul., vol. 22, no. 47, July 20, 1925, 94 pp., 42 figs.

Teeth, Involute. Rolling and Sliding Contact in Involute Teeth, J. Cryer. Machy. (Lond.), vol. 27, no. 688, Dec. 3, 1925, pp. 289-290, 9 figs. Graphical treatment.

Teeth, Wear Experiments. Some Comparative Wear Experiments on Cast-Iron Gear Teeth, G. H. Marx, L. E. Cutter and B. M. Green. Mech. Eng., vol. 48, no. 1, Jan. 1926, pp. 33-36, 8 figs. Report of experiments made in laboratories of mechanical-engineering department at Stanford Univ.

Testing. Testing Spur and Helical Gears or Cutters. Machy. (N. Y.), vol. 32, 32 no. 5, Jan. 1926, pp. 382-383, 4 figs. Describes two machines used in tool room of Maxwell Motor Corp., Detroit, Mich., for determining accuracy of spur and helical gears and gear-shaper cutters; how test is made; using machine as comparator; checking spacing and concentricity of teeth; using optical micrometer.

Worm. Worm Gearing—Its Evolution and Manufacture, H. E. Merritt. Machy. (Lond.), vol. 26, nos. 675 and 676, Sept. 3, and 10, 1925, pp. 708-711 and 737-742, 24 figs. Features in practice of David Brown & Sons (Huddersfield). Sept. 3; Worm-gear materials. Sept. 10: Manufacture of worm; production of worm wheels.

H

HEAT CONDUCTIVITY

Calculation. Equation of Conduction of Heat, M. C. Gray. Roy. Soc. Edinburgh—Proc., vol. 45, part 3, 1925, pp. 230-244. Discusses differential equation of conduction of heat in three-dimensional space and its various solutions, including Forsyth's and series solution; solution of equation for 2 dimensions, integral-equations solution, Fourier's solution, etc.

HEATING, GAS

Efficiency. Relation Between Heating Value of Gas and Its Usefulness to the Consumer, E. R. Weaver. U. S. Bur. of Standards—Technologic Papers, no. 290, July 21, 1925, pp. 347-463, 51 figs. Critical reviews of available data regarding relative usefulness of gases of different heating value, confined almost exclusively to facts expressed in definite figures; direct determination of useful facts obtained by burning gas in various appliances, and statistics regarding relative amount of gas used before and after changes of heating value, etc.

HEATING, STEAM

VACUUM. Vacuum Pump Heating Systems, R. H. Anderegg and M. W. Ehrlich. Domestic Eng. (Chicago), vol. 112, nos. 5, 6, 7 and 8, Aug. 1, 8, 15 and 22, 1925, pp. 22-24; 18-20; 33, 35 and 37; and 20-22; 22 figs. Aug. 1: Working parts of single-case and two-case vacuum pumps of water-seal type. Aug. 8 Ratings and capacities of pumps; vacuum pumps are listed in terms of equivalent direct radiation and selected on basis of water and air capacity. Aug. 15: Installation and operation of vacuum pumps. Aug. 22: Describes some actual vacuum heating installations; how to apply pumps to problems of actual heating systems.

HIGHWAYS

MAINTENANCE. Administration and Location of State Highways, G. F. Syme. Pub. Wks., vol. 56, no. 12, Dec. 1925, pp. 428-434, 5 figs. Discusses organization of State highway departments; maintenance most important function from administrative point of view; field procedure of making location; qualifications of a locating engineer.

RESEARCH. Highway Research Develops Definite Objectives. Eng. News-Rec., vol. 95, no. 24, Dec. 10, 1925, pp. 960-961. Annual convention of Highway Research Board shows increasing co-ordination and definite planning indeveloping information on uncertain questions.

HYDRAULIC TURBINES

BLADES. The Graphical Determination of the Meridian Paths of Turbine Blades (Sur la détermination graphique des traces meridiennes des aubes des turbines), Eydoux. Académie des Sciences—Comptes Rendus, vol. 181, no. 2, July 15, 1925, pp. 69-70. If turbine be set in the flow for development of mechanical energy, calculation shows that tangential component of vortex does not enter into blade reactions; based upon Lorenz's differential equation for this motion, author describes graphical construction for given curves which show energy exchanges, these curves being in meridian plane owing to above condition.

HIGH-HEAD. Development of High-Head Hydraulic Turbines, Wm. M. White. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1262-1268, 8 figs. Changes are largely in bearings, details of construction and methods of speed control.

REACTION. World's Highest Head Reaction Turbine Plant, B. West. Tech. Eng. News, vol. 6, no. 4, Nov. 1925, pp. 146-147, 3 figs. Desribes 860-foot head Oak Grove station of Portland Electric Power Co., including discussion of reasons for the development.

HYDRO-ELECTRIC DEVELOPMENTS

PROGRESS, 1925. Activity in Field of Water Power. Power, vol. 63, no. 1, Jan. 5, 1926, pp. 20-24, 9 figs. New contracts of 1,000,000 hp. reported; propeller-type shows gains; increased efficiency renders development of many low-head sites commercially economical.

HYDRO-ELECTRIC PLANTS

NIAGARA. Water-Power Possibilities of the St-Lawrence and Niagara Rivers, H. B. Dwight. Tech. Eng. News, vol. 6, no. 4, Nov. 1925, pp. 144-145, 2 figs. Discusses technical, economical, and political aspects involved in development of 6,000,000-hp. project.

ONTARIO. Norman Dam Power Development, S. T. McCavour. Contract Rec., vol. 39, no. 49, Dec. 9, 1925, pp. 1158-1160, 6 figs. New dam and power house on western outlet of the Lake of the Woods; five units to be installed at present; details of construction methods.

I

ICE MANUFACTURE

ELECTRIC. Electricity in the Manufacture of Ice, D. W. McLenegan. Gen. Elec. Rev., vol. 28, no. 12, Dec. 1925, pp. 846-857, 16 figs. General advantages of electric drive, process of ice manufacture, plant equipment, air compressor; air-storage tanks, ammonia-compressor motor, transformers, ammonia condensers, ice scoring machines.

ICE PLANTS

DESIGN. Many Factors Influence Ice Plant Design, H. J. Macintire. Power Plant Eng., vol. 30, no. 2, Jan. 15, 1926, pp. 151-154, 1 fig. Discusses fundamental principles, showing their application by solution of typical problem in ice-plant design.

ELECTRICALLY DRIVEN. Performance Test of Electrically Driven Raw Water Ice Plant. Ice & Refrigeration, vol. 69, no. 6, Dec. 1925, pp. 365-368, 4 figs. Report of performance of plant of Fulton Ice Co., New York City, in which author describes operating conditions which made it possible to obtain high efficiency shown; much credit due loyalty and team work of employees.

HAZARDS. Ice Plant Hazards. South. Engr., vol. 43, no. 10, Dec. 1925, pp. 51-52. Causes of accidents and how to avoid them. Presented at 14th Annual Safety Congress, Cleveland.

INDICATORS

PRACTICAL OPERATION. Practical Operation of the Indicator, W. H. Wakeman. South. Engr., vol. 43, nos. 8, 9 and 10, Oct., Nov. and Dec. 1925, pp. 54-57, 49-53 and 53-56, 90 figs. Diagrams showing what indicator discloses as to what is taking place in engine cylinder; peculiar indicator diagrams and what was done to remedy matters.

INDUSTRIAL MANAGEMENT

BUDGETING. My Experience with Many Industries, H. I. Shepherd. System, vol. 48, no. 6, Dec. 1925, pp. 699-701, and 742 1 fig. Discusses experience in various industries, the budget as a tool of management; set-up and operation of budget.

INDUSTRIAL CONTROL. Production Control—A Simple System of Recording, W. J. Hiscox. Machy. (Lond.), vol. 27, no. 689, Dec. 10, 1925, pp. 335-336, 4 figs. Describes series of charts which will render efficient service to management of any factory where production is handled on large number of work orders, corresponding to actual sales requirements.

INDUSTRIAL ORGANIZATION

PLANT ORGANIZATION. The Organization of an Industrial Plant, J. Seton Gray. Machy. (N. Y.), vol. 32, no. 5, Jan. 1926, pp. 398-400. Supervision of production; time- and cost-keeping departments; store-keeping department; time study and planning department; employment, inspection and miscellaneous-shop departments; importance of teamwork.

INDUSTRIAL PLANTS

SANITARY SURVEY. How to Make a Sanitary Survey of Your Plant, C. L. Ferguson. Indus. & Eng. Chem., vol. 17, no. 12, Dec. 1925, pp. 1275-1277. Notes on cleanliness, drinking water, ventilation, lighting, exhaust systems, toilets, wash rooms, dressing and rest rooms, etc.

INLAND WATERWAYS

INDUSTRIAL DEVELOPMENT, AND. Seaport and Inland Waterways, S. A. Thompson, World Ports, vol. 14, no. 2, Dec. 1925, pp. 47-81, 3 figs. Compares conditions on the two sides of the Atlantic as to inland waterways, seaports and transportation, showing resemblances and differences; the place of inland waterways in industrial development, etc.

INSULATION, ELECTRIC

HIGH-VOLTAGE. High-Voltage Insulation, J. B. Whitehead. Elec. World, vol. 87, no. 1, Jan. 2, 1926, pp. 31-32. Co-operative research brings new facts to light; now considering 132-kv. cables as practicable; survey of experimental work and status of insulation breakdown theory.

INSULATION, HEAT

GAS MANUFACTURE, USE IN. Insulation, L. E. Cover. Am. Gas Jl., vol. 123, no. 27, Dec. 5, 1925, pp. 611-612 and 620, 2 figs. Its importance in manufacture and domestic and industrial use of gas.

INSULATING MATERIALS, ELECTRIC

DIELECTRIC LOSSES. Dielectric Absorption in Fibrous Insulating Materials, R. E. Marbury and E. R. Le Chait. Elec. Jl., vol. 22, no. 12, Dec. 1925, pp. 605-610, 10 figs. Operation of dielectric lag meter; residual voltage of unimpregnated condenser and of impregnated condensers; relation between dielectric absorption and a.c. losses.

INSULATORS, ELECTRIC

HIGH-TENSION. Porcelain for High Tension Insulators, K. H. Reichaw. Ceramic Soc.,—Trans., vol. 25, part 4, 1925, pp. 279-301, 7 figs. Discusses question as to value of high tension porcelain, and present state of manufacture; complaints as to breakdowns in operation and serious trouble due to faulty manufacturing of line insulators; difficulties of absence of porosity with a well glazed and non-granular fracture; rational composition, presenting of clay silica and felspar; dielectric strength; mechanical testing, etc.

INTERCHANGEABLE MANUFACTURE

WORK-HOLDING FIXTURES FOR. Work Holding Fixtures for the Manufacture of Interchangeable Parts, C. A. Handschin. West. Machy. World, vol. 16, no. 10, Oct. 1925, pp. 399-400 and 415, 3 figs. Examples of special fixtures; points in designing drilling and reaming fixtures.

INTERNAL-COMBUSTION ENGINES

CARBON DEPOSITION. Tests of Carbon Deposition in Internal Combustion Engines, D. R. Brooks. Soc. Automotive Engrs.—Jl., vol. 18, no. 1, Jan. 1926, pp. 48-52, 5 figs.

DOUBLE-EXPANSION. A Double Expansion Internal Combustion Engine. Gas & Oil Power, vol. 21, no. 242, Nov. 5, 1925, pp. 25-27, 5 figs.

PROGRESS, 1925. Progress of the Internal-Combustion Engine. Power, vol. 63, no. 1, Jan. 5, 1926, pp. 18-19, 5 figs. High-Speed oil engines; Diesel locomotive; large units; transformation of semi-Diesel; high and low-speed gas engines.

See also Airplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Gasoline Engines; Oil Engines; Semi-Diesel Engines.

IRON CASTINGS

CLUTCH COUPLINGS. Clutch-Coupling Castings. Metal Industry (Lond.), vol. 27, no. 23, Dec. 4, 1925, pp. 537-539, 9 figs. Describes attempts to produce sound castings of this type, and successful methods finally employed.

IRON ORE

MAGNETITE. The Genesis of the Texada Island Magnetite Deposits, C.O. Swanson, Can. Dept. of Mines—Geol. Survey, no. 2066, 1925, pp. 106A-140A, 5 figs. Details of deposits in Texada Island including limestone, tonalite, porphyries; occurrance of recrystalization; gensis of all deposits formed by magnetic solutions in which the materials were concentrated by the crystalization of the intrusive.

IRRIGATION

DEVELOPMENTS. A New Idea in Drainage for the Irrigation Farmer, J. C. Marr. Agric. Eng., vol. 6, no. 12, Dec. 1925, pp. 306-307, 4 figs. Discusses sluicing or hydraulic methods of drainage, principle of which is similar to that of hydraulic mining and hydraulic method of constructing earthen dams, or displacement and conveyence of earthen materials by a rapidly moving stream of water, the farmer providing needed drainage facilities through expenditure of own time and energy rather than an outlay of captital.

L

LABOUR

EMPLOYMENT POLICY. A Systematic Scheme for an Employment Policy, Berger. Int. Labour Rev., vol. 12, no. 5, Nov. 1925, pp. 634-649. Outlines scheme for comprehensive employment policy which considers ordinary problem of filling normal vacancies in industrial employment from the available reserve of man power, and extraordinary problems of large-scale unemployment in periods of depression.

LATHES

MULTI-CUTTING. Multi-Cutting Lathes. Brit. Machine Tool Eng., vol. 3, no. 36, Nov.-Dec. 1925, pp. 329-335, 9 figs. Discusses possibilities of practice installing a standard machine tool modified to suit special work, instead of entirely special machine of new design.

LEAD ALLOYS

LEAD-ANTIMONY. The System Lead-Antimony, R. S. Dean, W. E. Hudson and M. F. Fogler. Indus. & Eng. Chem., vol. 17, no. 12, Dec. 1925, pp. 1246-1247, 2 figs. Solid solubility of antimony in lead at cutectic temperature; solubility of antimony in lead below eutectic temperature; age hardening of lead-antimony alloys.

LIGHT

PROJECTION. Studies in the Projection of Light, F. Benford. Gen. Elec. Rev., vol. 28, no. 12, Dec. 1925, pp. 866-872. Discusses sectional paraboloidal mirror and its properties for production of wide and soft-edged beam free from images used in out-door flood lighting and in studio illumination.

LIGHTING

STREET. Lighting Chicago's Residential Sections, J. T. Miller. Elec. World, vol. 86, no. 26, Dec. 26, 1925, pp. 1309-1311, 9 figs. Taking advantage of latest economic developnent to effect savings in construction, operation and maintenance, discourage crime and minimize traffic hazards.

Street Lighting from Utility Viewpoint, G. H. P. Dellmann. Elec. World, vol. 86, no. 24, Dec. 12, 1925, pp. 1203-1204, 2 figs. Benefits from lighting must be prime factor; general scheme should be adopted; non-ornamental lighting favoured; raising minimum standards.

LIGHTNING ARRESTERS

JOYCE. Lightning Arresters for Transmission and Distribution Circuits, E. E. Burger. Gen. Elec. Rev., vol. 28, no. 12, Dec. 1925, pp. 857-859, 4 figs. Economic consideration, and types of equipment best adopted to the several classes of service.

LIME

HYDRATED. Hydrated Lime as a Chemical Base, A. B. Searfe. Indus. Chemist, vol. 1, no. 1, Feb. 1925, pp. 38-41, 3 figs. Discusses lump lime versus hydrated lime, nature of hydrated lime, production, and mode of using.

LOCOMOTIVES

BRITISH DEVELOPMENT. The British Steam Railway Locomotive from 1825 to 1924, E. L. Ahrons. Engineer, vols. 139 and 140, nos. 3601-3650, Jan. 6-Dec. 11, 1925, pp. 2-4, 34-37, 66-68, 94-96, 124-126, 151-152, 178-181, 206-208, 232-233, 258-260, 288-290, 316-318, 344-346, 370-372, 398-400, 424-426, 452-454, 478-481, 506-507, 534-536, 562-564, 616-617, 642-644, 670-672, 698-701, 2-4, 28-29, 54-56, 80-82, 104-107, 132-133, 156-157, 180-181, 206-207, 232-233, 258-260, 284-286, 312-314, 338-339, 366-368, 394-395, 422, 452-453, 480-481, 508-510, 538-540, 570-571, 598-600 and 628-629, 314 figs. Traces gradual development during century. Jan. 9: Period 1828-31. Jan. 16 and 23: 1830-1837. Jan. 30 and Feb. 6: 1837-1841. Feb. 13, 20, 27, Mar. 6 and 13: 1841-1849. Mar. 20, 27, Apr. 3 and 10: 1849-1855. Apr. 17 and 24: 1855-1859. May 1: Locomotive performances, speeds and coke consumption, 1845-1859. May 8: Locomotives built by British firms for abroad (including those for Colonial and Indian railways). May 15, 22 and 29: 1860-1865. June 5 and 12: 1866-1869. June 19, 26, July 3 and 10: 1870-1875. July 17 and 24: 1876-1881. July 31: Train resistances and locomotive performances, 1855-1879. Aug. 7: Engines for Ireland and overseas, 1870-1879. Aug. 14, 21, 28, Sept. 4, 11, 18 and 25: Compound locomotives, 1882-1889. Oct. 2, 9, 16, 23 and 30: 1890-1900; articulated, steep gradient and miscellaneous locomotives. Nov. 6, 13, 20 and 27: 1901 to 1914. Dec. 4 and 11: 1914-1924.

COAL TRIALS. Locomotive Coal Trials on the Southern Railway, H. Holcroft. Engineer, vol. 140, no. 3651, Dec. 18, 1925, pp. 658-662, 4 figs. Result of series of trials in order to compare results of using typical South Wales and Yorkshire coals, to ascertain if any appreciable difference in coal consumption is made by passing Welsh coal through mechanical coaling plant, and, incidentally, to observe performance of new 4-6-0 type engines of "King Arthur" class.

DIESEL-ELECTRIC. Diesel Locomotive Development and Problems, L. Kniel. Diesel & Oil Engine Jl., vol. 1, no. 1, Nov. 1925, pp. 28-39, 18 figs. Details of design and construction; fuel consumption; transmission devices, electric drive, mechanical-gear drive, hydraulic drive and other transmission devices.

ELECTRIC. *See Electric Locomotives.*

OIL-ELECTRIC. Oil-Electric Locomotive Makes Record Run. Ry. Age, vol. 79, no. 26, Dec. 26, 1925, pp. 1190-1192, 5 figs. Travels 537 mi. in 28 hr. 45 min. with load of 377 tons on 473 gal. of fuel oil; built jointly by Gen. Elec. Co., Ingersoll-Rand Co. and Am. Locomotive Co. for Long Island R. R.

OIL-ELECTRIC VS. STEAM. Oil-Electric versus Steam Locomotives, W. W. Baxter. Ry. Rev., vol. 77, no. 24, Dec. 12, 1925, pp. 871-874, 4 figs. Operation in actual service indicates relative performance and cost of two sources of motive power.

THREE-CYLINDER. The Three-Cylinder High-Pressure Locomotive, H. N. Gresley. Instn. Mech. Engrs.—Proc., no. 4, May 1925, pp. 927-967 and (discussion), 968-986, 24 figs.

LUBRICANTS

MANUFACTURE. Using Oils and Greases for Industrial Lubrication, F. E. Gooding. Indus. Engr., vol. 83, no. 12, Dec. 1925, pp. 558-566, 4 figs. Discusses properties, sources of oil lubricants, blending and compounding; manufacture of lubricating greases; graphite and its action on scored bearings; effect of speed on charge of lubricant, etc.

LUBRICATING OILS

CARBON-RESIDUE TEST. The Carbon Residue Test for Lubricating Oils, W. M. Seaber. Indus. Chem., vol. 1, no. 2, Mar. 1925, pp. 79-80, 1 fig. Carbon residue test, known in United States as Conradson test, has certain drawbacks, chief of which is lack of control over temperature around crucibles; describes some of the results obtained, using an electric furnace whereby temperature can be controlled with limit of 5 deg. fahr.; it would appear that there is a distinct advantage over Conradson apparatus, using this method of heating oil, more concordant results being obtained.

REFINING. Lubricants, Lubrication and Insulating Oils, R. W. L. Clarke. Instn. of Petroleum Technologists—Jl., vol. 11, no. 51, Aug. 1925, pp. 337-342. Reviews literature on subject, including preparation, refining of oils, properties, oils and lubrication; insulating oils for transformers, etc.

M

MACHINE TOOLS

ANNUAL DIGEST, 1925. Tool Builders Introduce Machines for Higher Production, E. F. Ross. Iron Trade Rev., vol. 78, no. 1, Jan. 7, 1926, pp. 30-32 and 48, 8 figs. Recapitulation of machines tools and other equipment developed for machine-shop use and described in 12 monthly digests in this journal in 1925.

DEVELOPMENTS 1925. New Machine Tools. Machy. (Lond.), vol. 27, no. 690, Dec. 17, 1925, pp. 372-400, 61 figs. Details of lathes, chucking machines, drilling machines, milling machines, grinding and lapping machines, wheel lathes, etc. See also pp. 401-405, giving capacity list and summary of improved features.

Machine Tool Developments in 1925. Machy. (Lond.), vol. 27, no. 690, Dec. 17, 1925, pp. 363-371. Review of principal improvements in design.

PORTABLE. Portable Machine Tools. Machy. (Lond.), vols. 26 and 27, nos. 677, 678, 679, 680, 681 and 682, Sept. 10, 24, Oct. 1, 8, 15 and 22, 1925, pp. 769-782, 815-817, 1-4, 33-37, 83-89 and 97-100, 80 figs. Discusses more recent developments and describes their application; class of tools dealt with range from large duplex spindle milling machines, shaping, slotting, facing, boring and duplex spindle drilling and tapping machines, down to small electric and pneumatic hand tools such as drills and grinders; examples are included of practice in shipbuilding yard, locomotive-building and repair shop, heavy electrical machine shop, maintenance department of coal mine, power station, rubber factory, and motor-repair station.

SELECTION. Standard Machine Tools. Times Trade & Eng. Supp., vol. 17, no. 379, Oct. 10, 1925, p. 99. Discusses lathe and its derivatives, turret lathes and automatic lathes, drilling machines and gear-cutting machines; adoption of new machine tools and subsequent increase in output, especially in automobile industry.

MACHINERY

SAFETY DEVICES. Engineering Revision and Mechanical Safeguarding, E. W. Beck. Nat. Safety News, vol. 12, no. 6, Dec. 1925, pp. 9-12, 6 figs. General principles for mechanical safeguards; they should not interfere with operations, should be strong enough to withstand more than wear and tear, simple and easily accessible; daily inspection necessary; familiarity of workmen in operating them, etc.; gives examples.

MAGNESIUM

PROPERTIES AND MANUFACTURE. Magnesium: A Metal with a Future, L. P. Sidney. Chem. Age (Lond.), vol. 13, no. 334, Nov. 7, 1925, pp. 33-34. Relation to aluminum, properties and occurrence, process of manufacture, properties in fibrous condition, and use for castings.

MANGANESE STEEL

HEAT TREATMENT. Describes Results of Tests in Manganese Steel, Rob. Hadfield. Iron Trade Rev., vol. 77, no. 26, Dec. 24, 1925, pp. 1597-1598, 4 figs. Effect of special heat treatment; test results show that by appropriate heat treatment, manganese steel can be made hard and magnetic at same time. From paper read before French Congress of Chem. Industry, Paris.

MANHOLES

DANGEROUS. Gas Hazards in Street Manholes, S. H. Katz, E. G. Meiter and J. J. Bloomfield. U. S. Bur. of Mines—Reports of Investigation, no. 2710, Oct. 1925, 20 pp. Dangerous gases in street manholes and their principal sources; use of safety lamps on entering a manhole; tests for monoxide and explosive or inflammable gas mixtures.

METAL DRAWING

HEAVY SHEET STEEL. Examples of Heavy Sheet Steel Drawing, E. Sheldon. Am. Mach., vol. 63, no. 27, Dec. 31, 1925, pp. 1035-1038, 6 figs. Advantage taken of tendency of metal to thicken up, shells produced having wide variation in thickness of wall; drawing steel that is more than ¼-in. thick.

METALLOGRAPHY

ENGINEERS. Metallography for Engineers, W. Rosenhain. Metallurgist (Supp. to Engineer), Nov. 27, 1925, pp. 168-171, 7 figs. Failures and defects.

PHOTOMICROGRAPHS. Photo-Micrographs. Metallurgist (Supp. to Engineer), Dec. 25, 1925, pp. 184-187, 4 figs. Discusses fundamental question as to whether all etching reagents produce same pattern on a given specimen; describes examples which serve to show that all structures which can be developed on given surface by different reagents are closely correlated, and can be rightly regarded as different aspects of same structure; choice of magnification; interpretation of photomicrographs.

METALS

COLD WORKING, EFFECT OF. Effect of Cold Working on Endurance and Other Properties of Metals, D. J. McAdam, Jr. Am. Soc. Steel Treating—Trans., vol. 8, no. 6, Dec. 1925, pp. 782-836, 41 figs.

ENGINEERING AND SCIENCE IN METAL INDUSTRY. Engineering and Science in the Metal Industry, Z. Jeffries. Mech. Eng., vol. 48, no. 1, Jan. 1926, pp. 8-16, 15 figs. Growth of metal industries since 1885; selecting best metal or alloy for given purpose; factors governing properties of alloy; causes of hardness in steel; effect of science on metal industry.

FATIGUE OF. An Investigation of the Fatigue of Metals. Univ. Ill. Bul., vol. 23, no. 12, Nov. 23, 1925, 92 pp., 29 figs. Methods and apparatus used in investigation; concludes that at elevated temperatures a marked difference was found between ultimate tensile strength as determined by ordinary static tension tests and as determined by prolonged and retarded tension tests; of metals tested, those having high nickel content showed least falling off of ultimate tensile strength and proportional elastic limit as temperatures were increased, etc.

X-RAY EXAMINATION. X-Ray Examination of Inner Structure of Strained Metals, Iron Plastically Strained in Extension, Compression and Torsion, A. Ono. Kyushu Imperial Univ. College of Eng.—Memoirs, vol. 3, no. 6, 1925, pp. 267-286, 7 figs. Discusses crystal rearrangement as observed in X-ray examination of metals, plastically strained in extension, compression and torsion; also mechanism of crystal rearrangement and cost of strain hardening.

MICROMETERS

ULTRA. Valve Method of Measuring Small Motion, with Special Reference to Precise Recording of Sounds, Pressure-Variations and Vibrations, J. Obata. Tokyo Imperial Univ.—Report Aeronautical Research Inst., vol. 1, no. 11, Aug. 1925, pp. 305-319, 7 figs. Experiments carried out with view to apply methods of measuring small motion utilizing a generating circuit containing a triode to the precise recording of sounds, pressure-variations and vibrations; microphone and ultramicrometer used for this purpose.

MINERAL DEPOSITS

CANADA. Geology and Mineral Deposits of the East Central Manitoba Mining District, J. F. Wright. Can. Inst. of Min. & Metallurgy—Bul., no. 164, Dec. 1925, pp. 1146-1164, 9 figs. Discusses gold bearing quartz veins in the Eastern central Manitoba mining district, topography and geology, gold quartz deposits, copper deposits, etc.

Minerals Deposits of Hudson Bay Territory, R. C. Wallace. Can. Inst. of Min. & Metallurgy—Bul., no. 164, Dec. 1925, pp. 1165-1176. Mineral occurrences in Hudson Bay area, iron ores, native copper, copper-gold, mica, etc.; transportation and developments.

NICKELIFEROUS. Nickeliferous Mineral Deposit, Emory Creek, Yale Mining Division, British Columbia, C. E. Cairnes. Can. Dept. of Mines—Geol. Survey, no. 2066, 1925, pp. 100A-105A. Location and geology, genesis of nickeliferous deposits; assays, secondary sulphides, minerals, etc.

MINERAL RESOURCES

MANITOBA. Mineral Resources of Manitoba, R. C. Wallace. Can. Min. Jl., vol. 46, no. 52, Dec. 25, 1925, pp. 1171-1176, 6 figs. Discussion of minerals including amber, antomony, arsenic, building stone, cement rock, clays, coal, copper, gold, gypsum, kaolin, zinc and lead.

MINES

PERMISSIBLE EQUIPMENT. List of Permissible Mining Equipment. U. S. Bur. of Mines—Reports of Investigation, no. 2720, Nov. 1925, pp. 1-6. List of equipment tested and approved by U. S. Bureau of Mines up to Sept. 15, 1925, covers electric air compressors, coal drills, mining machines, mine pumps, room hoists, switches, electric cap lamps, flame safety lamps, etc.

MOMENTS

GRAPHICAL TREATMENT. Graphical Treatment of Moments, W. W. Padfield. Machy. (Lond.), vol. 27, no. 688, Dec. 3, 1925, pp. 293-295, 9 figs. Useful method for preliminary designing; shows that by means of moments many constantly recurring engineering problems may be solved simply and neatly.

MOULDING MACHINES

TYPES. Moulding Machines. Foundry Trade Jl., vol. 32, nos. 480 and 482, Oct. 29 and Nov. 12, 1925, pp. 370-372 and 403-408, 35 figs. Oct. 29: Early work on mechanical moulding; hydraulic machines. Nov. 12: Centrifugal casting; stripping plates; jolt machines; hydraulic moulding machines; built-up pattern plates.

MOULDING METHODS

STRICKLE MOULDING. A New Method of Strickle Moulding. Foundry Trade Jl., vol. 32, no. 485, Dec. 3, 1925, p. 474. New method of moulding invented by Sappin Frères, which obviates pulls occurring during stripping process when walls of casting are vertical or have not sufficient taper. Brief abstract from paper read before Franco-Belgian Foundry Congress.

MOTOR-BUS TRANSPORTATION

STREET RAILWAYS, CO-ORDINATION WITH. Can Motorcoaches Relieve Traffic Congestion? P. B. Harris. Soc. Automotive Engrs.—Jl., vol. 18, no. 1, Jan. 1926, pp. 33-34. After comparing some of major advantages of motor coaches and electric street cars in transportation service, author asserts that electric-railway companies believe that motor-coach lines have future as feeders, but that to be successful they must be operated by same companies that operate rail lines.

MOTOR BUSES

DEVELOPMENT. The Bus as a Mass Transportation Carrier, W. W. Harris. Engrs. & Eng., vol. 42, no. 12, Dec. 1925, pp. 321-323. Discusses possibility of bus as a carrier, in competition with street cars, railroads, taxis, etc.; increasing bus traffic in London; comparison of New York traffic; congestion of streets, and efficiency of the motor bus.

The Motorbus as an Adjunct to the Street Railway, R. H. Horton. Engrs. & Eng., vol. 42, no. 12, Dec. 1925, pp. 324-325. Discusses anormalous position of motor buses operating more cheaply in one locality and electric cars in another; major features to be considered being investment, depreciation, plttform labour and maintenance; conditions in Philadelphia.

GASOLINE-ELECTRIC. Operating Experience with Gasoline Electric Motorcoaches, R. H. Horton. Soc. Automotive Engrs.—Jl., vol. 17, no. 6, Dec. 1925, pp. 592-596. Results obtained in 5-months operation of fleet of 130 gasoline-electric single-deck pneumatic-tire and double-deck dual-solid-tire motor coaches by Philadelphia Rural Transit Co.; outstanding advantages realized in operation of this type of motor coach are enumerated; troubles that have been overcome.

N

NICKEL

ELECTROLYTIC. The Electrolytic Production of Nickel, A. N. Campbell. Metallurgist (supp. to Engineer), Nov. 27, 1925, pp. 167-168. Main factors which have hitherto prevented successful electrolytic production of nickel have now been indicated, and may be summarized as: (1) Imperfect removal of impurities from electrolyte; (2) poor electrical efficiency; (3) unsatisfactory nature of deposit. Systematic work may result in elimination of (1) and (3), but (2) must of necessity persist as long as insoluble anode, with consequent inevitable high cell voltage, is used.

NOZZLES

STEAM, DESIGN OF. Fourth Report of the Steam-Nozzle Research Committee. Instn. Mech. Engrs.—Proc., no. 4, May 1925, pp. 747-843, 31 figs. Deals with 12-deg. convergent impulse nozzles with thin and with thick blades; built-up type of impulse nozzle; test results of straight elementary nozzles; efflux angles of steam; superheat effect. Includes discussion.

O

OFFICE MANAGEMENT

Development. The Present State of the Art of Office Management, W. H. Leffingwell. Soc. Indus. Engrs.—Bul., vol. 7, no. 12, Dec. 1925, p. 10. Discusses management as the art of handling men, materials and machinery for purpose of producing certain desired results, measurement of work done and method of rating the various operations.

OIL ENGINES

Crankless. Tilting Thrust Blocks on Crankless Engines. Oil Engine Power, vol. 3, no. 11, Nov. 1925, pp. 649-650, 4 figs. Discusses application of swash plates in oil-pressure transmissions for converting reciprocating into rotary motion and vice versa, and gives example of its application to two-cycle airless-injection oil engine with four 7½ x 9-in. cylinders rated to deliver 100 hp. at 500 r.p.m.; also application to gas engines.

Two-Stroke. Some Tests on a Two-Stroke Cycle Oil-Engine, E. A. Allcut. Instn. Mech. Engrs.—Proc., no. 4, May 1925, pp. 819-881 and (discussion) 882-909, 21 figs. Tests made to investigate behaviour of engine under different loads, to ascertain extent of various heat losses and various efficiencies; as suitable oil calorimeter was not available for student and laboratory work, experiments described in appendices were undertaken with object of designing such a calorimeter.

OIL FUEL

Burners. Oil-Fired Cast-Iron and Steel Boilers Show High Combined Efficiency. Heat. & Vent. Mag., vol. 22, no. 12, Dec. 1925, pp. 71-74, 1 fig. Results of three series of tests, one with an A.B.C. burner, one with a Winslow industrial-type burner, and third with a Johnson burner.

Burning, Requirements for. Burning Fuel Oil, F. A. Rothwell. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 23-26, 5 figs. Discusses more important factors governing successful burning of fuel oil.

Methods Used in Burning Oil Fuel Under Boilers. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 26-30, 6 figs. Starting up, control of fuel and air, checks on performance, shutting down; storage and handling, special precautions.

Purification. Fuel and Lubricating Oil Purification Reviewed, L. H. Clark. Oil Engine Power, vol. 3, no. 12, Dec. 1925, pp. 700-702, 4 figs. Use of centrifugal machines for purifying oils; impurities of lubricating oils and their detrimental action on engines; drawbacks in purification of fuel oils and how to overcome them.

OPEN-HEARTH FURNACES

Acid Steel Melting. Acid Open Hearth Steel Melting Practice, R. Furness. Am. Soc. Steel Treating—Trans., vol. 8, no. 6, Dec. 1925, pp. 728-736 and (discussion) 736-738.

Basic Steel Melting. The Basic Open Hearth Practice, E. A. Whitworth. Am. Soc. Steel Treating—Trans., vol. 8, no. 6, Dec. 1925, pp. 739-744 and (discussion) 744-747. History of basic open-hearth steel-melting practice; furnace design; practice for high-grade carbon forging steel.

OXYACETYLENE WELDING

Copper. Autogenous Welding of Copper by the Oxyacetylene Process, A. Eyles. Am. Mach., vol. 63, no. 27, Dec. 31, 1925, pp. 1043-1045, 14 figs. Characteristics of copper, especially when in moltent state; fluxes not necessary; precautions to be taken in making sound welds; welded joints and their preparation.

P

PAPER INDUSTRY

Finland. The Pulp and Paper Industry of Finland, J. Matthews, Jr. Commerce Reports, no. 48, Nov. 30, 1925, pp. 520-522. Production regulated by trade associations; increasing output and export of pulp and paper; modern equipment of mills, etc.

PAVEMENTS

Repair Costs. Repair Costs of City Pavements, R. H. Simpson. Eng. World, vol. 27, no. 6, Dec. 1925, pp. 331-336, 7 figs. Discusses misleading character of cost figures, compares repairs costs for light and heavy traffic, for brick and asphalt pavements and develops diagrams.

PAVEMENTS, ASPHALT

Experimental. An Experimental Pavement, F. C. Lang. Minn. Techno-Log, vol. 6, no. 2, Nov. 1925, pp. 40-41, 2 figs. New types of construction employed in test pavement recently constructed through campus by state highway commission.

PAVEMENTS, BRICK

Salvage Value. The Salvage Value of Brick Pavements, A. S. Mirick. Min. & County Engineering, vol. 69, no. 5, Nov. 1925, pp. 245-248. Experience with brick pavements in various parts of Pennsylvania and West Virginia.

PEAT

Problems, Sweden. Peat and Peat Problems in Sweden, Sven Oden. Fuel, vol. 4, no. 12, Dec. 1925, pp. 505-527, 17 figs. Formation and constitution of peat; rational method of peat analysis proposed by author; utilization of peat; peat as fuel; economy of air-dried peat; pressing out peat water; theory of water removal by means of pressure; wet carbonization and low-temperature carbonization.

PIERS

Concrete. Extension of Concrete Pier No. 314 Navy Yard Charleston, S. C. G. S. Burrell. Pub. Works of Navy, Bul. no. 35, Oct. 1925, pp. 33-45, 8 figs. Details of rebuilding old pier, redriving piles; extension of pier, borings, piles spacing and testing, reinforcement of piles, etc.

PIPE LINES

Coolgardie, W. Australia. The Coolgardie Pipe Line in Australia, and Measures Taken to Correct Corrosion, F. F. Longley. New England Water Works Assn.—Jl., vol. 39, no. 4, Dec. 1925, pp. 421-444, 8 figs. Details of 350-mile pipe line; condition of corrosion and measures taken to minimize it; reduction of carrying capacity; de-aeration treatment, etc.

PLANERS

Roll Wabbler. Roll Wabbler Planer. Iron Age, vol. 116, no. 27, Dec. 31, 1925, p. 1807, 2 figs. Heavy travelling head machine, placed on market by Morton Mfg. Co., Muskegon Heights, Mich., accommodates rolls up to 56 in. in diam.

PLASTER

Gypsum. A High Strength Gypsum Plaster, M. L. Chassevent. Rock Products, vol. 28, no. 24, Nov. 28, 1925, p. 64, 1 fig. By working with water at a temperature too high for setting, a product resembling marble is said to be obtained. (Translated from Le Ciment, 1925, pp. 316 and 317.)

PLATINUM

South Africa. The Platinum Deposits of the Bushveld Igneous Complex, P. A. Wagner, S. A. Mining and Eng. Jl., vol. 36, part 2, Nov. 21, 1925, pp. 315-316. Classification of deposits and characteristics of the Dunite deposits, Merensky Horizon type and also Potgieterrust and those in upper part of the Norite Lopolith.

POLES, WOODEN

Preservation. How Pole Consumer Can Benefit Himself, H. S. Sackett. Elec. World, vol. 86, no. 25, Dec. 19, 1925, pp. 1245-1248, 3 figs. Economical utilization essential to perpetuate adequate supply of suitable pole timber; involves treatment, modified specifications, anticipation of wants and uniform inspection; new German timber-treating process claimed to be promising.

POTASH

Production. The Mineral Industry of the British Empire and Foreign Countries. Imperial Mineral Resources Bureau, 1925, 50 pp. Statistical tables of exports and imports for 21 different countries.

POWER

Equipment, European Developments. Power Equipment Developments in Europe, J. H. Blakey. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1281-1281, 2 figs. French-patented progressive-action friction clutch; rupture tests on steel stirrups carried out by Central Bureau of Normalization of Delft, Holland; mandrel for spreading ends of boiler tubes designed by German firm of Steinmüller; annealing of plates for electrical machines.

Power Show, New York City. Fourth Power Show Surpasses Predecessors. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 94-106, 5 figs. Pulverized-coal and combustion apparatus are centers of interest; steam turbines; centrifugal and reciprocating pumps; electrical equipment; furnace construction; valves and valve control; steam and vacuum traps; feedwater control; piping system and equipment; water heating and steam superheating; etc.

Progress, 1925. Year's Progress in Power Field Shows Many Marked Advances. Power, vol. 63, no. 1, Jan. 5, 1926, pp. 2-4, 3 figs. Results obtained from large new steam plants show remarkable reduction in fuel consumption; condensing steam station has operated on heat rate of 13,715 B.t.u. per kw-hr.; tests on hydro-electric units have shown combined overall efficiencies of 92 per cent for turbine and generator; improvements in furnace designs, etc.

PUBLIC UTILITIES

Public Works and Transport Congress. Public Works and Transport Congress. Engineer, vol. 140, nos. 3647, 3648 and 3649, Nov. 20, 27 and Dec. 4, 1925, pp. 540-542, 577-579 and 606-608, 2 figs. Nov. 20: Résumé of papers on sewage disposal, water supply, roads and bridges, etc.; see also Engineering, vol. 120, nos. 3126, 3127 and 3728, Nov. 27, Dec. 4 and 11, 1925, pp. 683-686, 714-715 and 749.

PULVERIZED COAL

Requirements for Burning. Requirements for Burning Pulverized Fuel, H. D. Savage. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 14-15. Economic results from pulverized fuel; coal-burning conditions made possible presage radical changes in plant design.

Systems. Pulverized Coal Systems of 1925, A. Scheffler. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1251-1254, 4 figs. Growth of method, typical results and new developments.

Unit System. Unit System for Powdered Coal are Successful, W. C. Heckeroth. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1254-1255, 3 figs. Ability to serve small and large plants, dependability and ability to use any fuel are factors.

PUMPS

Pit Sinking. Concrete Pump Pit Sunk as an Open Caisson, P. S. Nelson. Eng. News-Rec., vol. 95, no. 27, Dec. 31, 1925, pp. 1078-1079, 3 figs. Walls built on steel shoe; forms had exceptionally rigid design; water jets opening out of shoe proved ineffective; open-caisson operation recently carried out for new water-works station at Vicksburg, Miss.

PUMPING STATIONS

Automatic. Automatic Pumping Stations. Brown Boveri Rev., vol. 12, no. 12, Dec. 1925, pp. 251-261, 21 figs. Electrically driven centrifugal pumps used in connection with water supply for isolated dwellings, hotels, and large establishments, industrial and agricultural purposes, and whole towns, developed by Brown Boveri.

PYROMETRY

Methods. Pyrometry, J. L. Haughton. Metallurgist (Supp. to Engineer), Nov. 27 and Dec. 25, 1925, pp. 162-165 and 179-181, 9 figs. Notes on platinum-resistance, thermoelectric, and radiation pyrometry.

R

RADIOTELEGRAPHY

Reception. A New Directional Receiving System, H. T. Friis. Inst. Radio Engrs.—Proc. vol. 13, no. 6, Dec. 1925, pp. 685-709, 17 figs. Methods of combining the signal currents from different antennas in a directional receiving system; describes system by which all phase and amplitude adjustments are performed upon beating current imputs of a double detection receiver.

Short-Wave. Short-Wave Transmission Theory, E. V. Appleton. Wireless World, vol. 17, no. 26, Dec. 23, 1925, pp. 885-887. Refraction and absorption in the upper atmosphere; the heaviside layer and its action on short-waves; absorption of different wave lengths.

RAILS

Failure. An Examination into the Causes of the Failure of Steel Rails, E. A. Dancaster. Indus. Chemist, vol. 1, no. 9, Oct. 1925, pp. 441-448, 6 figs. Describes how examination of piece of rail is carried out, in connection with a series of investigations being carried out by author in conjunction with W. H. Shortt into microstructure of rails which have failed in service.

RAILWAY ELECTRIFICATION

Great Britain. Traction Motors and Substation Equipment for the Southern Railway. English Elec. Jl., vol. 3, no. 3, Oct. 1925, pp. 105-114, 12 figs. Details of electrification of first part of suburban lines of South-Eastern and Chatham Railway, operating on direct current at 660 volts, led to the trains by the conductor rail, running rail being used as a return; power in bulk from Deptford Station of London Electric Supply Corp. to railways; main distribution at Lewisham in the form ol three-phase, 25-cycle supply at 11,000 volt; motor equipment, rotary converters, switch gear, substations.

RAILWAY MANAGEMENT

Statistics, Value of. Statistics and Their Value in All Phases of Railway Economics, W. E. Symons. Ry. & Locomotive Eng., vol. 38, no. 12, Dec. 1925, pp. 354-355, 1 fig. Gives illustrations of great value of comparative statistics in all phases of railway ownership and operation.

RAILWAY MOTOR CARS

Gasoline. New Type Motor Rail Car Introduced, W. W. Baxter. Ry. Rev., vol. 77, no. 22, Nov. 28, 1925, pp. 807-809, 2 figs. All-steel construction with two engines driving both trucks employed in new unit for branch lines; built by Smalley Rail-Car Co. at Davenport, Ia. See also description in Ry. Age, vol. 79, no. 24, Dec. 12, 1925, pp. 1183-1185, 4 figs.

RAILWAY OPERATION

Economics. Economics of Railway Operation. Am. Ry. Eng. Assn.—Bul., vol. 27, no. 278, Aug. 1925, pp. 66-80. Report of committee covering method for determining allowance for maintenance-of-way expenses due to increased dues and increased investments, including items chargeable to roadbed and track accounts, also bridges and buildings.

RAILWAY TIES

LIFE MEASUREMENT OF. Life of Ties Measured by New Method. Eng. News-Rec., vol. 95, no. 26, Dec. 24, 1925, p. 1034. Diagram and table enable probable life of groups of ties to be determined from annual rate of renewal.

SUBSTITUTE. Report of Committee on Ties. Am. Ry. Eng. Assn.—Bul., vol. 26, no. 275, Mar. 1925, pp. 1009-1078, 17 figs. Report of Committee on making tests of substitutes ties, their design, rail fastening, insulation; results with copper-content steel; cross ties of foreign woods; testing woods.

RAILWAY TRACK

BALLAST CLEANING. Vacuum Cleaner Renovates Ballast on Pennsylvania. Ry. Age, vol. 79, no. 26, Dec. 26, 1925, pp. 1195-1196, 2 figs. Vacuum cleaner of such size and power that it is capable of lifting stone ballast and foreign matter embedded in it from track to cleaning chamber mounted on car has been employed in renovating ballast on Philadelphia division of Pennsylvania. See also description in Ry. Eng. & Maintenance, vol. 21, no. 12, Dec. 1925, pp. 495-496, 2 figs.

STRESSES. Special Committee on Stresses in Railroad Track. Am. Ry. Eng. Assn.—Bul., vol. 26, no. 275, Mar. 1925, pp. 1081-1245, 103 figs. Details of conduct of tests and production data; straight and curved tracks, stresses in rails, vertical and lateral stresses in curved track; test carried out in Chicago, Milwaukee and Eastern Rys.

RAILWAYS

CHANGING PROBLEMS AND I. C. C. Changing Problems of Railways and I. C. C., F. J. Lisman. Ry. Age, vol. 79, no. 26, Dec. 1925, pp. 1204-1006. Consolidation; motor buses and trucks; long and shorthaul clause; rates; valuation.

REAMERS

FLOATING CUTTERS. Adjustable Reamer with Floating Cutters. Engineering, vol. 120, no. 3129, Dec. 18, 1925, p. 779, 3 figs. Describes reamer brought out by D. Brown & Sons, Huddersfield; two short, diametrically opposed cutters of rectangular section are employed. See also Machy. (Lond.), vol. 27, no. 691, Dec. 24, 1925, pp. 422-423, 5 figs.

REFRACTORIES

SILICA. Silica Refractories, G. Weyman. Gas Engr., vol. 41, no. 596, Dec., 1925, pp. 256-257. Discusses origin of refractories, attack of dust, difficulties of binding, "after expansion", examination and microscopic structure.

RESEARCH

INDUSTRIAL. Industrial Picture Through the Focus of Research, M. Holland. Am. Welding Soc.—Jl., vol. 4, no. 11, Nov. 1925, pp. 12-17. Development of growth of research in industries, and the part governments, national research council, and other bodies are taking in it.

PURE-SCIENCE. The Vital Need for Greater Financial Support to Pure-Science Research, Herbert Hoover. Mech. Eng., vol. 48, no. 1, Jan. 1926, pp. 6-7. Points out that United States is backward in development of research in pure science; scientific work seriously impeded by lack of financial resources; need of adequate organized financial support to pure science recognized by leaders of industry.

RESINS

SYNTHETIC. Synthetic Resins in Industry. Indus. Chemist, vol. 1, nos. 1, 2 and 3, Feb., Mar. and Apr. 1925, pp. 10-13, 73-78 and 145-148, 15 figs. Manufacture and use of synthetic resinous condensation products of phenol-formaldehyde class, with special reference to their molding characteristics.

RIVERS

COLORADO. Slit and Channel Conditions in Colorado River Delta, S. L. Rothery. Eng. News-Rec., vol. 95, no. 27, Dec. 31, 1925, pp. 1068-1071, 9 figs. How deposition centributes to instability of channel; effect of flood scour on levees; Bescadero cut dependent on competent engineering maintenance; present condition threatens disastrous results.

RIVETED JOINTS

TESTS. Comparative Tests of Button Head and Countersunk Riveted Joints, J. B. Kommers. Univ. Wis.—Bul., vol. 9, no. 5, 59 pp. 10 figs. Method and apparatus for testing comparative strength of buttonhead and contersunk rivets, etc.; concludes that average ultimate shearing strength of countersunk joints is at least equal to that of buttonhead joints for lap, single-covered butt and double-covered butt joints; for lap joints diameter of rivet and thickness of plate seem to have little effect on ultimate shearing strength of rivets; deformation, and results of bending tests.

ROAD MACHINERY

ASPHALT MIXING PLANT. A Portable Asphalt Plant. Engineer, vol. 140, no. 3652, Dec. 25, 1925, pp. 700-701, 2 figs. Describes asphalt or bituminous-macadam mixing plant, by Marshall, Sons & Co., of Gainsborough, which are of American Cummer design, but entirely British-made.

ROADS

CONSTRUCTION AND MAINTENANCE, EUROPE. Highway Construction and Maintenance Problems in Europe and America, W. Calder. Surveyor & Mun. & Cty. Engr., vol. 67, nos. 1748, 1749, 1750 and 1751, July 17, 24, 31 and Aug. 7, 1925, pp. 61-62, 85-86, 99-100 and 120, 6 figs. An Australian road engineer's impressions. Effect of motor traffic; advantages of smooth road surfaces; foundations; tar-macadam; cold spray; clinker asphalt; Scottish roads; asphaltic or bituminous materials; cement concrete roads.

WEAR. Effect of Pleasure Traffic on Bronx Roads, L. G. Holleran. Pub. Wks., vol. 56, no. 12, Dec. 1925, pp. 425-427, 1 fig. Discusses effect of intense traffic of pleasure vehicles, using pneumatic and balloon tires, on asphalt block and bituminous concrete road surfaces.

ROADS, CONCRETE

CONSTRUCTION. Efficiency in Concrete Road Construction, J. I. Harrison. Pub. Roads, vol. 6, no. 9, Nov. 1925, pp. 194-202, 1 fig. Report of observations made on going projects on public roads of efficient production including stop watch studies.

ROCK DUST

PRODUCTION AND USE. Production and Use of Rock Dust, R. Reddic. Min. Congress Jl., vol. 11, no. 11, Nov. 1925, pp. 547-553, and 569, 9 figs. A discussion dealing with chemical and physical properties of rock dust, sources of supply, equipment required, and its production and use; rock dusting now recognized as a real factor in mine safety.

ROLLING MILLS

ELECTRIC DRIVE. Electrical Rolling Mills, D. W. Blakeslee. Iron & Steel Engr., vol. 2, no. 12, Dec. 1925, pp. 508-512, 17 figs. Discusses finishing mills, bar mills, rod mills, method of electric drive, power consumption, etc.

Selection of Electric Drives for Reversing Mills, L. A. Umansky. Iron & Steel Engr., vol. 2, no. 12, Dec. 1925, pp. 479-500, 21 figs. Shows how capacity of a contemplated reversing drive may be determined, what factors affect the size of the machines ,and how they affect it; how the terms "horsepower," "torque," ampere," etc., are related to each other in a reversing-mill equipment; gives new procedure for the rather simple calculations required and proves that these calculations very closely approach actual test results.

HIGH-SPEED COLD. The High-Speed Cold Rolling Mill. Engineer, vol. 140, no. 3652, Dec. 25, 1925, pp. 688-691, 2 figs. Author believes that, now that application of roller bearings has been proved to be successful with cold-rolling mill, greatest obstacle in way of adoption of high rolling speeds has been removed.

STEEL-ROLLING PRACTICE. The Theory and Practice of Rolling Steel, W. Tafel. Iron Trade Rev., vol. 77, nos. 12, 13, 14, 15, 16, 17, 19, 21, 23, 25 and 27, Sept. 17, 24, Oct. 1, 15, 22, Nov. 5, 19, Dec. 3, 17 and 31, 1925, pp. 677-679, 739-741, 824-825, 964-966, 1033-1036, 1143-1146, 1277-1280, 1404-1405 and 1434, 1530-1533 and 1651-1655, 65 figs. Important theories and rules of rolling; characteristics of rolling process; notch test; guides; excess over draft increases stress; roll diameter affects grip; roll-pass design.

S

SEMI-DIESEL ENGINES

IGNITION PLUG FOR. Ignition Plug for Semi-Diesel Engines. Engineering, vol. 120, no. 3130, Dec. 25, 1925, p. 817, 1 fig. Plug designed by Lodge Plugs, Ltd., Rugby, Eng., for igniting oil spray until some part of combustion chamber becomes sufficiently hot to maintain ignition.

SEWAGE DISPOSAL

NEW YORK. Wards Island for Treating New York's Sewage. Pub. Wks., vol. 56, no. 12, Dec. 1925, pp. 438-440. Sewage from three boroughs to be treated on northern part of this island of it can be recovered from state, to which it has been leased; outline of proposed plan.

SHAFT SINKING

LINING SIMULTANEOUSLY, AND. An Improved Device for Progressively Lining Shafts with Concrete Without Interfering with Sinking Operations, E. M. Roberts. Min. and Mech. Engrs., vol. 75, part 3, April 1925, pp. 125-130, 7 figs. Device for lining shafts with concrete simultaneously with shaft sinking, consisting of a platform or cradle moveable vertically in shaft, two concreting cylinders, an annular base, means for enabling the raising and lowering of cylinders as the shaft is being lined, means for adjusting diametrically concreting cylinders.

SHAPERS

GEAR-CUTTING ATTACHMENTS. Gear Cutting Equipment for Shaping Machines. Engineering, vol. 121, no. 3131, Jan. 1, 1926, pp. 11-14, 12 figs. Gear-cutting attachments introduced by Matterson, Ltd., Shawclough, Rochdale, in which sigle straight tool is employed; this tool is ordinary V-type.

SILICA BRICK

ONTARIO QUARTZITES FOR. Ontario Quartzites Available for the Manufacture of Silica Brick, E. S. Moore and G. B. Langford. Can. Min. Jl., vol. 46, no. 49, Dec. 4, 1925, pp. 1110-1112, 4 figs. Lorrain quartzite; results of laboratory tests on quartzites; microscopic characters of quartzites; fusion tests.

SOIL

LAND AND CLAY. Principles of Soil Mechanics, Chas. Terzaghi. Eng. News-Rec., vol. 95, nos. 19, 20, 21, 22, 23, 24, 26 and 27, Nov. 5, 12, 19, 26, Dec. 3, 17, 14 and 31, 1925, pp. 742-746, 790-800, 874-878, 912-915, 987-990, 1026-1029 and 1064-1068, 42 figs. Nov. 5: Phenomena of cohesion of clay. Nov. 12: Compressive strength of clay—Modulus of elasticity: Poisson's ratio. Nov. 19: Determination of permeability of clay. Nov. 26: Settlement and consolidation of clay. Dec. 3: Physical differences between sand and clay. Dec. 17: Electric behavior of sand and clay. Dec. 24: Friction in sand and in clay. Dec. 31: Future development and problems.

STANDARDIZATION

ELECTRICAL. Commercial Results of Standardization, M.D. Cooper. Wis. Eng., vol. 30, no. 2, Nov. 1925, pp. 27-28 and 56-58. Discusses practical results of standardization and shows its good effect, as an example quoting the Kaiser Vacuum Lamps selling in United States at 27 cts. and in England at 54 cts.

WELDING. Standardization of Hose Connections for Welding and Cutting Torches and Regulators. Am. Welding Soc.—Jl., vol. 4, no. 11, Nov. 1925, pp. 49-53, 2 figs. Details of standards approved by American Welding Society in Oct. 1925, and agreed to by various other associations.

STANDARDS

U. S. BUREAU OF STANDARDS REPORT. Annual Report of Director of the Bureau of Standards for Fiscal Year Ended June 30, 1925. U. S. Bur. of Standards—Miscl. Publications, no. 69, 1925, 41 pp. Details of its activity during fiscal year, covering weights and measures, electricity, heat and power, optics, chemistry, mechanics and sound, structural engineering, metallurgy, ceramics, simplified practice, building and housing, etc.

National Bureau of Standards. U. S. Bur. of Standards—Circular, no. 1, Oct. 29, 1925, 111 pp., 86 figs. Report on purposes and activities of Bureau of Standards and details of work carried out in scientific and industrial research, testing standards and specifications, simplified practice, etc.

STEAM

HIGH PRESSURES AND TEMPERATURES. High Steam Pressures and Temperatures. Power Plant Eng., vol. 30, no. 2, Jan, 15, 1926, pp. 131-133, 3 figs. High steam pressures and temperatures bring greater economy but limits are fixed by properties of materials available. (Abstract.) Report of Prime Movers Committee of N. E. L. A.

SPECIFIC HEAT AT HIGH PRESSURES. Graphical Representation of the Specific Heat of Steam at High Pressures, Schmolke. Mech. Eng., vol. 48, no. 1, Jan. 1926, pp. 63-64, 10 figs. Points out that with modern tendency toward commercial employment of high steam pressures, knowledge of thermodynamic properties—especially specific heat—of steam at higher ranges becomes of great importance; describes method of calculation. Translated from Wärme, vol. 48, Aug. 21, 1925.

STEAM ACCUMULATORS

INSTALLATION IN STEAM PLANT. Industrial Plant to Install Steam Accumulator. Power, vol. 62, no. 26, Dec. 29, 1925, pp. 1013-1014, 1 fig. New arrangement of steam lines in power plant; accumulator, which is of Ruths type, is designed to take care of all fluctuations in consumption of steam occurring during normal operation in any part of refinery; this will allow boilers to be operated at practically constant rating, which is expected to give much higher overall efficiency.

PRINCIPLE OF. Steam Accumulators, A. J. T. Taylor. Combustion, vol. 13, no. 5, Nov. 1925, pp. 275-277, 2 figs. A discussion of principle upon which they are based and of their importance to heat-using industries.

STEAM ENGINES

TYPES AND APPLICATIONS. The Steam Engine as a Factor in Industrial Power. Power, vol. 63, no. 1, Jan. 5, 1926, pp. 16-17. Special investigation shows trends in types and applications to industries; figures show steam engine holding its own.

STEAM GENERATORS

PULVERIZED-COAL-BURNING. Steam Generator of Unique Design Gives High Rating. Power Plant Eng., vol. 30, no. 2, Jan. 15, 1926, p. 157. Combustion Steam Generator, recently placed on market, combines recent developments of pulverized fuel, water-cooled furnace wall, preheated air and turbulent action in combustion space; practically all boiler surface is exposed to radiant heat.

STEAM POWER PLANTS

DESIGN DEVELOPMENTS. Power Station Design Continues to Progress, P. Junkersfeld. Power Plant Eng., vol. 29, no. 24, Dec. 15, 1925, pp. 1248-1250, 1 fig. Interconnection of generating stations presents new problems to designers: B.t.u. required per kw-hr. cut to 16,000 in 1925.

STEAM TRAPS

DESIGN. Theory Involved in the Design and Testing of Steam Traps, L. C. Price. Sibley Jl. of Eng., vol. 39, no. 7, Oct. 1925, pp. 382-385, 2 figs. Discusses classification, capacity and its calculation, dumping frequency, selecting traps for a given job.

STEAM TURBINES

DESIGN. Graphical Design of Steam Turbines, A. Oppitz. Mech. Eng., vol. 48, no. 1, Jan. 1926, pp. 60-61, 8 figs. Author attempts to apply to turbine design the comparatively newly developed method of applied mathematics, namely, nomography. (Abstract.) Translated from Archiv für Wärmwirtschaft, vol. 6, Oct. 1925.

Steam Turbine Growth Steady. Power, vol. 63, no. 1, Jan, 5, 1926, pp. 12-15, 4 figs. Large-capacity units; higher steam pressure and temperature; high-economy small units; continued refinements in design; large condensers and new designs installed; valves and piping show progress.

EFFICIENCY OF BLADING. The Efficiency of Reaction Blading. Engineering, vol. 120, no. 3129, Dec. 18, 1925, pp. 775-776, 1 fig. Refers to test results on Brown-Boveri steam turbine, described by Prof. Stodola in same journal, Oct. 2, 1925; and discusses figures somewhat more fully than was done in report; explanation of term, hydraulic efficiency.

OVERHAULING. Overhauling the Main Turbines at Connors Creek. Power Plant Engrs., vol. 30, no. 2, Jan. 15, 1926, pp. 135-136, 4 figs. All of turbines in Detroit Edison plant, which is about 10 years old, have been entirely overhauled and rebuilt.

STEEL

ALLOY. *See Alloy Steel.*

COLD-WORKED. Thermal Disturbances and Recrystallization in Cold-Worked Steels, V. N. Krivobok Am. Soc. Steel Treating—Trans., vol. 8, no. 6, Dec. 1925, pp. 703-720, 20 figs.

HIGH-SPEED. *See Steel, High-Speed.*

LOW-CARBON. Flow In a Low-Carbon Steel at Various Temperatures, H. J. French and W. A. Tucker. U. S. Bur. of Standards—Technologic Papers, no. 296, 1925, pp. 619-640, 11 figs.

MANGANESE. *See Manganese Steel.*

STAINLESS. Non-Corrosive Steels, F. R. Palmer. Tech. Eng. News, vol. 6, no. 3, Oct. 1925, pp. 102-104, 4 figs. Production and characteristics of stainless and rustless steels, their micrographic structures, hardening temperatures, etc.

STEEL CASTINGS

ELECTRIC. Some Metallurgical Points in Electric Steel Castings and Notes on Defects, F. A. Melmoth. Foundry Trade Jl., vol. 32, no. 489, Dec. 31, 1925, pp. 549-552.

STEEL, HIGH-SPEED

CHEMICAL COMPOSITION, EFFECT OF. Experiments with Nickel, Tantalum, Cobalt and Molybdenum in High Speed Steels, H. J. French and T. G. Diggcs. Am. Soc. Steel Treating—Trans., vol. 8, no. 6, Dec. 1925, pp. 681-699 and (discussion) 699-702, 5 figs.

STEEL, HEAT TREATMENT OF

METHODS AND APPARATUS. Heat Treating Methods and Apparatus, C. B. Bellis. Am. Soc. Steel Treating—Trans. vol. 8, no. 6, Dec. 1925, pp. 837-850, 9 figs.

PROPORTION TO TOTAL PRODUCTION. Proportion of Heat Treated Steel to Total Production, C. J. Stark. Am. Soc. Steel Treating—Trans., vol. 8, no. 6, Dec. 1925, pp. 721-727.

STEEL INDUSTRY

ANNUAL ANALYSIS, 1925. Fifth Annual Analysis Shows Steel's Use. Iron Trade Rev., vol. 78, no. 1, Jan. 7, 1926, pp. 11-14, 5 figs. Presents annual analysis for 1925 of finished steel among leading consuming groups; various aspects of year's business in analysis of shipments and consumption in accordance with classified groups; gross production of finished steel in United States in 1925 approximates 33,000,000 tons, greatest ever recorded; steel requirements of automotive industry contributed more than any other single element to building up of great market.

STEEL WORKS

ENGLAND. Messrs. Brown Bayley's Steel Works, Engineering, vol. 120, nos. 3111, 3113, 3116, 3117, 3119, 3123, 3124, 3125, 3127, 3129 and 3130, Aug. 14, Sept. 4, 18, 25, Oct. 9, Nov. 6, 13, 20, Dec. 4, 18 and 25, 1925, pp. 192-196, 256-258, 343-345, 374-376 and 450, 567-570, 619-621, 654-655, 702-703, 759-762 and 791-794, 139 figs. partly of supp. plates. Account of plant and manufacturing process of works in Sheffield. Eng.

STOKERS

OPERATION. Good Firing Requires Intelligent Appreciation of Functions of Stokers, R. S. Riley. Power Plant Eng., vol. 30, no. 1, Jan. 1, 1926, pp. 2-5, 2 figs. Points out that essentials of stoker operation are good equipment properly kept up, adequate records of results and attention to fuel bed, air supply and ash-pit conditions.

STREET RAILWAYS

CAR REPAIRING. Arc Welding Reduces Maintenance Costs, A. M. Candy. Elec. Ry. Jl., vol. 66, no. 25, Dec. 19, 1925, pp. 1072-1074, 9 figs. Equipment and facilities for welding in shops of Worcester Consolidated Street Ry.; welding booths are arranged in a row between overhauling pits and machine shop.

TRACK RECONSTRUCTION. Rebuilding Track Amid Traffic Congestion, C. A. Elliott. Elec. Ry. Jl., vol. 66 no. 25, Dec. 19, 1925, pp. 1063-1067, 15 figs. Particulars of new methods of track reconstruction adopted by Pacific Elec. Ry. because of increase in traffic congestion; special work is made up in advance; gangs comprise about 50 men; work is done in two nine-hour shifts; under favorable conditions one block of double track is rebuilt in 20 days; average rates of progress for various jobs are given.

SUBSTATIONS

CONTROL. Centralized Supervision of Automatic Substation System, R. J. Wensley. Elec. World, vol. 86, no. 25, Dec. 19, 1925, pp. 1259-1260, 2 figs. Describes supervisory control system designed and installed to operate both on Staten Island Rapid Transit Co.'s control system of substation converters and upon 33,000-volt transmission system of Staten Island Edison Co. supplying railway converters.

SPACING AND SIZE. Economic Spacing and Size of Substation, E. L. Sweet. Elec. World, vol. 86, no. 24, Dec. 12, 1925, pp. 1200-1202, 7 figs. Effect of substations on primary distribution costs; evaluation of losses and costs to secure minimum overall costs; use of general standard advocated.

SUPERPOWER

STATIONS. The Metallurgical and Chemical Industries in Relation to Super-Power Stations, E. K. Scott. Combustion, vol. 13, no. 6, Dec. 1925, -pp. 356-357. Discusses superpower problems in connection with Great Britain; an ideal superpower plant should provide factories with cheap industrial gas and electricity, supplying at same time low-temperature coke for house fires and making all by-products from coal.

SURVEYING

TRAVERSING, TAPES FOR. Use of 300- and 500-ft. Tapes for Survey Traversing, H. Rubey. Eng. News-Rec., vol. 95, no. 26, Dec. 24, 1925, pp. 1024-1029, 7 figs. Economy and speed increased; charts for slope corrections, vertical components, corrections due to temperature, pull and sag.

T

TELEPHONY

BELL SYSTEM. General Engineering Problems of the Bell System, H. P. Charlesworth, Elec. Communication, vol. 4, no. 2, Oct. 1925, pp. 111-125, 18 figs. Character and scope of problems involved in caring for growth and operations of Bell System; plant extensions to meet service requirements, necessity for advanced planning; analysis of engineering cost studies; discusses New York-Chicago toll cable and New York City telephone problem.

LOADED CIRCUITS. Irregularities in Loaded Telephone Circuits, Geo. Crisson, Elec. Communication, vol. 4, no. 2, Oct. 1925, pp. 98-110, figs. 14. Describes line irregularities in long-distance transmission; structure of coil loaded circuits which permit calculation of possibility of obtaining an assigned accuracy of balance between line and net work; gives formulae and results of calculations compared with measurements made on circuits of known accuracy of loading.

THERMOCOUPLES

TEMPERATURE MEASUREMENT AND CONTROL, FOR. Thermo-Couples—Their Use for Temperature Measurement and Control, P. M. Heldt. Automotive Industries, vol. 53, no. 26, Dec. 24, 1925, pp. 1056-1059, 5 figs. Characteristics of rare-metal and base-metal-type couples; methods of keeping temperature of cold junction constant or compensating for changes in it; special types for special uses; installation.

TOLERANCES

SYSTEM FOR ALLOWANCES AND. The Evolution of an Allowance and Tolerance System, T. Rapson. Machy. (Lond.), vol. 27, no. 688, Dec. 3, 1925, pp. 297-299, 7 figs. Description of inception, experiments and revisions, final results of which were put into operation as being most suitable for class of work produced, and conditions existing, in connection with manufacture of automobiles and internal-combustion engines for various purposes.

TRANSFORMERS

DEVELOPMENT AND APPLICATIONS. Power Transformers, C. E. Sisson. Eng. Jl., vol. 9, no. 1, Jan. 1926, pp. 3-12, 12 figs. Development of power transformers with some modern features and applications.

OILS. Methods of Testing Transformer Oils, H. C. Staeger. Indus. & Eng. Chem., vol. 17, no. 12, Dec. 1925, pp. 1272-1275, 2 figs. Outline of chemical constitution of oils followed by outline of type of reactions occurring under influence of elevated temperatures in presence of oxygen; several standard tests of insulating oils are critically reviewed; described BBC (Brown, Boveri Co.) test and claims it is most nearly representative of service conditions and as taking account of all phases of oil deterioration.

PHASE ANGLE OF CURRENT. The Phase Angle of the Current Transformer, E. G. Reed. Elec. Jl., vol. 22, no. 12, Dec. 1925, pp. 594-596, 6 figs. Phase angle for varying primary current; and for varying volt-ampere secondary load; effect of phase angle on power reading.

TAYLOR CONNECTION. Taylor Connection for Transforming from Three-Phase to Two-Phase, J. B. Gibbs. Power, vol. 62, no. 26, Dec. 29, 1925, pp. 1005-1006, 5 figs. Presents diagram of connection; comparison with other 3-phase to 2-phase connections, showing advantages and disadvantages.

TIE-IN. Tie-In Transformer Equipped with Load Ratio Control, M. H. Bates. Gen. Elec. Rev., vol. 28, no. 12, Dec. 1925, pp. 823-826, 4 figs. Describes various operating principles that have been incorporated in design of such transformers, and gives details of particularly large unit constructed along these lines.

TRANSPORTATION

RAILWAYS AND HIGHWAY CARRIERS. A Survey of the Bus and Truck Situation. Ry. Age. vol. 79, nos. 23 and 24, Dec. 5 and 12, 1925, pp. 1023-1028 and 1077-1082, 14 figs. Points out that highways competition is seriously affecting railways revenues; suggestions for solution of problem; what is being done by railways to meet competition of motor-bus and truck transportation. Information derived mainly from answers made by railway presidents throughout country to questionnaire. Dec. 12: Tendency toward adoption of highway carriers by railroads themselves.

TUBES

COLLAPSING PRESSURE. The Collapse of Short Thin Tubes by External Pressure, G. Cook. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. of Sci., vol. 50, no. 298, Oct. 1925, pp. 844-848, 2 figs. Discusses mathematical investigation of collapsing pressure of short tubes by Southwell and others and gives results of tests carried out, showing very good arrangement between calculated and observed pressures.

TUNGSTEN

MINING AND USES. Report of Sub-Committee on Tungsten. Min. & Met. Soc. of Am., vol. 43, no. 6, Sept. 1925, pp. 84-105. Discusses tungsten minerals, mining and conversion of ore, manufacture and use of finished product; substitutes; geographical distribution of deposits; domestic sources of supply.

TURBO-GENERATORS

AIR COOLER FOR. Air Cooler for Turbo-Generators. Engineering, vol. 121, no. 3131, Jan. 1, 1926, pp. 28, 3 figs. Cooler of closed-circuit type, manufactured by Cole, Marchent & Morley, Bradford.

V

VANADIUM

PRODUCTION AND APPLICATIONS. Vanadium: Its Production and Commercial Applications, A. J. Ewins. Indus. Chemist. vol. 1, no. 1, Feb. 1925, pp. 3-4. Notes on occurrence and source; use in steel industry, and other uses; production.

VAPORS

PRESSURES. Pressure-Temperature Charts—Extended Ranges, Geo. Galingaert and D. S. Davis. Indus. & Eng. Chem., vol. 17 no. 12, Dec. 1925, pp. 1287-1289, 6 figs. It has been shown that empirical method of Cox of plotting vapor-pressure data was suitable for range of 0 to 300 deg. cent. in case of several vapors; it is shown in this paper that this method is applicable over very much greater ranges.

VENTILATION

AUTOMATIC VENTILATORS. New Tests of Automatic Ventilators, J. P. Calderwood and A. J. Mack. Heat. & Vent. Mag., vol. 22, no. 12, Dec 1925, pp. 49-53, 13 figs. Investigation of 22 commercial types, with comparative data on plain stationary, stationary siphoning, plain rotary and rotary siphoning types.

BUILDINGS. Is Present Ventilation Practice Wrong? F. M. R. Butler. Contract Rec., vol. 39, no. 50, Dec. 16, 1925, pp. 1182-1184.

UNIT SYSTEM. Ten Fundamentals of Unit Ventilation and Their Application, A. J. Nesbitt. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 31, no. 12, Dec. 1925, pp. 545-552, 5 figs. Ventilation of schools and other buildings by unit system designed by Hubbard; details of principal changes since 1908; use of by-pass damper; change in form; adaptation of air filters and successful application of polyphase a.c. motors.

VOLTMETERS

CREST. Crest Voltmeters and Their Characteristics, D. F. Miner. Elec. Jl., vol. 22, no. 12, Dec. 1925, pp. 571-577, 19 figs. The simple crest voltmeter; calibration; form of condenser used with crest voltmeter; rectifiers.

Engineering Index

This Index is prepared by the American Society of Mechanical Engineers.

In this department will be published from month to month the titles of current engineering papers with the authors and source and a brief extract of the more important. It is designed to give the members of The Institute a survey of all important articles relating to every branch of engineering profession.

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A

AERONAUTICAL INSTRUMENTS

Altimeters. Behm Acoustic Sounder for Aircraft. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 346, Jan. 1926, 5 pp., 3 figs. on supp. plates. This sounder enables non-barometric determination of altitude by night or in fog which functions on acoustic principle of water sounder, the sound waves passing from airship to ground and return. Translated from German.

AERONAUTICS

Developments. Possible Lines of Aeronautical Development, R. F. Hall. Aviation, vol. 20, no. 7, Feb. 15, 1926, pp. 218-220, 14 figs. Development of compound wings; helicopter possibilities; reducing landing speed; additional wing attachments; vertical flight; construction; monocoque construction; metal-wing structures; airplane glider.

AIR

Pollution by Smoke. Measuring the Smoke Pollution of City Air, J. S. Owens. Analyst Jl., vol. 51, no. 598, Jan. 1926, pp. 2-18, 5 figs. Divides methods of measuring into those aiming at measuring deposit of impurity from the air and those dealing with impurity while suspended in the air; filtration of suspended matter, washing it out with water, electrical precipitation; measuring deposit; dust counters and other methods.

AIR COMPRESSORS

Electric Motors For. Power Drive Equipment for Air Compressors, G. Fox. Indus. Engr., vol. 84, no. 1, Jan. 1926, pp. 13-18, 8 figs. Type and capacity of motor required, control apparatus necessary and mechanical connection for coupling motor to compressor.

AIR CONDITIONING

Humidifying System. The Humidity Problem, A. C. Willard. Sheet Metal Worker, vol. 16, no. 24, Jan. 1, 1926, pp. 863-865, 2 figs. Fundamental requirements for successful humidification, cost of evaporating by electricity, gas, etc.

AIRCRAFT CONSTRUCTION MATERIALS

Dopes. Dopes and Their Application. Air Service Information Circular, vol. 6, no. 544, Nov. 1, 1925, 11 pp., 18 figs. Discusses composition, tests and storage of dope, a colloidal solution of cellulose acetate, and application with brush or by spraying.

Two-Cycle. Two-Stroke-Cycle Engines for Airplanes, J. Jalbert. Nat. Advisory Committee for Aeronautics—Tech. Memo., no. 347, Jan. 1926, 23 pp., 17 figs. Application of two-stroke engines to airplane after their adoption in automobiles; reduced heating; scavenging exhaust gases; intake, fuel consumption, alimentation, distribution, carburetion, idling speed, ignition; Laviator, C. F. A. and other engines. Translated from Aeronautique, July and Aug. 1925.

AIRPLANES

Airfoils. The Rolling and Yawing Moments of an Aerofoil in Straight Flight, H. Glauert. Aeronautical Research Committee—Report & Memoranda, no. no. 980, July 1925, 5 pp. Concludes that induced yawing moment can be reduced to some extent by use of tapered wings whose tip chord is less than half the central chord, but possibility of obtaining no yawing moment about wind axes depends on some device which introduces a profile yawing moment of the opposite sign to induced yawing moment.

Multiple-Engine. Multi-Engine Airplanes and Forced Landings, H. G. Smith. Aviation, vol. 20, no. 3, Jan. 18, 1926, p. 78. Points out that multiple engines insure greater reliability; one forced landing in 343,000 flights or one in 1400 years, a possibility.

Scale Effect. The Air Forces on a Model of the Sperry Messenger Airplane Without Propeller, M. N. Munk and W. S. Diehl. Nat. Advisory Committee for Aeronautics—Report, no. 225, 1925, 12 pp., 9 figs. Report on scale effect research made in wind tunnel of National Advisory Committee of Aeronautics with a 1/10 scale model of Sperry Messenger airplane with U.S.A.-5 wings showing that scale effect is almost confined to the drag.

AIRSHIPS

Mooring Towers. 210-Ft. Airship Mooring Tower at Detroit Airport, H. V. Thaden. Eng. News-Rec., vol. 96, no. 5, Feb. 4, 1926, pp. 202-204, 3 figs. With new system, dirigible lands passengers and freight at ground instead of at top of tower; bow held in sliding guide as ship is hauled down; anchor trucks restrain ship's hull.

ALLOYS

Aluminum. *See Aluminum Alloys.*

Brass. *See Brass.*

Viscosity. Viscosity of Alloys at High Temperatures (Contribution à l'étude de la viscosité des alliages à température élevée), J. Cournot and K. Sasagawa. Revue de Métallurgie, vol. 22, no. 12, Dec. 1925, pp. 753-763, 9 figs. Describes apparatus for determining rapidly and with sufficient accuracy speed of hot pouring and limits of viscosity at various temperatures.

ALUMINUM ALLOYS

Casting. The Casting of Aluminum Alloys. Chem. Age (Lond.), vol. 14, no. 342, Jan. 2, 1926, p. 3. Practical notes on process; preparation of alloy.

Commercial. Commercial Aluminium Alloys from the Users' Point of View, J. B. Hoblyn. Foundry Trade Jl., vol. 33, no. 480, Jan. 7, 1926, pp. 3-5, and (discussion), no. 491, Jan. 14, 1926, pp. 34-36. Investigation of how far results obtained experimentally from casting made under favorable conditions, were reproduced in practice; in author's belief, there is a future for heat-treated aluminum alloys in automobile construction; in stressed parts, castings, if heat treated, have very extensive field. (Abstract.)

Duralumin. *See Duralumin.*

Light Casting. Aluminum Alloys Develop Greater Commercial Applications, E. V. Pannell. Foundry, vol. 54, no. Feb. 1, 1926, pp. 105-107. Presents list showing average analysis and approximate physical properties of 67 alloys which are of more or less commercial value.

ALUMINUM

Properties and Uses. Aluminum — Its Strength and Lightness, R. C. Rowe. Can. Foundryman, vol. 17, no. 1, Jan. 1926, pp. 14-17, 4 figs. Malleability and ductility; origin of bauxite and its uses in abrasives; production of aluminum from alumina; uses of aluminum.

AMMONIA

By-Product. By-Product Ammonia in the United States, H. A. Curtis. Am. Fertilizer, vol. 63, no. 9, Oct. 31, 1925, pp. 33-36. Production of by-products, fixed nitrogen, production and distribution of ammonia nitrogen in United States, cost of manufacturing ammonia sulphate, ammoniates and fertilizers, etc.

APPRENTICES, TRAINING OF

Building, Trades. Apprenticeship in the Building Trades, D. L. Hoopingarner. Mech. Eng., vol. 48, no. 2, Feb. 1926, pp. 111-114. Problems of apprenticeship; economic and educational background; what is being done in apprenticeship training in building trades.

Craftsmen. The Training and General Position of the Craftsman, K. C. Appleyard. Foundry Trade Jl., vol. 33, no. 491, Jan. 14, 1926, pp. 28-30, and (discussion), no. 491, Jan. 14, 1926, pp. 28-30, and (discussion), no. 492, Jan. 21, 1926, pp. 51-52. Fundamentals and history of craftsman; present position and future development; social and psychological factors; aspirations of craftsman; discontent and progress; choosing apprentice; artisan training.

Railway. The Training of Railway Apprentices, M. Chouard. Ry. Engr., vol. 47, no. 552, Jan. 1926, pp. 7-10, 2 figs. Details of apprenticeship system developed by Paris-Orleans Railway, which has produced very good results and has greatly increased efficiency of the mechanical engineering staff.

AQUEDUCTS

Providence, R.I. Construction of Steel Portion of Providence Aqueduct, B. F. Snow. Eng. News-Rec., vol. 96, no. 4, Jan. 28, 1926, pp. 159-161, 5 figs. Nearly two miles of 66-in. steel pipe coated at trench side; collapse and restoration of 2200-ft of the line.

ARCHES

Concrete. The Design of a Symmetrical Hingeless Arch, A. C. Hughes. Surveyor, (Lond.), vol. 69, no. 1774, Jan. 15, 1926, pp. 51-53, 6 figs. Abutments of reinforced concrete or mass concrete; forces acting on abutment of arch; spandrel walls, calculations, etc.

Temperature Deformations in Concrete Arches, H. Cross. Eng. News-Rec., vol. 96, no. 5, Feb. 4, 1926, pp. 190-191, 2 figs. Crown deflections give basis for direct method of determining temperature effects by simple calculation.

AUTOMOBILE ENGINES

Crankcase-Oil Dilution. A Suggested Remedy for Crankcase-Oil Dilution, R. E. Wilson and R. E. Wilkin. Soc. Automotive Engrs.—Jl., 18, no. 2, Feb. 1926, pp. 163-170, 11 figs.

Design Trend. Higher Compression Ratios a Feature of This Year's Engines, P. M. Heldt. Automotive Industries, vol. 54, no. 2, Jan. 14, 1926, pp. 50-54, 11 figs. Better understanding of laws of heat flow in combustion chamber, aluminum-alloy pistons and improved fuel are factors contributing to trend; many gear-type oil pumps now outside crankcase.

Sleeve-Valve. Sleeve-Valve Engine Development, W. Ferrier Brown. Automobile Engr., vol. 16, no. 211, Jan. 1926, pp. 18-25, 14 figs. Outlines development of sleeve-valve engine and shows steady progress made with this type from its inception in 1908 to its present state.

Starting. Progress Report on Engine-Starting Tests. J. O. Eisinger. Soc. Automotive Engrs.—Jl., vol. 18, no. 2, Feb. 1926, pp. 147-152, 12 figs.

Steam Cooling. Cylinder-Temperature Control by Evaporation, A. G. Herreshoff. Soc. Automotive Engrs.—Jl., vol. 18, no. 2, Feb. 1925, pp. 153-159, 9 figs.

AUTOMOBILE FUELS

Equilibrium Boiling Points. Equilibrium Boiling Points, W. A. Whatmough. Indus. & Eng. Chem., vol. 18, no. 1, Jan. 1926, pp. 43-45, 2 figs. Equilibrium boiling points of motor fuels have been investigated by Barnard and Wilson, and, independently, by writer in connection with new system of dry-gas carburation, which involves boiling fuel before its admixture as dry gas with air.

Synthetic. Synthetic Motor Fuels—Has Europe Found the Formula? W. Ostwald. Automotive Industries, vol. 54, no. 3, Jan. 21, 1926, pp. 108-110. Author claims there is no longer any doubt as to chemists' ability to produce quality heat units from cheap materials and only question now is how it can be done to best advantage. Translated from Motorwagen.

AUTOMOBILES

Chassis Design. New Cars Reflect Tendency to Build Chassis Closer to Ground, H. Chase. Automotive Industries, vol. 54, no. 2, Jan. 14, 1926, pp. 54-57, 6 figs. Supplementary parts are fitted with greater care than formerly; centralized lubricating systems used on more models.

AVIATION

Aerial Navigation. Progress Necessary to Develop Aerial Navigation (Les Progrès Techniques sont nécessaires au développement de la Navigation Aérienne), E. Allard. Assn. des Ingenieurs sortis de l'Ecole Polytechnique de Bruxelles—Bul. Technique, vol. 21, no. 2, 1925, pp. 33-44, 5 figs. Records attained since Blériot crossed English Channel; problems of safety, economy, metals for airplanes, fuels.

Night Flying. Night Flying Experiments in Europe. Aviation, vol. 20, no. 6, Feb. 8, 1926, pp. 182-183, 1 fig. London-Paris airway lighted; experiments with neon lights and radio direction finding; fog difficulties.

B

BATTERIES

Standard Cells. Standard Electrical Cells, M. Eppley. Franklin Inst.—Jl., vol. 201, no. 1, Jan. 1926, pp. 17-46, 2 figs. Discusses cell made up of cadmium amalgam, solution of salt of cadmium, excess of salt of mercury to correspond to salt of cadmium and mercury; containers for standard cells; neutral solution and acid solution types, etc.

BEARINGS

Oil Film in. Charts for Studying the Oil Film in Bearings, Geo. B. Karelitz. Mech. Eng., vol. 48, no. 2, Feb. 1926, pp. 128-131, 5 figs. Presents charts which give designer or investigator a means of determining with sufficient accuracy the shape and pressures in oil film for bearings under different conditions.

BOILER FEEDWATER

Treatment. Fundamentals in the Conditioning of Boiler Waters, R. E. Hall. Engrs. Soc. of Western Penn.—Proc., vol. 41, no. 9, Dec. 1925, pp. 347-377, 14 figs. Relation of water softening to boiler-water conditioning; deposits resulting from evaporation or natural waters; mechanism of scale formation and means of obviating it; boiler-water sludges and steam-line deposits, control of suspended material and wet steam and non-condensible gases in steam.

Pure Feed Water, D. G. McNair. Power Engr., vol. 21, no. 238, Jan. 1926, pp. 23-25. Deaerators and their functions; evaporators; advantages of multiple effect; preheaters, coils and straight tubes.

BOILER FURNACES

Arches. Suspended Furnace Arches for Bagasse Furnaces. Int. Sugar Jl., vol. 27, no. 324, Dec. 1925, pp. 661-663, 2 figs. Discusses function of furnace arch, flat suspended arches, advantages of Liptak arches, their durability, etc.

Brown-Coal-Fired. Steam Raising Plant at Yallourn, Vic. Commonwealth Engr., vol. 13, no. 4, Nov. 2, 1925, pp 139-141, 3 figs. Details of John Thompson water-tube boilers fired with brown coal at power station of the Victorian Electricity Commission, each boiler guaranteed to evaporate 70,000 lb. of water per hour; test carried out with brown coal containing 48 per cent moisture showed maximum of 105,000 lb. per hour and efficiency of 77.3 per cent, stokers burning 98 lb. of coal per sq. ft. on grate area.

Combustion Control. Combustion Control System Reduces Labor. Blast Furnace & Steel Plant, vol. 14, no. 1, Jan. 1926, p. 47. Describes system which saved $4359.04 a year in wages, and also increased boiler efficiency appreciably.

European. Fuels and Furnaces in Europe, W. Trinks. Fuels & Furnaces, vol. 4, no. 1, Jan. 1926, pp. 19-30 and 36'22 figs. Developments noted by author on recent trip; high-temperature and low-temperature carbonization; liquefaction of coal; materials handling; heating furnaces; sheet furnaces; welding, atmosphere control, etc.

Oil-Fired. Systems for Burning Liquid Fuel. Southern Power Jl., vol. 44, no. 1, Jan, 1926, pp. 39-47, 18 figs. Design of coil burning furnaces, advantages and drawbacks of oil firing, circulation and heating of oil, types of oil burners, operating costs, etc.

Radiation in. Radiation in Boiler Furnaces, B.N. Broido. Mech. Eng., vol. 48, no. 2, Feb. 1926, pp. 133-137 and (discussion) 137-138, 4 figs.

Wall Design. Refractories for Boiler Furnace Walls, H. C. Thayer. Power Plant Eng., vol. 30, no. 4, Feb. 15, 1926, pp. 256-257, 4 figs. Designs of furnace walls which overcome difficulties due to expansion and contraction of firebrick under influence of temperature changes, etc.

BOILER OPERATION

Valve Control. Motor Control for Valves, C. J. Sittinger. Elec. World, vol. 87, no. 4, Jan. 23, 1926, pp. 201-202, 2 figs. Montaup Elec. Co. uses central control system for closing boiler valves at Somerset station; emergency system provided.

BOILER PLANTS

Fuel Measurement for Tests. Fuel Measurement for Boiler Tests, D. S. Frank. Power Plant Eng., vol. 30, no. 3, Feb. 1, 1926, pp. 200-201, 2 figs. Simple yet accurate apparatus for weighing coal or oil, constructed at small cost.

BOILER PLATE

Metallurgical Problems. The Metallurgical Aspects of Modern Boiler Practice, L. P. Sidney. Chem. Age (Lond.), vol. 14, no. 342, Jan. 2, 1926, pp. 2-3. Factors of problem; boiler pressures and temperatures; elasticity and viscous flow; determinations of flow; chromium and nickel in boiler plates.

BOILER TUBES

Failures. Why Boiler Tubes Burnt Out, Geo. C. Reinhard. Power, vol. 63, no. 2, Jan. 12, 1926, pp. 51-53, 3 figs. Removal of scale resulted in tube failure; scientific study made of conditions; trouble due to sulphur in oil.

BOILERS

Electrically Heated. Central Heating Plant by Means of Electric Boilers of Lyons Gas Co. (L'installation de chauffage central par chaudières électriques de la Compagnie du Gas de Lyon), D'Aubenton-Carafa. Electricien, vol. 56, no. 1384, Nov. 15, 1925, pp. 512-514, 4 figs. Design and operation of boilers heated by current during low load (mainly night time) calculated to maintain a temperature of +18 deg. cent. for 10½ hours per day with outside temperature at —10 deg. cent.; steam accumulators of 30 cu. m., one each boiler; pipe lines of 1600 m.

Fuel-Waste Estimation. Insufficient Data for Estimating Fuel Waste, H. D. Fisher. Power Plant Eng., vol. 30, no. 3, Feb. 1, 1926, pp. 218-220. Points out that fuel-gas temperature, soot on tubes and carbon in ash are entirely overlooked by F. C. DeWeese in his investigation of a poorly run boiler plant, described in Nov. 15, 1925, issue of same journal.

Internal-Combustion. The Internal-Combustion Boiler, O. Brunler. Inst. Mar. Engrs.—advance paper for mtg. Nov. 24, 1925, 6 pp., 5 figs. Details of internal-combustion boiler, principle of which is to maintain flame burning in water in order to produce steam; application to generator which can produce 11,000 lb. of steam-gas mixture per hour.

Locomotive. *See Locomotive Boilers.*

Water-Tube. *See Boilers, Water-Tube.*

BOILERS, WATER-TUBE

Oil-Fired. Handling Oil-Fired Water-Tube Boilers, Geo. H. Briggs. Power, vol. 63, no. 4, Jan. 26, 1926, pp. 130-131. Problems encountered; proper air regulation; damper control.

BOLTS

Manufacturing and Stocking. Manufacturing and Stocking Bolts in the Shop, E. Kennedy. Ry. Mech. Engr., vol. 100, no. 1, Jan. 1926, pp. 56-57, 2 figs. Notes on establishing a system for manufacturing and stocking of finished bolts.

BOREHOLES

Surveying. A New Instrument for Surveying Boreholes, J. S. Owens. Instn. Min. & Metallurgy—Bul., no. 256, Jan. 1926, pp. 1-18, 20 figs. Describes new instrument for surveying boreholes consisting of external water-tight casing which protects internal mechanism from injury; the latter is opened in two carrier tubes connected mechanically and electrically by means of bayonet joint which permits them to be withdrawn for adjustment, setting and charging; in one carrier tube clinometer and compass bowl are free to rotate on axis at right angles to the cradle pivot other carrier tube contains mechanism controlling consecutive exposures.

BRASS

Heat Treatment. Annealing, Tempering and Drawing of Some Industrial Nickel-Brasses (Le recuit, la trempe et le revenu de quelques laitons au nickel industriels), F. M. Ostroga. Revue de Métallurgie, vol. 22, no. 12, Dec. 1925, pp. 776-786, 16 figs. Concludes that it is always possible to secure hardening corresponding to annealed state of metal by means of tempering with or without drawing; hardness is the more pronounced the finer the new microstructure.

Ingot Production. The Production of Sound Brass and Copper Ingots. Metal Industry (Lond.), vol. 28, no. 1, Jan. 1, 1926, pp. 3-7. General discussion of practical problems at meeting of Birmingham and West Midlands Section of Inst. of Metals, dealing with mold dressings, mold materials, pouring temperatures and speeds, cooling rates, feeding, casting and melting equipment, manual skill, etc.; comparisons of British, European Continental and American practice.

Melting and Pouring. Melting and Pouring of Brass and Bronze, T. J. Bamford. Foundry Trade Jl., vol. 33, no. 493, Jan. 28, 1926, pp. 76-78. Utilization of scrap metal; aluminum as an impurity; using turnings and borings; melting furnaces. Includes discussion and author's reply.

BRASS FOUNDRIES

Tumblers for Castings. Tumblers for Brass Castings. Foundry Trade Jl., vol. 32, no. 488, Dec. 24, 1925, p. 256. Discusses use of tumbling barrel as cleansing factor; tumbling consists of filling or partially filling barrels with castings, cleansing material and sometimes liquid; shapes and materials employed in making tumblers; loading tumblers.

BRIDGE PIERS

Underpinning. High-Level Bridge, Newcastle-upon-Tyne: Underpinning and Repair of Foundations of River Piers, C. F. Bengough. Engineering, vol. 121, no. 3132, Jan. 8, 1926, pp. 43-44. Methods employed in underpinning foundations with concrete; excavation was carried out through shafts; concrete used in underpinning was 1:2:4 mixture. (Abstract.) Paper read before Instn. Civ. Engrs.

BRIDGES, CONCRETE

Arch. Bridge Reconstruction Work of the Ministry of Transport. Engineering, vol. 121, no.3136, Feb. 5, 1926, p. 157, 4 figs. partly on p. 172. Reconstruction of Muskham bridge over River Trent; new bridge consists of two skew arches, each of 100-ft. span over river, and two 25-ft. shore spans, which serve as flood openings; these are constructed as reinforced concrete girders.

Continuous Girder. Reinforced Concrete Continuous Girder Bridge Built in China. Eng. News-Rec., vol. 96, no. 4, Jan. 28, 1926, p. 149, 2 figs. Details of 11-span highway bridge, 616-ft. long at Shin Tai Hsien.

Floor Slabs. Wearing Surfaces for Concrete Bridge Floor Slabs, E. F. Kelley. Eng. News-Rec., vol. 96, no. 1, Jan. 7, 1926, pp. 26-27. Renewable surface desirable on reinforced concrete floors as protection from injury by tire chains.

BRIDGES HIGHWAY

Concrete. The Construction of the New Oswald-street Bridge, Glasgow, W. L. Scott. Engineer, vol. 141, no. 3655, Jan. 15, 1926, pp. 62-63, 7 figs. Deals with erection of structure, particularly construction of river and abutment piers and their foundations; supports for river pier, and abutment lintol beams, consist of circular reinforced concrete caissons.

Construction 1925. Highway Bridge Construction Activity in 1925. Eng. News-Rec., vol. 46, nos. 2 and 3, Jan. 14 and 21, 1926, pp. 79-83 and 122-124, 26 figs. Summary of state highway bridge construction by regions and states based on incomplete reports from several highway departments.

Impact Studies. Experimental Impact Studies on Highway Bridges, A. H. Fuller and R. A. Caughey. Iowa State College Agriculture & Mech. Arts—Official Pub., vol. 24, no. 30, Dec. 23, 1925, 61 pp., 45 figs. Details of 1925 work of co-operative project by U. S. Bureau of Public Roads, Iowa State Highway Commission and Engineering Experiment Station of Iowa State College to investigate the effect of impact; covers determination of observed stresses due to certain static and dynamic loads in steel floor systems and in some cases of truss members of five steel bridges with concrete floor slabs and seven steel bridges with plank flooring.

Loading. British Standard Unit Loading for Highway Bridges, J. M. Liddell. Engineer, vol. 141, no. 3657, Jan. 29, 1926, pp. 119-121, 12 figs. Explanation of charts. Description of unit loading; maximum stresses in plate girders and in framed girders; maximum pier reactions.

Melbourne, Victoria. Premium Design for Bridge over River Yarra, Melbourne. Civil Eng. Rec., vol. 2, no. 6, Dec. 15, 1925, pp. 196-200, 1 fig. Details of bridge 320-ft. long between inside faces of abutments on roadway of 75-ft. clear between kerbs and two 12-ft. sidewalks, with clear headway of 11-ft. above low water; competitive designs for Victorian Public Works Department.

BRIDGES, RAILWAY

Steel. Building Four-Track Steel Bridge Over Newark Bay: Two Types of Foundation. Eng. News-Rec., vol. 96, no. 5, Feb. 4, 1926, pp. 184-189, 7 figs. Bridge over Newark Bay built by Central Railroad of New Jersey, having high-level crossing of girder spans with two vertical lifts, replacing present low-level trestle with bascules; details of floating cofferdam and pneumatic piers.

Central of New Jersey Builds Remarkable Bridge. Ry. Age, vol. 80, no. 3, Jan. 16, 1926, pp. 217-222, 8 figs. Four-track structure across Newark Bay contains a mile of long girder spans and 4 double-track lift spans.

BUILDING CONSTRUCTION

FIREPROOF. Fire-Proofing the Bronx Terminal Market Building, F. W. Skinner. Brooklyn Engrs. Club—Proc., vol. 24, Oct., 1925, pp. 17-35, 13 figs. Construction equipment, methods, and operations for encasing exposed steel surfaces of floor beams, girders and trusses, with reinforced gunite; storing, conveying and mixing sand and cement for 12,000 cu. yd. of gunite; application of gunite, cement guns, etc.

BUSBARS

60-CYCLE FOR HEAVY CURRENTS. Carrying Capacity of 60-Cycle Busses for Heavy Currents, T. G. Le Clair. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 1, Jan. 1926, pp. 9-14, 9 figs. Paper is presented with idea of giving ready reference for determining bus-capacities without involved calculations; curves are given showing carrying capacity of a few types which are proposed as standards, and, in addition, a few curves compiled from tests showing distribution of current in busses to show necessity of this type of design; by a little careful study of these curves, average designer may quickly choose type of bus which will best meet his requirements for carrying capacity and allowable space.

C

CABLES, ELECTRIC

HIGH-TENSION. Dielectric Problems in High-Voltage Cables, P. Dunsheath. Instn. Elec. Engrs.—Jl., vol. 64, no. 349, Jan. 1926, pp. 97-125 and (discussion) 125-149, 63 figs. Deals with important problems of particular theoretical and practical interest at present time in connection with design, manufacture, and operation of high-voltage impregnated-paper cables; dielectric absorption; fundamentals of a.c. losses; "V" curve for loss and power factor; connection between a.c. and d.c. losses; rise of power factor with voltage; breakdown; assessment of cable quality; absorption calculations. Bibliography.

Testing High-Voltage Cables with D.C. After Installation, N. A. Allen. Elec. Communication, vol. 4, no. 3, Jan. 1926, pp. 184-195, 13 figs. Methods of producing high tension d.c., operation of Kenotron rectifier testing set, fault location, etc.; two-valve Kenotron can be used very efficiently for applying d.c. integrity tests to cables after installations, Kenotron outfit can be utilized for burning out faults sufficiently to permit making accurate localization tests. Bibliography.

IMPREGNATING. Methods of Impregnating Cables, H. W. Fisher. Elec. World, vol. 87, no. 4, Jan. 23, 1926, pp. 195-196, 4 figs. New developments in impregnation of high-voltage cable; advantages and disadvantages of practices used; newest scheme offers great possibilities.

CABLEWAYS

FUNICULAR. The Aiguille du Midi Funicular Aerial Line (Le funiculaire aérien de l'Aiguille du Midi), A. Bourgain. Nature (Paris), no. 2697, Dec. 12, 1925, pp. 373-380, 12 figs. Layout and constructon of line from Pèlerins to Paraz and finally to Midi (near Mount Blanc, Switzerland), of 3842-m. altitude, of which the first section has recently been opened to traffic; three-cable system; cars equipped with electric motors of 55 to 70 kw.

CAR COUPLERS

AUTOMATIC. Japanese Railways Adopt Automatic Couplers, S. Akiyama. Ry. Mech. Engr., vol. 100, no. 1, Jan. 1926, pp. 30-34, 6 figs. Final work of changing from screw and link type to automatic is completed in one day.

Vienna Tests New Coupler. Elec. Traction, vol. 22, no. 1, Jan. 1926, pp. 31-32, 4 figs. New system of automatic train and current coupling being tested in Vienna, Austria.

CAST IRON

ANALYSIS. The Rapid Determination of Structural or Constitutional Analysis, J. E. Fletcher and J. G. Pearce. Brit. Cast Iron Research Assn.—Bul. no. 11, Jan. 1926, pp. 17-20, 6 figs.

DIESEL-ENGINE. Cast Iron for Diesel Engines, A. Campion. North-East Coast Instn. Engrs. & Shipbldrs.—advance paper, for mtg. Jan. 22, 1926, pp. 201-216, 10 figs.

FACTORS AND PROBLEMS. Some Factors which Constitute Problems in the Iron Foundry, S. G. Smith. Foundry Trade Jl., vol. 33, no. 492, Jan. 21, 1926, p. 42. Stresses importance of freezing phenomena, volume changes, solid contraction, etc.; distortion is direct result of contraction; examples of effect of mass on shrinkage; importance of correct sand control and of adequate liquid metal in risers to accomplish proper feeding. (Abstract.)

GRAPHITE IN. Graphite in Pig and Cast Iron. Metal Industry (Lond.), vol. 28, no. 2, Jan. 8, 1926, pp. 39-40, 1 fig. Discusses importance of effect on graphite of temperature to which iron is raised during smelting and remelting; refers to some of principal researches on subject, more particularly recent work of Piwowarski; importance of subject in connection with suggested reforms of pig-iron grading.

GRAY, LIQUID SHRINKAGE OF. Liquid Shrinkage in Grey Iron, J. Longden. Foundry Trade Jl., vol. 33, no. 494, Feb. 4, 1926, pp. 85-92, 17 figs. Existing theories; defects due to what is known as Leonard effect; influence of dissolved gases; experimental data; influence of temperature on castings; graphite in molten cast iron; influence of length of cooling range; influence of slow pouring; filtering cast iron; rod feeding; chills and denseners; feeding heads.

GRAY, STRUCTURE OF. Compares Gray Iron Structure, Wm. Campbell. Foundry, vol. 54, no. 4, Feb. 15, 1926, pp. 148-149, 5 figs. Comparison between structure of gray iron cast in sand molds and cast-iron permanent molds cooled by oil. Abstract of report.

PEARLITIC. Pearlitic Cast Iron (La fonte perlitique), B. Buffet and A. Roeder. Société Industrielle de Mulhouse—Bul., vol. 91, no. 9, Nov. 1925, pp. 622-634, 14 figs. Discusses qualities of good gray iron, machinable cast iron, pearlitic and steeled cast iron, graphitization, testing and uses.

SUPERHEATING. The Superheating of Cast Iron. Metallurgist (Supp. to Engineer, vol. 141, no. 3657), Jan. 29, 1926, pp. 15-16, 1 fig. Review of two papers by Piwowarski, published in Stahl u. Eisen, Aug. 27 and Dec. 3, 1925.

CASTINGS

ECONOMICAL PRODUCTION. Cutting Down Waste on Castings, A. A. Wood. Iron Age, vol. 117, no. 7, Feb. 18, 1926, pp. 487-488, 2 figs. Reducing amount of metal and thus minimizing machining operations successfully practised in many plants; in author's belief, excess finish is economic waste; large savings in plant of Warren Webster & Co., Camden, N. J., in cutting down patterns. (Abstract.) Paper read before Philadelphia Foundrymen's Assn.

MACHINES FOR HOLLOW. Casting Machines for Production of Hollow Castings such as Tubes, (Machine à couler pour la fabrication de pièces de fonte à noyaux, telles que les tubes, etc.) Métallurgie et Construction Mécanique, nos. 50 and 51, Dec. 10 and 17, 1925, pp. 1675-1679 and 1715-1719, 13 figs. Details of machine in which formation of mold and core and their assembling is carried out automatically; machine after producing the core places it accurately in the mold produced simultaneously.

CEMENT, PORTLAND

PROGRESS. Twenty-one Years' Progress in the Portland Cement Industry, A. C. Davis. Concrete & Constructional Eng., vol. 21, no. 1, Jan. 1926, pp. 69-77, 6 figs. Discusses progress in manufacture, improvements in quality, increase in fineness and strength, rapid-hardening, aluminous cement, testing, etc.

CENTRAL STATIONS

BUDGETING OPERATION. Budgeting Central-Station Operation, H. P. Liversidge. Elec. World, vol. 87, no. 4, Jan. 23, 1926, pp. 189-191, 1 fig. Points out that budgets help keep balance among three dominating factors, engineering, financing and commercial activities; outlines their scope; details of their formulation and operation; measurement of success.

CONTROL BOARDS. Power Station Control Boards, E. Zeuthen. Elec. Jl., vol. 23, no. 1, Jan. 1926, pp. 4-9, 7 figs. Details of advance in design for Toronto power station and Boardman substation of Ohio River Edison Co.; making switching practically fool-proof by suitable interlocking, facilitating real supervision by limiting panel equipment to essential instruments, segregating switchboards, etc.

CHAIN DRIVE

SILENT. Silent Chain Drives on Industrial Equipment, F. E. Gooding. Indus. Engr., vol. 84, no. 1, Jan. 1926, pp. 8-12, 8 figs. Discusses application in driving compressors, blowers and fans, conveyors, pulverizers, etc.

CITIES

ENGINEERING IN. Engineering in the Small City, A Survey. Eng. News-Rec., vol. 96, no. 2, Jan. 14, 1926, pp. 76-78. Suggested improvements in administration of engineering services in the city under 100,000 population, based on editorial study from coast to coast.

CLAY

BENTONITE. The Minerals of Bentonite and Related Clays and Their Physical Properties, C. S. Ross and E. V. Shannon. Am. Ceramic Soc.—Jl., vol. 9, no. 2, Feb. 1926, pp. 77-96, 2 figs. Occurrence and structure, mineralogy and chemical composition, optical properties.

COAL

ASH. Coal Ash and Clean Coal, R. Lessing. Royal Soc. of Arts—Jl., vol. 74, nos. 3817 and 3818, Jan. 15 and 22, 1926, pp. 182-197 and 205-218, 13 figs. Reviews treatment of coal at collieries, showing that every step in operations is closely bound up with problems for solution of which a knowledge of its mineral constituents and chemical and physical properties is indispensable; distribution of mineral matter in coal, chemical method of coal getting, clearing and washing process, sampling, etc.

CARBONIZATION. The Case for Low Temperature Carbonization in America Today, H. W. Brooks. Combustion, vol. 14, no. 1, Jan. 1926, pp. 46-54, 3 figs. Compares American and European conditions, concludes that lower temperature carbonization lends itself better to dividend-paying possibilities in America than by-product coke oven methods on account of lower operating and investment costs, higher oil and richer gas yields, and production of finely divided easily ignitable coke, etc.

HEATING VALUE. A Simple Method for Determining Heating Value of Solid Fuels (Einige einfache Verfahren zur Bestimmung der Heizwertes fester Brennstoffe), H. Winkelmann. Brennstoff- u. Wärmewirtschaft, vol. 7, no. 24, Dec. 2, 1925, pp. 477-482. Method of taking samples approved by V. D. I. (Assn. of German Engrs.) and others; determining water content and ash content; describes von Jüptner process of calculation in which one gram of finely pulverized fuel is put into a platinum crucible and after determining moisture content, is heated until no more combustible gases escape.

PULVERIZED. *See Pulverized Coal.*

SEMI-COKING. Low-Temperature Semi-Coking Benefits Coal, R. D. Hall. Coal Age, vol. 29, no. 3, Jan. 21, 1926, pp. 112-114, 1 fig. Toledo plant manufactures amalgam; Rhode Island field prepares to produce carbonized product; charring coal dust in suspension is new venture.

COAL HANDLING

PAPER MILLS. Coal Handling and Boiler Operation at Northern Paper Mills, H. W. Gochnauer. Mfg. Industries (Mgmt. & Admin.), vol. 11, no. 1, Jan. 1926, pp. 23-24, 5 figs. Methods and equipment employed.

COKE MANUFACTURE

METHODS. The Manufacture of Coke of the Most Suitable Qualities for Domestic and Industrial Purposes, W. W. Townsend. Gas Jl., vol. 173, no. 3269, Jan. 6, 1926, p. 31. Selection of coals, washing at colliery or gas-works, blending, retorting and quenching in thin layers.

COLD STORAGE

PLANTS. Modern Warehouse of Terminal Refrigerating & Warehousing Co. Ice & Refrigeration, vol. 70, no. 1, Jan. 1926, pp. 118-122, 12 figs. Describes combined cold-storage and ice-making plant: details of structural features; insulation; refrigerating system, etc.

COLUMNS

CRITICAL LOAD. The Theory of Columns, Jas. J. Guest. Engineering, vol. 121, no. 3136, Feb. 5, 1926, p. 186, 2 figs. Author describes method by which he obtains Eulerian critical load.

CONCRETE

FIELD, STRENGTH OF. Effect of Manipulation on Strength of Field Concrete, G. W. Hutchinson. Eng. News-Rec., vol. 96, no. 6, Feb. 11, 1926, pp. 246-247, 1 fig. Tests show that concrete of constant visible quality varies according to amount of work given placing.

READY MIXED. Ready Mixed Concrete Easily Sold in Birmingham, Ala., W. E. Barker. Eng. News-Rec., vol. 96, no. 7, Feb. 18, 1926, pp. 282-283, 3 figs. Mechanical features, testing and inspection, and business methods of plant selling concrete that utilizes blast furnace slag for aggregate.

RESEARCH. Researches in Concrete, W. K. Hatt. Purdue Univ. Eng. Dept.—Bul., vol. 9, no. 11, Nov. 1925, 102 pp., 30 figs. Survey of research work on occasion of the 100th anniversary of invention of Portland cement, comprising expansion and contraction, strength of dry and wet hardened concrete, extensibility, elasticity, plastic flow, permeability, fatigue, heat transmission, fire resistance of concrete, non-rusting of steel, reinforcing steel and bond, effect of age, amount of mixing water, time of mixing, field and laboratory tests. Bibliography.

WATER PERMEABILITY AND ABSORPTION. Relation between Water Permeability and Water Absorption of Concrete, E. Anderson. Indus. & Eng. Chem., vol. 18, no. 1, Jan. 1926, pp. 17-18, 1 fig. Describes water-absorption and water-permeability tests for concrete; results of experiments indicate that there is, in general, no direct relation between per cent water absorption of cement mortar specimen and its water permeability or water tightness; recommends that for determination of water permeability of concrete some method be employed which directly measures this property.

CONCRETE BLOCKS

TESTING. A Method of Testing Concrete Blocks, H. G. Lloyd. Structural Engr., vol. 4, no. 1, Jan. 1926, pp. 3-14, and discussion 15-16, 2 figs. Discusses consistency of portland cement and method of determination; ingredients used in concrete, grading, percentage of water, method of preparation of blocks, crushing tests and crushing strength, comparison of weight and strength, etc.

CONCRETE CONSTRUCTION, REINFORCED

DESIGN. Reinforced Concrete in Relation to Present-Day Design, A. E. Richardson. Concrete & Constr. Eng., vol. 21, no. 1, Jan. 1926, pp. 37-46, 7 figs. Discusses necessity for co-operation between architect and engineer; traditional methods and materials; development of steel and concrete, possibilities of reinforced concrete; and gives various examples.

CONCRETING

COLD-WEATHER. Aids to Cold-Weather Concreting, H. L. Mahaffy. Contract Rec., vol. 40, no. 5, Feb. 3, 1926, pp. 88-89, 1 fig. Details of convenient method of determining temperatures of concrete in place.
Winter Concrete Must Be Kept Warm, A. M. Bouillon. Ry. Eng. & Maintenance, vol. 22, no. 1, Jan. 1926, pp. 10-13, 5 figs. Heating of aggregates and water should be followed up with precautions against freezing in forms.

CONDUITS

INSTALLATION AND USES. The Installation and Uses of Conduit, J. E. Housley. Power, vol. 63, no. 2, Jan. 12, 1926, pp. 58-59, 1 fig. Discusses kinds and types of conduit, roughly divided into rigid and flexible classes; methods of installation.

CONVERTERS

SYNCHRONOUS. Synchronous Converters and Synchronous Motor-generator Sets Compared for Industrial Service, W. B. Snyder. Gen. Elec. Rev., vol. 29, no. 2, Feb. 1926, pp. 115-117, 3 figs. A balanced analysis of inherent characteristics of both sources of direct-current power, to enable proper selection; discusses first cost and efficiency, power-factor, power contract, power supply, direct-current load, etc.

CORROSION

PROBLEMS. Meeting of German Corrosion Committee. Metal Industry (Lond.), vol. 28, no. 3, Jan. 15, 1926, pp. 53-55 and 66. Summarized translations of papers presented at meeting of German Official Committee for Metal Protection (Reichsausschuss für Metallschutz), as follows: Tin Plating and Lead Plating, M. Schlötter; Determination of Quality of Zinc Coatings, H. Bablik; Influence of Thermal and Mechanical Treatments upon Resistance of Aluminum to Corrosion, W. Wiederholt; Corrosion of Condenser Tubes, E. Goos; Cathodic Polarization of Metals, E. Liebreich.

COUPLINGS

SHAFTING AND MACHINES, CONNECTING. Types of Couplings for Connecting Shafting and Machines, S. Rice. Belting, vol. 28, no. 1, Jan. 1926, pp. 29-30. Discusses flange, sleeve, clamp, compression, cut-off and flexible coupling, general construction and service to which each is adapted.

CRANES

ELECTRIC DERRICK. Electric Derrick Crane. Engineering, vol. 121, no. 3136, Feb. 5, 1926, pp. 108-109, 6 figs. Crane of level-luffing type made by Anderson-Grice Co., Carnoustie, Scotland.

FULL-ARCH. Cranes Increase Pier Capacity over 300 Per cent. Eng. News-Rec., vol. 96, no. 3, Jan. 21, 1926, pp. 118-119, 2 figs. Full-arch cranes of 10 to 20-ton capacity built for New York Central Railroad at Weehawken, N. J., to handle boxed automobiles for export.

JIB DESIGN. Notes on the Design of Crane Jibs, F. G. Fiegehen. Mech. World, vol. 79, no. 2037, Jan. 15, 1926, pp. 48-50, 4 figs. Detailed discussion of design.

CRUSHERS

GYRATORY. The Development of the Gyratory Crusher, H. W. Weimer. Rock Products, vol. 29, no. 2, Jan. 23, 1926, pp. 38-41, 5 figs. Discusses rock crushing machinery, use and applications, size of crushers, capacity, power requirements, erecting and operating.

CUPOLAS

AIR-BLAST CONVEYANCE TO. The Conveyance of Air-Blast to Cupolas and Forced-draught Furnaces, W. J. May. Mech. World, vol. 79, no. 2036, Jan. 8, 1926, pp. 28-29, 6 figs. Discusses air propelling and distributing.

CUTTING METALS

OXYGEN LANCE. Cutting Salamanders and Heavy Masses of Iron with an Oxygen Lance, E. E. Thum. Blast Furnace & Steel Plant, vol. 14, no. 1, Jan. 1926, pp. 18-20, 1 fig. Outlines methods whereby large masses or blocks of iron or steel may be cut to handling size; oxygen lance consists essentially of steel pipe, passing a stream of pure oxygen; operation of lance; application to drilling of salamanders, breaking up spills and ladle skulls, and cutting ingots and heavy metal masses.

CUTTING TOOLS

LUBRICATION AND COOLING. Cutting, Grinding and Rust Prevention, J. A. Maguire. Can. Machy., vol. 35, no. 1, Jan. 7, 1926, pp. 26-27. New method of holding oil in a cutting emulsion in suspension with water, thus avoiding rust, keeping point of tool cooler, and lengthening its life.

STARTING. Starting Cutting Tools, F. Horner. Can. Machy., vol. 35, no. 4, Jan. 28, 1926, pp. 13-16, 8 figs. Devices used to insure accuracy and prevent damage;; special starting tools; eccentric cuts; use of loose bushings, etc.

D

DAMS

CONCRETE. Bulding America's Largest Dam, W. B. West. Sibley Jl. Eng., vol. 39, no. 9, Dec., 1925, pp. 419-422 and 428-429, 5 figs. Details of Wilson dam, largest concrete dam for hydro-electric development in U.S.A., containing 1,000,000 cu. yds. of concrete; data on electric equipment of Muscle Shoals Nitrate plant.

EARTH-FILL. Construction Methods on Alouette Dam. Contract Rec., vol. 40, no. 3, Jan. 20, 1926, pp. 46-49, 7 figs. Details of plant and procedure in building an earth-fill dam, 1000 ft. long and 63 ft. high, which forms a storage reservoir for the Alouette power development in British Columbia.

FAILURES. Failure of Dam in Wales Due to Washout Under Foundation. Eng. News-Rec., vol. 96, no. 1, Jan. 7, 1926, pp. 12-13, 5 figs. Concrete footings not carried to depth required by plans; poor concrete; lack of engineering supervision.

WATER PRESSURES. Tests of Water Pressures Under Brule River Dam. Eng. News-Rec., vol. 96, no. 7, Feb. 18, 1926, pp. 274-275, 4 figs. Dam of Peninsular Power Co., near Florence, Wis., has pipes from foundation to downstream face, fine cracks in bedrock prove practically watertight.

DIE CASTING

DEVELOPMENTS. Diecasting Industry Makes Progress, J. S. Gullborg. Foundry, vol. 54, no. 2, Jan. 15, 1926, pp. 48-49. Material used in early days of industry: use of stronger and more ductile material as industry grew larger; modern machines; proper filling and ventilating of dies. (Abstract.) Address before Chicago Foundrymen's Club.

DIES

CONSTRUCTION OF. Construction of Sheet Metal Tools, C. E. Stevens. Forging—Stamping—Heat Treating, vol. 12, no. 1, Jan. 1926, pp. 18-25, 10 figs. Details of die construction.

DIESEL ENGINES

GENERATOR DRIVE. Flywheel-Type Generators for Oil Engines. Oil Engine Power, vol. 4, no. 2, Feb. 1926, pp. 76-79, 8 figs. Rotor of generator supplants flywheel, reduces generator and overall cost, saves outboard bearings.

INDUSTRIAL USE. Industrial Use of the Diesel Engine, M. Rotter. Power Plant Eng., vol. 30, no. 4, Feb. 15, 1926, pp. 263-264. Consideration of Diesel installations involves efficiency, cost of fuel and lubrication, maintenance and fixed charges.

DIRECTION FINDING

EXPERIMENTAL RESULTS. Radio Direction Finding. Aviation, vol. 20, no. 4, Jan. 25, 1926, pp. 109-110. Results of experimental work reported by E. Sibley, Superintendent of Radio Air Mail Service.

DREDGES

HYDRAULIC. High Power Hydraulic Dredge for General Contracting, J. M. Allen. Eng. News-Rec., vol. 96, no. 5, Feb. 4, 1926, pp. 196-197, 1 fig. Speed-up gear gives high runner velocity with slow speed engine; frame barge gives mobile discharge.

DURALUMIN

HEAT TREATMENT. The Effect of Heat Treatment on Some Mechanical Properties and on the Microstructure of Duralumin Sheet, Rob. J. Anderson. Am. Metal Market, vol. 33, no. 12, Jan. 19, 1926, pp. 4-6 and 16. Brief abstract of results of extensive investigation on constitution, heat treatment and microstructure of duralumin, Thesis presented to Mass. Inst. Technology.

E

EDUCATION ENGINEERING

ELECTRICAL. Report of Conference of Teachers of Electrical Engineering, Held at Schenectady, N.Y., June, 17, 1925, L. A. Hawkins. Eng. Education—Jl., vol. 16, no. 5, Jan. 1926, pp. 378-388. Discusses research as an aid in teaching.

ELECTRIC CONDUCTORS

SINGLE. Properties of the Single Conductor—New Fundamental Relations, C. Hering. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 1, Jan. 1926, pp. 31-39, 7 figs. In opinion of writer, proofs, deductions, and discussion herein presented, will show that new system of treatment of electrical problems can be based on single-straight conductor, as distinguished from that based on Maxwell complete circuit; not to replace latter system but to supplement it, and to test correctness of parts of it; single-conductor system leads to some new and useful results, and shows that term self-inductance has been used in dual sense and that distinction should be made analogous to that between resistance and reactance.

ELECTRIC CURRENTS, ALTERNATING

ANALYSIS. Alternating Current Analysis, R. D. Mershon. Am. Inst. Elec. Engrs.—Jl., vol. 1, Jan. 1926, pp. 43-45, 4 figs. Analytical method of solving a.c. problems, requiring simple algebra only.

ELECTRIC FURNACES

AUXILIARIES. Auxiliary Equipment for Electric Furnaces, J. D. Keller. Fuels & Furnaces, vol. 4, no. 1, Jan. 1926, pp. 49-56, 17 figs. Discusses wiring diagrams, control and safety switches, relays and fuses, for resistor-type furnaces.

BRASS-MELTING. Melting Brass by Electricity. Elec. News, vol. 34, no. 2, Jan. 15, 1926, p. 25, 1 fig. National Bronze Co., Montreal, install 175-kva. electric furnace; excellent central-station load; one of few used for this purpose in Canada.

HARDENING. Magnetic Indicator is Designed to Control Hardening Furnace Temperatures. Automotive Industries, vol. 54, no. 3, Jan. 21, 1926, pp. 104-105, 3 figs. Describes Wild-Barfield automatic hardening furnace manufactured in London, Eng., equipment consists of electrically heated furnace and control panel electrically connected thereto; latter consists of magnetic indicator which produces musical sound until steel ceases to be magnetic, which is considered correct temperature for quenching.

HEAT BALANCE OF. Balance of Electric Furnaces (Le bilan des fours électriques), A. Levasseur. Société Française des Electriciens—Bul., vol. 5, no. 48, Aug. 1925, pp. 738-771, 13 figs. Electric, calorific and electrothermal efficiency; consumption of electrodes; induction, resistance and arc furnaces; power factors; advocates more rational study of furnaces and abandonment of mere empiricism.

HEAT-TREATING GEARS. Gears Heat Treated Electrically. Iron Age, vol. 117, no. 6, Feb. 11, 1926, pp. 401-402, 2 figs. Normalizing and hardening in automatic furnaces; compensating action of heat and large savings are features.

HIGH-TEMPERATURE. High Frequency Electric Induction Furnaces for very High Temperatures (Fours électriques à induction à haute fréquence pour très hautes températures), Ribaud. Jl. de Physique & Radium, vol. 6, no. 9, Sept. 1925, pp. 294-299, 5 figs. Describes two models of furnaces which may be used up to 3000 deg. cent., with linings of porous charcoal of very low heat conductivity; may be used for burning or melting refractories, and for reactions in a gaseous atmosphere, etc.; provided with optical pyrometers.

OSCILLATING. The Oscillating Electric Furnace, Nolly System (Four Electrique oscillant, système de Nolly). Jl. du Four Electrique, vol. 34, no. 17, Dec. 1, 1925, pp. 230-232, 2 figs. Furnace used by Société Métallurgique de St-Béron, for melting reduction and refining, a combination of several electrodes replacing usual silica arch; cooled by circulating water; advantages, etc.

ELECTRIC LOCOMOTIVES

SAFETY DEVICE FOR. Safety Device for Electric Locomotives. Elecn., vol. 96, no. 2488, Jan. 22, 1926, pp. 88-89, 3 figs. New device used by Rhaetian Railways in Switzerland, developed by Brown Boveri, which operates only when locomotive is in motion, and if then only after it has covered a certain distance which can be regulated as desired; action of device commences after driver releases his hold of push button.

ELECTRIC MOTORS

CONTROLLERS. Tendencies in Electric-Motor Control Installations, J. E. Housley. Power, vol. 63, no. 4, Jan. 26, 1926, pp. 134-135, 4 figs. Attention is called to practices that should be avoided in controller installations and examples are given of methods for mounting motor-control apparatus that makes foi flexibility and safety in operation and maintenance.

ELECTRIC MOTORS, A. C.

INDUCTION. Polyphase Induction Motors with Double Squirrel-Cage Windings, C. W. Kincaid and D. F. Alexander. Elec. Jl., vol. no. 1, Jan. 1926, pp. 15-19, 10 figs. Discusses high starting-torque and short time running, low starting torque and continuous running and high starting torque and continuous running at full load; characteristics of rotor windings, etc.

Synchronous. Effects of Changing the Load on a Synchronous Motor. J. M. Cunningham. Power, vol. 63, no. 3, Jan. 19, 1926, pp. 99-102, 5 figs. Discusses effect on power factor of power system when load on synchronous motor is varied, and at what load on motor will corrective effect on system's power factor be greatest.

ELECTRIC MOTORS, D. C.

Band Losses. Motor Band Losses, T. Spooner. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 1, Jan. 1926, pp. 14-17, 3 figs. Shows that motor-band losses are of appreciable magnitude, sometimes sufficiently large to be detrimental to cooling of machine; losses are shown to be due chiefly to change in radial component of flux as band passes by pole tip; for average bands, about 15 per cent of losses (hysteresis and eddy) are due to tangential flux in bands; shows typical set of curves for calculating hand losses.

Types. Characteristics of Direct-Current Motors, R. W. Owens. Elec. Jl., vol. 23, no. 1, Jan. 1926, pp. 37-43, 10 figs. General d.c. motor with bracket type bearings, crane type motor and mill type motor; enclosed intermittent ratings, windings, speed adjustment, etc.

ELECTRIC RAILWAYS

Equipment. Developments in Electric Equipment in 1925, W. D. Bearce. Ry. Rev., vol. 78, no. 1, Jan. 2, 1926, pp. 63-65, 5 figs. Railroads augment existing facilities by additions of many new cars and locomotives; oil-electric locomotives; steam-road electrification; city and suburban systems; gas-electric buses; automatic railway substations.

ELECTRIC TRANSMISSION LINES

Over-Compounded Voltages. Transmission Systems with Over-Compounded Voltages, H. B. Dwight. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 1, Jan. 1926, pp. 25-30, 2 figs. Gives methods of calculating transmission line with transformers, first with over-compounded generator voltage and constant receiver voltage, in which case diagram is a circle, and second, with over-compounded voltage at both generator and receiver, in which case diagram is an ellipse; discusses advantages and limitations of using over-compounded voltage.

Towers. Towers, H. S. Brubaker. Elec. Light & Power, vol. 4, no. 2, Feb. 1926, pp. 25-27, 14 figs. Unusual designs and methods of construction including 5 tower structure of the West Penn Power Co. at Logans Ferry with length of span of 2250 ft., and other types.

ELECTRIC WELDING, ARC

Automatic. Welding Automatically by Electricity. Can. Mfr., vol. 46, no. 1, Jan. 1926, p. 6, 1 fig. Automatic electric welder which may be used for quantity production and for repair work; cost data.

Structural Steel. Structural Steel Welding on a Commercial Basis, H. P. Egan. Am. Welding Soc.—Jl., vol. 5, no. 1, Jan. 1926, pp. 51-58, 7 figs. Details of two-story buildings of Peerless Automobile Sales Co., Canton, Ohio, in which 95 tons of structural steel are entirely welded, both in shop fabrication and erection.

ELECTRIC WIRING

Conductivity Tests. Conductivity Tests of Wires and Cables, H. M. Friend. Elec. World, vol. 87, no. 3, Jan. 16, 1926, pp. 151-152. Describes simple, fairly accurate and quickly computed method of measuring conductivity used by writer for past 4 years.

ELECTRICAL INDUSTRY

Development. Some Developments in the Electrical Industry During 1925, J. Liston. Gen. Elec. Rev., vol. 29, no. 1, Jan. 1926, pp. 13-69, 104 figs. Survey of signal advances made during 1925 covering turbines, supercharges, marine equipment, main and industrial haulage, electric railways, waterwheel generators industrial motor control and motor application, arc welding, radio, transformers, lightning generator research, automatic stations, outdoor stations, switching houses, lighting, etc.

ELECTRICAL MACHINERY

Heating Curves. Parameters of Heating Curves of Electrical Machinery, V. Karapetoff. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 1, Jan. 1926, pp. 40-42. Points out that for thermal purposes an electrical machine cannot be considered as single body, since stator consists of two metal bodies (winding and core) between which there may be considerable heat interchange, and that rotor is also such a composite body; differential equations of heat flow in a combinational body are established and solved; stator winding is thermally determined by its heat capacity and its heat dissipation coefficient, and so is stator core.

ELEVATORS

Passenger. A Notable High-Speed Elevator Installation, C. R. Callaway and E. D. Harrington. Gen Elec. Rev., vol. 29, no. 2, Feb. 1926, pp. 84-96, 14 figs. Details of elevators in Equitable Life Assurance Society's building; variable-voltage or Ward-Leonard control and its advantages; car-speed regulation; electrical and mechanical equipment, safety devices, roping, etc.

Safeguarding. The Safeguarding of Lifts, R. Lister. Engineering, vol. 121, no. 3132, Jan. 8, 1926, p. 61. Summary of chief items in elevator specification to be examined from point of view of safety.

EMPLOYMENT MANAGEMENT

Analyzing Employee Attitudes. Analyzing and Rebuilding Employee Attitudes, J. F. Sherman. Indus. Mgmt. (N. Y.), vol. 71, no. 1, Jan. 1926, pp. 1915. The constructive, negative neutral types of workers; finding and winning the natural winner; points out that there is in modern industry a place for a specialized science of man engineering— analysis and measurement of attitude or motive factor, and rebuilding of it along constructive lines.

ENAMELS

Weathering of Lacquer. Accelerated Weathering as Applied to Lacquer Enamels, H. A. Nelson. Can. Chem. & Metallurgy, vol. 10, no. 1, Jan. 1926, pp. 11-13. Present state of general work on accelerated weathering; testing lacquer enamels; comparison of accelerated tests with outdoor exposure tests, and results of recent investigation on lacquer enamels carried out in laboratory of the New Jersey Zinc Co.

ENGINEERING

Science, Relation to Advancement in. The Advancement of Engineering in Relation to the Advancement of Science, A. E. Kennelly. Mech. Eng., vol. 48, no. 2, Feb. 1926, pp. 102-108, 7 figs. Definition of engineering; engineering in early times; points out that manufacture on large scale is virtually engineering itself; tendency of present engineering age toward accuracy of reasoning and precision of thought; tendency for world leadership to rest mainly upon science and its applications.

ENGINEERS

Industrial Opportunities. Opportunities for Engineers in Industry, J. O. G. Gifibonf, Mech. Eng. vol. 48, no. 3, March 1926, pp. 261-262. Necessity of advising preparatory-school and engineering-college graduate about the duties, opportunities, and responsibilities of engineer, so that he may make more intelligent choice of his profession.

EXPLOSIVES

Applications. Notes on Explosives, E. Godfrey. Can. Inst. Min. & Metallurgy—Bul. no. 165, Jan. 1926, pp. 95-109, 5 figs. Discusses various applications for mining tunnel driving, roadmaking, submarine work, clearing land of stumps, etc.; drilling, tamping and blasting operations.

F

FANS

Starting and Stopping. The Effect on the Ventilation Current of Stopping and Starting a Main Fan, R. A. H. Flugge-de Smidt. Chem., Met. & Min. Soc. of S. Africa, vol. 26, no. 5, Nov. 1925, pp. 110-114, 2 figs.

FEEDWATER HEATERS

Locomotive. A Locomotive Feed-water Heater. Engineer, vol. 141, no. 3654, Jan. 8, 1926, p. 53, 2 figs. Combined feedwater heater and pump specially suited for service on locomotives, manufactured by Worthington-Simpson, of Newark-on-Trent.

FLIGHT

Path of Airplane, Determining. Photographic Time Studies of Airplane Paths, A. G. Von Baumhauer. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 345, Jan. 1926, 10 pp., 5 figs.

FLOW OF AIR

Measurement. The Practical Measurement of Air Flow, E. Ower. Domestic Eng. (Lond.), vol. 45, no. 11, Nov. 1925, pp. 229-231, 3 figs.; and vol. 46, no. 1, Jan. 1926, pp. 3-9, 15 figs.

FLOW OF LIQUIDS

Orifices. Experiments on Contraction of Jets of Liquids (Esperienze sulla contrazione delle vene liquide), F. de Marchi. Annali dei Lavori Pubblici, vol. 58, no. 8, Aug. 1925, pp. 689-731, 15 figs. Discusses flow of liquids through 4 orifices, 3 of which were provided with short internal tubes in addition, and studies variation in jet, develops formulas for coefficients of flow, of contraction and of velocity; effect of viscosity.

FORGING MACHINES

High-Duty. National High-Duty Forging Machine. Am. Mach., vol. 64, no. 6, Feb. 11, 1926, pp. 257-258, 4 figs. Improvements in line of forging machines of Nat. Machy. Co., Tiffin, O.

FORGINGS

Steel, Hard Spots on. Hard Spots on Steel Forgings, J. D. Gat. Blast Furnace & Steel Plant, vol. 14, no. 2, Feb. 1926, pp. 74-78, 15 figs.; also in Forging—Stamping—Heat Treating, vol. 12, no. 1, Jan. 1926, pp. 2-7, 15 figs. Summary of careful investigation of phenomena connected with these formations.

FOUNDATION

Bearing-Power Tests. Bearing-Power Tests on Deep Caisson Foundations, R. L. Waring and C. T. Morris. Eng. News-Rec., vol. 96, no. 3, Jan. 21, 1926, pp. 109-112, 8 figs. American Insurance Union building in Columbus founded on hard clay 90-ft. below ground where borings indicated limestone; clay strength measured and bearing areas proportioned accordingly.

FOUNDRIES

Cost Methods. Describes a British System of Finding Foundry Costs. T. Smith. Foundry, vol. 54, no. 4, Feb. 15, 1926, pp. 151-153, 7 figs. Describes methods which are not hypothetical but illustrative of practice in large British iron and steel foundry.

Economics. Foundry Economics, J. Wolstenholme. Foundry Trade Jl., vol. 33, no. 493, Jan. 28, 1926, pp. 74-75. Cost of casting and part it plays in analyzing cost of engineering products; cost of molding and coremaking; piece work. (Abstract.) Paper read before Junior Instn. Engrs.

Management and Costs. Foundry Management and its Effect on Foundry Costs, Wm. J. Barretts. Am. Foundrymen's Assn.—reprint no. 498, for mfg. Oct. 6, 1925, pp. 6-14. Measuring management; comparison of iron and steel foundries; failures amoung foundries; measuring management in industry; successful operation through a cost system; underbidding without cost guidance; casting and cupola charging; costs as guidance in securing new equipment and as a guide in making sales.

Fuels. *See Coal, Lignite; Oil Fuel; Pulverized Coal.*

FURNACES, ANNEALING

Regenerative Gas-Fired. Regenerative Gas-Fired Furnaces, A. Harvey and H. W. Jackson. Metal Industry (Lond.), vol. 28, no. 1, Jan. 1, 1926, pp. 9-13, 6 figs. Equipment at new French non-ferrous works, for melting and annealing copper and brass alloys; crucible producer-gas-fired melting furnace for brass.

FURNACES, GAS

Selas. Gas Furnaces Applied to the Steel Industry, S. A. Sears. Machy. Market, nos. 1309, 1310, 1311 and 1312, Dec. 4, 11, 18 and 25, 1925, pp. 21-22, 19-20 and 22, 4 figs. Discusses theories on fuels and combustion; characteristics of gas as fuel.

FURNACES, INDUSTRIAL

Radiant-Heat. Radiant-Heat Furnaces. Engineering, vol. 121, no. 3134, Jan. 22, 1926, pp. 106-108, 7 figs. Typical examples of Krupp radiant-brick furnaces, employing principle of surface combustion, which are made for practically all industrial heating processes, such as reheating, forging, welding, annealing tempering, hardening, metal melting, etc., as well as for use in connection with manufacture of glass and pottery; any kind of clean gas can be used as fuel.

G

GALVANIZING

Testing Thickness of Coatings. Methods for Testing the Thickness of Zinc Coatings, H. Bablik. Metal Industry (Lond.), vol. 28, no. 2, Jan. 8, 1926, pp. 33-35, 2 figs.

GAS ENGINES

Otto. The Use of Gas engines (Warun nitch wieder Gasmotoren?), Schäfer. Gas- u. Wasserfach, vol. 68, no. 50, Dec. 12, 1925, pp. 783-785. Otto four-stroke engine and its fifty years of existence; proposes that all liquid fuel should be reserved for engines used in locomotion, but gas should be used for stationary engines. See also comment by Elvers, pp. 785-786.

GASES

Combustion of. The Processes of Combustion as a Foundation for the Industrial Uses of Gas, F. Plenz. Gas World, vol. 84, no. 2166, Jan. 23, 1926, pp. 81-82. Concludes that for high temperature excess of either gas or air should be avoided; hydrogenous gases give highest temperatures, their use requires a good burner and gas-air mixture must be passed in at high velocities to obviate back firing. Translated from Gas- und Wasserfach.

H

HEATING, ELECTRIC

Industrial. Status of Industrial Electric Heating. Elec. World, vol. 87, no. 4, Jan. 23, 1926, pp. 197-200, 5 figs. Rapid progress in applications to varied industries; increased production and better quality output attained in numerous installations; central stations beginning to appreciate load-building possibilities.

Panel. Electric Panel Heating, E. M. Bussy. Elec. Rev., vol. 98, no. 2510, Jan. 1, 1926, pp. 3-4, 2 figs. Discusses panel-heating system in Cinema de Paris, in London, which has 34 standard panels on auditorium ceiling, etc.; units are 6 ft. by 3 ft. by 1⅛ in. fixed on surface of ceiling and finished with suitable molding following general lines of decoration.

HEATING, HOT-AIR

Gravity System. Temperature Conditions Existing, in the Rooms of a Residence Heated by a Gravity Warm Air System, V. S. Day. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 2, Feb. 1926, pp. 73-78, 5 figs. Data and conclusions of study of temperature conditions existing in various rooms of residence of National Warm Air Heating and Ventilating Assn. at Illinois Univ.

HEATING, HOUSE

Combination Air and Water System. Combination Heating System, A. M. Daniels. Sheet Metal Worker, vol. 16, nos. 24, 25 and 26, Jan. 1, 15 and 29, 1926, pp. 866-868 and 885, 912-915 and 950-951, 7 figs. Data to enable furnaceman to design and instal properly combination warm-air and hot-water heating system; location of radiators, size of pipes to serve radiators; two-pipe up-feed direct-return system; over-head down-feed system with single riser.

Fuel Savers. Tests of Household Fuel Savers and the Economical Use of Coal, F. G. Hechler. Pan. State College Eng. Experiment Station—Bul., no. 34, Oct. 1925, pp. 5-35, 10 figs.

HIGHWAYS

Planning. What Comprises the Ideal Highway? S. W. Campbell. Contract Rec., vol. 40, no. 1, Jan. 6, 1926, pp. 9-10. Improvements in recent years, construction of pavements, drainage, resistance to traffic.

Relocation. Highway Relocation Practice in Pennsylvania, W. W. Crosby. Eng. News-Rec., vol. 96, no. 6, Feb. 11, 1926, pp. 232-233, 1 fig. Procedure followed in line rectification when road construction is required by wear or traffic, (Abstract) Paper presented before Am. Road Bldrs' Assn.

Widening and Thickening. Widening and Thickening California Paved Roads, R. M. Morton and N. A. Bowers. Eng. News-Rec., vol. 96. no. 1, Jan. 7, 1926, pp. 6-11, 12 figs. Contains two articles as follows: General Methods and Costs, by R. M. Morton; Construction Methods and Plant, by N. A. Bowers.

HYDRAULIC TURBINES

Coupling. Methods of Coupling Hydraulic Turbines (A propos de méthodes d'accouplement des turbines hydrauliques), R. Thomann. Bul. Technique, vol. 51, no. 24, Nov. 21, 1925, pp. 289-293, 3 figs. Discusses two turbines of 600 and 720 r.p.m., respectively, when to replace the smaller by the larger, when to couple them, how to proportion supply water for each when coupled, determining optimum of coupling, etc.

High-Speed. High-Speed Turbines for the Berne Hydro-Electric Power Station. Engineering vol. 121, no. 3133, Jan. 15, 1926, pp. 74-76, 10 figs. Details of turbines constructed by T. Bell & Co., Kriens, Switzerland, with specific speed of 970 r.p.m.; efficiency of turbines is 85 per cent as compared with 75 per cent of old Jonval turbines.

Kaplan. The Kaplan Turbine. Engineering, vol. 121, no. 3135, Jan. 29, 1926, pp. 152-154, 7 figs. Details of 10,000-hp. Kaplan turbine at Lilla Edet power station, Swede; distinguishing characteristic of Kaplan type of propeller turbine is that vane angle is variable, runner being constructed on lines of screw propeller with feathering blades.

Racing. Racing of Turbines at Fixed and Variable Head (Note sur l'emballement des turbines sous chute fixe et sous chute variable), L. Barbillion. Electricité & Mécanique, no. 7, July-Aug. 1925, pp. 7-7 to 7-14, 6 figs. Discusses action of regulator in limiting speed, curve of speeds attained by turbines, relation between curve of angular acceleration and that of speed; comparison of speeds attained at a given moment witb fixed and with variable head, etc.

Reaction. Efficiency Test on High-Head Reaction Turbine. Eng. News-Rec., vol. 96, no 1, Jan. 7, 1926, pp. 18-19, 1 fig. Oak Grove unit on Portland system shows 90 per cent efficiency at 35,000 hp. under 882-ft. effective head.

HYDRO-ELECTRIC DEVELOPMENTS

British Columbia. Development at Bonnington Falls, B. C. L. A. Campbell. Can. Engr., vol. 50, no. 3, Jan. 19, 1926, pp. 141-144, 7 figs.

Ontario. Hydro-Electric Power Commission of Ontario, Canada. Australasian Elec. Times, vol. 4, no. 9, Sept. 27, 1925, pp. 597-601, 9 figs. Compares developments of Australia with those of Ontario; trend of energy prices; Niagara, St. Lawrence and other systems.

HYDRO-ELECTRIC PLANTS

Operation. Hydro-Electric Operating Economies, A. R. Haynes. Elec. Light & Power, vol. 4, no. 2, Feb. 1926, pp. 21-24 and 102. Features of operation as effecting water savings in governing hydro-electric station having considerable storage.

Suggestions Regarding Hydraulic Plant Operation, L. F. Harza. Power Plant Eng., vol. 30, no. 4, Feb. 15, 1926, pp. 268-270, 1 fig. Parallel operation with steam plants.

I

IMPACT TESTING

Notched-Bar Tests. An Application of the Two-Testpiece Method of Notched Bar Impact Testing, Metallurgist (Supp. to Engineer, vol. 141, no. 3657), Jan. 29, 1926, pp. 14-15. Review of work by M. Moser in Stahl u. Eisen, vol. 45, 1925, p. 1879, in which he describes applications of two-specimen method of impact testing, and gives results of analysis of large number of tests made by this method.

INDUSTRIAL MANAGEMENT

Cost Control. The Effectiveness of Cost for Controlling Waste, T. D. Nevins. Soc. Industrial Engrs.—Bul., vol. 8, no. 1, Jan. 1926, pp. 3-6. Discusses importance of costs in prevention of waste by analyzing expenses, and budgeting, and gives typical cases.

Engineer's Relation to. Relation of the Engineer to Management, H. Diemer. Professional Engr., no. 1, Jan. 1926, pp. 5-7 and 11. Discusses gradual isolation of engineer as technical specialist, industrial engineering, and its limits, management engineering, budgeting and forecasting in business analogous to designing and planning, etc.

Financial and Industrial Investigations. Scope of Financial and Industrial Investigations, A. Andersen. Mfg. Industries (Mgmt. & Admin.), vol. 11, no. 1, Jan. 1926, pp. 17-22. Conditions and sources of data; place of financial investigation; place of appraisal; differences between external and internal investigations; data from appraisal, legal, research and accounting data; use of balance sheets; relative importance of data.

Hand and Machine Labour. Hand Labour and Machinery as Producers, R. Polleys Mfg. Industries (Mgmt. & Admin.), vol. 11, no. 1, Jan. 1926, pp. 11-12. Comparative advantages and formulae for cost calculations.

Inventory Control. The Control of Inventory Through the Scientific Determination of Lot Sizes, H. S. Owen. Indus. Mgmt. (N. Y.), vol. 71, no. 1, Jan. 1926, pp. 12-16, 5 figs. Specification or groundwork from which all control records originate.

Modern Methods. New Fields for Modern Management, W. Clark. Am. Mach., vol. 64, no. 7, Feb. 18, 1926, pp. 285-287, 1 fig. Contrast between old-fashioned and modern shops; development of sales quotas and various types of budgets; typical administrative control chart.

Production Control. An Effective Production Control System, J. J. Swan. Mfg. Industries (Mgmt. & Admin.), vol. 11, no. 1, Jan. 1926, pp. 39-43, 15 figs. Employed in manufacture of automatic printing presses.

Standard Practice Instructions. Standard Practice Instructions, P. M. Atkins. Am. Mach., vol. 64, no. 1, Jan. 7, 1926, pp. 23-27, 5 figs. Necessity for handling on explicit instructions for routine work; example worked out for details handled by balance of stores clerk.

INDUSTRIAL ORGANIZATION

Personnel, Choice of. Judging Organization and Personnel A. Andersen. Mfg. Industries, vol. 11, no. 2, Feb. 1926, pp. 113-117. Broad and detailed tests on organization; organization balance; relations of organization and personnel; functions of committees; personal statistics; personnel qualifications and analysis; vital importance of personnel.

INDUSTRIAL TRUCKS

Electric. Electric Trucks in the Locomotive Repair Shop, H. J., Payne. Ry. Elec. Engr., vol. 17, no. 1, Jan. 1926, pp. 21-23, 7 figs. Practice of one railroad indicates that this equipment fills definite need; work done by elevating platform trucks; saving on chip removal.

INSULATION, HEAT

Buildings. Advantages of Heat Insulation in Hotels, Apartment Houses, and Private Residences, R. H. Heilman. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32. no. 1, Jan. 1926, pp. 37-52, 12 figs. Discusses various types of insulating materials and gives data helpful to heating engineer in selecting and directing use of suitable heat insulation.

INSULATING MATERIALS, ELECTRIC

Transformers. Herkolite Insulating Materials in Transformers, V. M. Montsinger and W. S. Moody. Gen. Elec. Rev., vol. 29, no 2, Feb. 1926, pp. 102-108. 9 figs. Discusses paradoxical requirements which insulation must meet and describes a new insulating material which is extremely dense, strong and hard, yet elastic enough not to break under short-circuit stresses; it is readily machined and will take high polish when necessary.

INTERNAL-COMBUSTION ENGINES

British Show, Olympia. The Shipping, Engineering and Machinery Exhibition. Automobile Engr., vol. 16, no. 211, Jan. 1926, pp. 2-11, 28 figs. Notes on exhibits in internal-combustion-engine section.

Fuels. Fuels for High-Compression Engines, S. W. Sparrow. Oil & Gas Jl., vol. 24, no. 34, Jan. 14, 1926, pp. 118-122 and 184-190, 13 figs. Discusses characteristics with reference to preignition and detonation; compression ratio and preignition; methods of measuring detonation, etc.

Steam Cooling. Evaporative Cooling, H. C. Harrison. Soc. Automotive Engrs.—Jl., vol. 18, no. 2, Feb. 1926, pp. 195-200, 5 figs.

Supercharging. Supercharging Internal-Combustion Engines, C. R. Short. Soc. Automotive Engrs.—Jl., vol. 18, no. 2, Feb. 1926, pp. 185-194, 23 figs.

See also Automobile Engines; Diesel Engines; Gas Engines; Oil Engines.

IRON

Corrosion. Tbe Nature of the Protective Film of Iron, T. Fujihara. Am Electrochem. Soc.—advance paper, no. 1, for mtg. Apr. 22-24, 1926, pp. 1-8, 9 figs. Discusses phenomena connected with formation of protective film or membranes when drops of water are placed on a polished iron surface.

Protective Coatings. Note on the Protection of Iron by Cadmium ,H. S. Rawdon. Am. Electrochem. Soc.—advance paper, no. 3, for mtg. Apr. 22-24, 1926, pp. 21-30, 3 figs. Results of qualitative experiments with specimens of steel and iron, in each of which a plug of anotber metal was inserted and immersed in dilute sodium-chloride solution; zinc and cadmium behaved alike in preventing corrosive attacks of iron.

IRON AND STEEL

Bibliography. Review of Iron and Steel Literature for 1925, E. H. McClelland. Blast Furnace & Steel Plant, vol. 14, no. 1, Jan. 1926, pp. 49-51, also Forging—Stamping—Heat Treating, vol. 12, no. 1, Jan. 1926, pp. 15-17. Classified list of more important books, serials and trade publications during year, with few of earlier date, not previously announced.

IRON AND STEEL

World Capacity. World Iron and Steel Capacity. Iron Age, vol. 117, no. 1, Jan. 7, 1926, pp. 22-24, 2 figs. Equipment for 108,000,000 tons of pig iron, and how it is subdivided geographically; equipment for 117,000,000 tons of ingots and castings and its subdivision.

IRON CASTINGS

Cleaning. Cleaning Gray Iron Castings, E. H. Trick. Foundry, vol. 54, no. 2, Jan. 15, 1926, pp. 71-72, 4 figs. Methods and machinery used to handle castings from shakeout to warehouse in Southwestern plant making varied work.

Light. The Production of Light Grey-Iron Castings, D. McQueen. Foundry Trade Jl., vol. 33, no. 492, Jan. 21, 1926, pp. 53-54. Main considerations in iron for light castings are that it should be fluid so as to run thin castings and also soft, as large percentage of castings have to be drilled and some polished; influence of manganese and carbon; sulphur in light castings; mis-run castings; sands for light work; molding methods. (Abstract.)

Road Rollers. Making a Motor Road Roller, B. Hird. Foundry Trade Jl., vol. 32, no. 488, Dec. 24, 1925, pp. 527-529, 12 figs. Methods and equipment employed in making casting for hind roller of a Barford Perkins motor road roller; these castings weigh from 3 to 6 tons; molding in box for bottom part; coremaking.

IRON METALLURGY

Developments, 1925. Ferrous Metallurgy in 1925, H. M. Bolyston. Iron Age, vol. 117, no. 1, Jan. 7, 1916, pp. 46-50, 1 fig. Technical developments in steel, iron and alloys; contributions of research; progress in heat treatment; improved testing; improved testing equipment; foundry problems; blast-furnace design and operation; open-hearth furnace; rolling mills, etc.

J

JETTIES

GRAIN. The Design, Construction and Operation of a Grain Jetty at the Port of Vancouver, British Columbia, H. W. Frith. World Parts, vol. 14, no. 3, Jan. 1926, pp. 43-65, 9 figs. Jetty 930 ft. long and 56 ft. wide, accommodating two vessels on west side and one on east side, berths being dredged 35 ft. at low water; construction and method of placing cribs; superstructure and conveying equipment, etc.

L

LACQUERS

TESTS. Durability of a Colored Lacquer Containing Various Resins, H. A. Gardner. Paint Manufacturers' Assn. of U. S. Sci. Section—Circular, no. 252, Oct. 1925, pp. 168-173, 2 figs. Details of tests to determine effect of various resins; durability of brush lacquer, with results tabulated.

Physical Tests on Lacquers, H. A. Gardner and H. C. Parks. Paint Manufacturers' Assn. of U. S., Sci Section—Circular, no. 253, Nov. 1925, pp. 174-194, 4 figs. Tests to determine physical properties, including tensile strength and elongation of films, roof-exposure tests; cold-water test, baking, bending, etc., together with composition of lacquer.

LEAD ORES

EASTERN CANADA. Lead and Zinc in Eastern Canada, F. J. Alcock. Min. & Metallurgy, vol. 7, no. 230, Feb. 1926, pp. 51-56, 4 figs. Ores may be grouped under three divisions depending on their character and origin; (1) Ores of Appalachian region; (2) ores of Grenville region; and (3) calcite-barite veins of Ontario and Quebec. Published with permission of Director of Geol. Survey of Canada.

LIGHTING

FACTORIES. Illumination and Industrial Welfare, A. F. McBride. Illum. Eng. Soc. —Trans., vol. 21 no. 1, Jan. 1926, pp. 61-69. Regulations affecting welfare of industrial workers with particular emphasis on importance of adequate industrial illumination and its relation to efficient production, improved safety conditions, better eyesight and health.

LIGHTNING ARRESTERS

AUTOVALVE. Theory of the Autovalve Arrester, Jos. Slepian. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 1, Jan. 1926, pp. 3-8, 12 figs. Discusses advantage of valve-type arresters for high-voltage, power-system protection.

LOCKS

CONCRETE. Lockport Lock Construction Plant, Illinois Waterways. Eng. News-Rec., vol. 96, no. 6, Feb. 11, 1926, pp. 228-231, 6 figs. Locks consists of parallel gravity-section walls, 938-ft. long. 110-ft. apart and 66-ft. high, having left of 41-ft., cableway handles 7-yd. bucket.

LOCOMOTIVES

DIESEL-ENGINED. Clutch Drive Locomotive of 1600 HP. Oil Engine Power, vol. 4, no. 2, Feb. 1926, pp. 82-93, 2 figs. Direct-drive Diesel locomotive now being built at Krupps to specifications of American railroad; drawbar pull 40,000 lbs., high speed 49.75 m.p.h.; mechanical transmission throughout, avoiding electric or hydraulic intermediary systems.

TYPES. Three New Locomotive Types in '25, C. B. Peck. Ry. Age, vol. 80, no. 1, Jan. 2, 1926, pp. 47-49, 3 figs. All demonstrate that capacity possibilities of single-unit driving wheelbases have not been exhausted; 2-8-4 type built by Lima Locomotive Works; 4-10-2, three-cylinder, built for Southern Pacific; and 2-10-4 type, for Texas & Pacific, built by Lima Locomotive Works.

LUBRICATION

CUTTING TOOLS. Importance of Lubrication in Working of Metals (Importance de la lubrication, dans le travail d'usinage des métaux), J. Jacquet. Arts et Métiers, vol. 78, no. 61, Oct. 1925, pp. 407-411, 3 figs. Use of cutting compound for increasing speed of cutting and experiments carried out.

JOURNAL. A Graphical Study of Journal Lubrication, H. A. S. Howarth. Mech. Eng., vol. 48, no. 2, Feb. 1926, pp. 131-132 and (discussion) 132-133, 3 figs. Continues investigation of journal lubrication reported to Society under same title in 1923 and 1924; presents friction curves for central and offset partial bearings whose curvature radius exceeds that of journal; characteristics of fitted partial bearings are studied, including their varying capacities and friction.

M

MAGNESIUM ALLOYS

ELECTRON. The Alloy Electron, W. Schmidt. Metal Industry (Lond.), vol. 28, no. 6, Feb. 5, 1926, p. 130. High-magnesium alloy first introduced to public by Chemische Fabrik Greisheim-Elektron in 1909; review of developments, especially since end of war; physical and mechanical properties; casting in green sand; facility of working.

MALLEABLE CASTINGS

ANNEALING. Malleable Iron (La Malléable), M. Guedras. Fonderie Moderne, vol. 20, Jan. 1926, pp. 4-6. Discusses oxidizing cementation known as annealing, its chemical and thermal aspects; use of Ardennais furnace in France; formation of skin due to oxidation.

METALLURGY

BIBLIOGRAPHY. A Carefully Prepared List of Books on Metallurgy and Allied Subjects. Forging—Stamping—Heat Treating, vol. 12, no. 1, Jan. 1926, pp. 45-47.

METALS

DRAWING PROPERTIES. Some Attempts to Measure the Drawing Properties of Metals, Wm. S. Montgomery, Jr., and E. R. Enders, Jr. Mech. Eng., vol. 48, no. 2, Feb. 1926, pp. 119-124, 2 figs. Results of series of tests made with idea of ascertaining whether or not measurable properties bear any relation to drawing properties of metals.

HIGH TEMPERATURES, RESISTANCE TO. The Use of Metals at High Temperatures, W. Rosenbain. Metallurgist (Supp. to Engineer, vol. 141, no. 3657), Jan. 29, 1926, pp. 2-4, 2 figs. Discusses manner in which materials are exposed to high temperatures and mechanism of their resistance under these adverse conditions.

STRENGTH. The Effect of Tension on the Transverse and Longitudinal Resistance of Metals, P. W. Bridgman. Am. Soc. Arts & Sci.—Proc., vol. 60, no. 8, Oct. 1925, pp. 423-449, 1 fig. New experimental method for measuring change of resistance in a metal under tension with direction of flow at right angles to tension; results of measurement on aluminum, gold, copper, silver, platinum, iron, nickel, etc.

THIN TRANSPARENT FILMS OF. Thin Transparent Films of Metal. Metallurgist (Supp. to Engineer, vol. 141, no. 3657), Jan. 29, 1926, p. 6. Describes process worked out by C. Müller at the Reichsanstalt at Charlottenburg, who has succeeded in making excessively thin films of nickel, copper, etc., which are continuous and sufficiently strong to be reasonably handled; they can even be soldered or welded together to form thermocouples; they are also transparent.

MINERAL RESOURCES

BRITISH COLUMBIA. Mineral Resources of the Lardeau and Trout Lake Mining Divisions of British Columbia, N. W. Emmens. Can. Min. Jl., vol. 47, nos. 1 and 2, Jan. 1 and 8, 1926, pp. 5-8 and 36-38, 5 figs. Lardeau and Trout Lake section and its resources of gold, silver, lead and zinc.

NON-METALLIC, CANADA. Non-Metallic Minerals of Canada, Sir S. Brunton. compressed Air Mag., vol. 31, no. 1, Jan. 1926, pp. 1485-1489, 5 figs. Discusses large fields of non-metallic resources, including abrasives, arsenic, barytes, clay, coal, fluorspar, graphite, etc.

MORTARS

STRENGTH TESTS. Report of Committee on Materials of Construction, M. O. Witbey. Eng. Soc. Wis., Seventeenth Annual Report, 1925, pp. 109-121, 1 fig. Results of strength tests on mortars for masonry construction cured in cold and warm temperatures at the materials testing laboratory of the University of Wisconsin; concludes that freezing is detrimental to the strength of mortars, used in brick laying, etc.

MOTOR BUSES

BRISTOL. The Latest Bristol Production. Motor Transport (Lond.), vol. 42, no. 1091, Jan. 25, 1926, pp. 115-117, 7 figs. Latest model by Bristol Tramways & Carriage Co. for single-deck bodies with 32 seats; 4-cylinder mono-block engine with detachable head; wheelbase, 16 ft.; overall length, 25 ft. 6 in.

MOTOR TRUCKS

CHASSIS SUSPENSION. Chassis Suspension for Industrial Vehicles. Motor Transport (Lond.), vol. 42, no. 1092, Feb. 1, 1926, pp. 129-131, 6 figs. Recent improvements in design; effect of imperfect suspension; suiting the spring to its load, spring lubrication, etc.

N

NATURAL GAS

CANADA. Natural Gas in 1923 and Petroleum in 1923, R. B. Harkness. Ontario Dept. of Mines—33rd Annual Report, vol. 33, 1925, 112 pp., 12 figs. Discusses changes and improvements in service, extension of gas lines, price of manufactured and natural gas, leakage, exploration work, etc.; oil at base of Trenton limestone, drill cuttings, yield of oil wells in 1923, price of oil, refining operations, etc.

ENERGY CONTAINED IN. Energy Contained in Petroleum Gas, S. F. Shaw. Min. & Metallurgy, vol. 7, no. 229, Jan. 1926, pp. 9-10. Notes amount of oil that could be lifted by natural gas if 100 per cent efficiency were obtained and efficiencies actually obtained in use of this gas.

O

OIL

BIBLIOGRAPHIES. Recent Articles on Petroleum and Allied Substances, U. S. Bureau of Mines, Dec. 1925, 31 pp. List of recent articles on geology and origin, development and production, transportation, and storage, refining and refineries, etc.

OIL ENGINES

COLD-STARTING. Blackstone Spring-Injection Cold Starting Engine. Elec. Times, vol. 69, no. 1786, Jan. 7, 1926, pp. 12-13, 2 figs. Details of improved oil prime mover developed by Blackstone & Co. of Stamford, in which air compressor and hot-bulb attachment of cylinder bead is replaced by mechanical injection device together with completely water-cooled cylinder head; injection device having a low-pressure fuel-measuring pump, high-pressure fuel-injection pump and spring-loaded fuel-injection valve, etc.

15,000-B.HP. A Large Double-Acting Oil Engine. Engineer, vol. 141, no. 3657, Jan. 29, 1926, p. 134. Details and tests of 9-cylinder, double-acting 2-cycle 15,000-b.hp. oil engine built under license form M.A.N. Co., Ausgburg; claimed to be largest unit yet constructed; it will be employed for driving 10,000-kw. alternator at Neuhof Electricity Works, Hamburg.

OIL FUEL

BURNERS FOR. Burning of Fuel Oil, E. T. Keenan. Southern Power Jl., vol. 44, no. 1, Jan. 1926, pp. 36-38, 4 figs. Discusses analysis of liquid fuels; how fuel oil is burned, methods of atomizing, selection of type of burner, etc.

TESTING. Modern Test Methods for Fuel Oil, W. D. Campbell. Nat. Engr., vol. 30, no. 2, Feb. 1926, pp. 57-60, 1 fig. Instructions for handling bomb calorimeter in making tests and precautions to be taken to insure accuracy, how to determine acid and sulphur content, how to calculate results.

OSCILLOGRAPHS

TRANSIENT PHENOMENA, FOR STUDY OF. Study of Time Lag of the Needle Gap, K. B. McEachron and E. J. Wade. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 1, Jan. 1926, pp. 46-52, 7 figs. Describes oscillograph used by authors and discusses method of operation; tests were made with a wave which was nearly perpendicular, reaching its maximum in about one microsecond; such a wave was obtained by discharge of condenser through suitable circuit; gives oscillogram which shows wave front used; results of tests in which this wave front was applied to gaps; shows that with any given gap setting and sparkling voltage time lags vary through wide limits; also that, for same voltage, increased gap settings mean increased lag.

OXYACETYLENE WELDING

HOSE CONNECTION FOR EQUIPMENT. Standard Hose Connections for Welding Equipment. Am. Mach., vol. 64, no. 6, Feb. 11, 1925, p. 253. Reference-book sheet for holding and fastening devices.

P

PAVEMENTS, ASPHALT

DESIGN. Design of Bituminous Pavements, H. W. Skidmore. Eng. & Contracting (Roads & Streets), vol. 64, no. 6, Dec. 2, 1925, pp. 1229-1233, 2 figs. Discusses method of designing mixtures for asphalt pavements and gives examples.

PAVEMENTS, CONCRETE

CONSTRUCTION. How to Stop Cement Overrun in Pavement Construction, R. E. O'Connor. Muni. & County Eng., vol. 70, no. 1, Jan. 1926, pp. 19-26. Specifications, methods and equipment used in construction, cause of overrun, inundation, effect of grade, selection of forms, etc.

PIGMENTS

LITHOPONE. Lithopone Making Rapid Progress in Plant Industry, C. F. Beatty. Chem. & Met. Eng., vol. 33, no. 1, Jan. 1926, pp. 27-28. Zinc pigments finding increasing outlets in rubber, plastics, printing inks, pottery glazes, abrasives and oil cloth.

PIPE, CAST-IRON

BRONZE WELDING. Effect of Heat of Bronze Welding on Cast Iron Pipe, A. R. Lytle. Am. Welding Soc.—Jl., vol. 5, no. 1, Jan. 1926, pp. 28-50, 35 figs. Discusses theories that depend on structural changes occurring in cast iron due to heat of application of bronze; cast-iron welding of sand-cast and centrifugally cast pipe; bronze welding of the same, etc.

CENTRIFUGALLY CAST. Making Cast Iron Pipe Centrifugally, F. Grossmann. Foundry, vol. 54, no. 2, Jan, 15, 1926, pp. 58-59. Description of the de Lavaud machine and its operation; advantages of centrifugal process.

PNEUMATIC MACHINERY

LUBRICATION. Lubrication of Pneumatic Machinery. Lubrication, vol. 12, no. 1, Jan. 1926, 12 pp., 25 figs. Lubrication of air tools on pneumatic machinery; design, construction and operation of drills, riveters, hoists, their operating conditions, lubrication requirements, cleanliness and methods of cleaning.

POWER

DEVELOPMENTS, MISSISSIPPI VALLEY. Power Developments in the Mississippi Valley, S. Insull. Power Plant Eng., vol. 30, no. 4, Feb. 15, 1926, pp. 250-253. Resources of Middle West; development of interconnected power systems; power outlook for future.

POWER FACTOR

CALCULATION. Calculation of Power Factor for Electric Energy rates (Calcul du facteur de puissance co-intervenant dans les tarifications d'énergie électrique). Electricien, vol. 56, no. 1386, Dec. 15, 1925, pp. 559-561, 4 figs. Methods of direct calculation, by trigonometric functions, by graphs, by curves, etc.

CORRECTION. Power-Factor Correction, Its Imports to the Power User, M. A. Hyde. Iron & Steel of Can., vol. 9, no. 1, Jan. 1926, pp. 10-11. Various types of corrective equipment, synchronous motors, synchronous and static condensers, etc.

MIDWEST POWER CONFERENCE, CHICAGO. Midwest Power Conference Meets All Expectations. Power, vol. 63, no. 6, Feb. 9, 1926, pp. 211-218. Review of papers presented at conference held in Chicago from Jan. 26 to 29, 1926, discussing power developments in Mississippi Valley; water power and interconnection; changing viewpoints in turbine practice; combined operation of steam and hydraulic systems; electric-power development in Chicago district; by-product processing; boiler-water conditioning; industrial-plant design; turbine testing; first aid and power for coal mines; oil and gas power; etc.

POWER SHOW, CHICAGO. Chicago Power Show Arouses Great Interest. Power Plant Eng., vol. 30, no. 4, Feb. 15, 1926, pp. 282-294, 35 figs.

POWER TRANSMISSION

SHAFTING. Using Steel Forms for Supporting Lineshafting, P. L. Pyribil. Indus. Eng., vol. 84, no. 1, Jan. 1926, pp. 19-25, 14 figs. Erection of lineshafts in mill-type steel and concrete buildings, with particular attention to provisions for easy anchorage of mechanical equipment and to facilitate future changes in layout.

PRESSES

PUNCH, DIE SETS FOR. Standardized Die Sets for Punch-Press Work, F. H. Colvin. Am. Mach., vol. 64, no. 6, Feb. 11, 1926, pp. 245-249, 19 figs. How standardization of sets makes it possible to use modern production methods and to secure accurate results at low cost.

PROSPECTING

METHODS. Swedish Electric Prospecting Methods, H. Lundberg, K. Sunberg, and J. Eklund. Can. Min. Jl., vol. 47, nos. 2 and 3, Jan. 8 and 15, 1926, pp. 29-32 and 51-52, 2 figs. Potential methods based on investigation of distribution of potential in electrical field by tracing equipotential curves between different points; electromagnetic methods based on causing current to flow in ore body and then examining disturbances in electromagnetic field caused by it; magnetic seismic, gravity methods and interpretation.

PULVERIZED COAL

BOILER FIRING. A Critical Analysis of Pulverized Fuel for Small Boiler Plants, A. A. Fette. Nat. Engr., vol. 30, no. 2, Feb. 1926, pp. 65-67. Discussion of bin or storage system; drying of coal; problems of pulverized-coal plant; comparison with stokers; cost data of pulverizing and stoker systems.

Notes on Powdered Fuel, W. Lulofs. Elec. Times, vol. 69, no. 1787, Jan. 14, 1926, pp. 35-38, 3 figs. Discusses reduction of excessive air for combustion to limit supply to that which is theoretically necessary, and its consequent advantage in decreasing heat losses due to reduction of quantity of unnecessary air heated and saving of heat units because smaller quantity of gas can be reduced by boiler to a lower temperature before reaching the chimney.

Powdered Fuel, W. Lulofs. Combustion, vol. 14, no. 1, Jan. 1926, pp. 40-43, 1 fig. Discusses pulverized coal firing combined with mechanical stoking resulting in decreased efficiency and steam production and increased adaptability for varying load.

CARBONIZATION. Carbonization of Pulverized Fuel at Low Temperature, S. McEwen. Combustion, vol. 14, no. 2, Feb. 1926, pp. 107-110, 2 figs. McEwen-Rune process of pulverization of coal to be carbonized and its elevation to top of an internally heated tower; powdered fuel is caused to fall down this tower in form of a cloud meeting in its downward passage and upward current of hot inert gases.

PUMPS

HYDRAULIC. A New Hydraulic Pump. Engineer, vol. 141, no. 3654, Jan. 8, 1926, pp. 52-53, 1 fig. New design brought out by West Hydraulic Eng. Co.; it is of vertical type, and one of its outstanding features is provision made for lubricating running parts.

PUMPS, CENTRIFUGAL

HYDRODYNAMIC THEORY. The Hydrodynamic Theory of Turbines and Centrifugal Pumps, B. Eck. Engineering, vol. 121, nos. 3134 and 3135, Jan. 22 and 29, 1926, pp. 98-101 and 125-127, 21 figs. Author has succeeded in deducing exact solution for one particular case of turbine or pump problem, that in which turbine has but a single vane; from this he has derived approximate expressions applicable to practical turbines or centrifugals having multiple vanes.

PYROMETERS

INDICATING AND RECORDING. Indicating and Recording Pyrometers, P. M. Heldt. Automotive Industries, vol. 54, no. 3, Jan. 21, 1926, pp. 94-99, 9 figs. Their design and operation; potentiometer principle; automatic cold-junction compensation; checking against standard cell; automatic signaling device; automatic inking arrangement.

R

RADIOTELEGRAPHY

ATMOSPHERICS. The Present Status of Radio Atmospheric Disturbances, L. W. Austin. Wash. Acad. Sciences—Jl., vol. 16, no. 2, Jan, 19, 1926, pp. 41-46, 5 figs. Discusses uncertainty of our knowledge concerning atmospheric disturbances, origin of rumbling disturbances or grinders, connection between intensity of disturbances and position of sum; effects of thunderstorms, etc.

RADIOTELEPHONY

BROADCASTING. Some Studies in Radio Broadcast Transmission, R. Brown, D. K. Martin and R. K. Potter. Bell System Tech. Jl., vol. 5, no. 1, Jan. 1926, pp. 142-213, 50 figs. Discusses radio transmission tests from station 2XB in New York City to outlying field stations, to study fading and distortion of radio signals under night time conditions; concludes that fading can be quite sharply selective as to frequency, wave interference is probable cause; quality distortion may result from dynamic instability of transmitter.

RECEPTION. Progress in Radio Receiving During 1925, Dr. A. N. Goldsmith. Gen. Elec. Rev., vol. 29, no. 1, Jan. 1926, pp. 70-77, 19 figs. Reviews year's progress in receiving circuits, receivers, vacuum tubes, power supply devices and power amplifiers, etc.

RAILS

FAILURE. An Examination into the Causes of the Failure of Steel Rails, E. A. Dancaster. Ry. Engr., vol. 47, no. 552, Jan. 1926, pp. 21-27 and 33, 7 figs. Series of investigations into microstructure of rails which have failed in-service, showing that in sound rails fracture is close to the end, generally passing through fishbolt holes; failure in flawed rail is due to pipes, transverse cracks, blowholes, or excessive segregation.

SPECIFICATIONS. Report of Committee on Rail. Am. Ry. Eng. Assn.—Bul., vol. 27, no. 283, Jan. 1926, pp. 473-629, 70 figs. Revised specifications for spring washers; rail failures; effect of various bolt tensions on mechanical strength of joints; effect of welding in changing structure of rail; standard specifications for manufacture of open hearth-steel girder rails of plain, grooved and guard types.

RAILWAY ELECTRIFICATION

FACTORS AFFECTING. Factors Affecting Electrification, A. G. Oehler, Ry. Age, vol. 80, no. 1, Jan. 2, 1926, pp. 50-51, 1 fig. Points out that new conditions have been introduced which may influence future development.

RAILWAY MANAGEMENT

ACCOUNTING. Report of Records and Accounts. Am. Ry. Eng. Assn.—Bul., vol. 27, no. 281, Nov. 1925, pp. 245-284. Gathering and recording data for keeping up to date valuation records of property; feasibility of reducing number of forms and simplifying those retained; comparison of daily and monthly time and material reports.

FORECASTING REVENUES. Forecasting Railway Revenues, J. E. Slater. Ry. Age, vol. 80, no. 2, Jan. 9, 1926, pp. 187-192, 11 figs. Methods worked out by New Haven to assist in budgeting of expenses.

RAILWAY MOTOR CARS

GASOLINE-ELECTRIC. High Capacity Gas-Electric Car for the Seaboard. Ry. Age, vol. 80, no. 4, Jan. 23, 1926, pp. 273-275, 6 figs. Dual power plant and four motors permit high-speed operation with greater hauling capacity.

The Reading Gas-Electric Rail Car, T. H. Murphy. Ry. Age, vol. 80, no. 2, Jan. 9, 1926, pp. 168-170, 4 figs. Car is controlled from either end and can also be used in multiple-unit operation. See also Ry. & Locomotive Eng., vol. 39, no. 1, Jan. 1926, pp. 17-19, 1 fig.

RAILWAY OPERATION

STATISTICAL DATA. Traffic, Earnings and Expenses, M. O. Lorenz. Ry. Rev., vol. 78, no. 1, Jan, 2, 1926, pp. 41-45, 2 figs. Résumé of comparative statistical data pertaining to railway operation.

TRAIN CONTROL. Train Control Progress in 1925, J. H. Dunn. Ry. Age, vol. 80, no. 1, Jan, 2, 1926, pp. 115-119. Twenty-four divisions completed under first order and two under second; Interstate Commerce Commission has made two final results.

RAILWAY SIGNALING

A. R. A. REPORT. Report on Signals and Interlocking. Am. Ry. Eng. Assn.—Bul., vol. 27, no. 281, Nov. 1925, pp. 315-351, 1 fig. Automatic train control; signals for highway-crossing protection; requisites for automatic signals for highway crossing protection.

AUTOMATIC EQUIPMENT, 1925. An Active Year in Interlocking and Signal Construction, J. H. Dunn. Ry. Age, vol. 80, no. 1, Jan. 2, 1926, pp. 97-104, 3 figs. More equipment placed in service during 1925 than in any year since 1914; statistical data on automatic signaling completed in 1925 and contemplated for 1926.

RAILWAY TIES

PRESERVATIVE TREATMENT. Systematic Protection of Ties Effect Marked Economies, E. F. Robinson. Ry. Age, vol. 80, no. 2, Jan. 9, 1926, pp. 175-180, 3 figs.; also Ry. Eng. & Maintenance, vol. 22, no. 1, Jan. 1926, pp. 15-21, 4 figs. Timber-preserving plant at Bradford, Pa., of Buffalo, Rochester & Pittsburgh Ry.; methods employed; air seasoning; native hardwoods prove most satisfactory.

SPECIFICATIONS. Report of Committee on Ties, Am. Ry. Eng. Assn.—Bul., vol. 27, no. 283, Jan. 1926, pp. 687-732, 9 figs. Specifications for cross-ties, switch-ties, dating nails; making ties for service records; extension of service test records for furnishing information for study of economics of ties; adherence to specifications; substitute ties.

RAILWAY TRACK

REINFORCED-CONCRETE SLAB. Building a More Permanent Track, F. H. Alfred and P. Chipman. Ry. Eng. & Maintenance, vol. 22, no. 1, Jan. 1926, pp. 4-8, 4 figs. Reinforced-concrete slab is suggested to support rails; marked savings anticipated.

RELAYING MACHINE. Railway Track-Relaying Machine. Engineering, vol. 121, no. 3134, Jan. 22, 1926, pp. 102-103, 24 figs. partly on supp. plates. Machine designed and patented by A. W. Bretland, is adaptation to track laying, of system of block laying, long standardized in pier and harbor work. See also description in Engineer, vol. 141, no. 3655, Jan. 15, 1926, pp. 75-77, 9 figs.

SPECIFICATIONS. Report of Committee on Track. Am. Ry. Eng. Assn.—Bul., vol. 27, no. 283, Jan. 1926, pp. 631-686, 25 figs. Proposed revised specifications for steel tie plates and for soft-steel track spikes; specifications for gros filler sections and for wooden handles for track tools; effect of brine drippings on track appliances; canting rail inward and taper of tread of wheel; railway renewals; tie plates, etc.

RAILWAY YARDS

A. R. A. REPORT. Report of Committee on Yards and Terminals. Am. Ry. Eng. Assn.—Bul., vol. 27, no. 282, Dec. 1925, pp. 353-388, 6 figs. Joint use and operation of passenger terminals; scales; freight-yard design; mechanical means for controlling movement of cars in hump yards.

REDUCTION GEARS

TYPES. Gears for Speed Reduction. Power, vol. 63, no. 5, Feb. 2, 1926, pp. 181-183, 8 figs. Types of gear drives; applications in power plant.

REFRACTORIES

PROPERTIES. Refractories, M. C. Booze. Fuels & Furnaces, vol. 4, no. 1, Jan. 1926, pp. 41-44 and 71-72. Discusses consumption, life, selection and testing of refractories; improvement of properties, recent developments.

REFRIGERATING MACHINES

HIGH-SPEED. Modern High Speed Refrigerating Machines, G. W. Daniels. Cold Storage, vol. 29, no. 334, Jan. 21, 1926, pp. 9-12. Advantages and disadvantages of low speed and high speed; construction of valves, suction pipes and passages, lubrication, balancing, etc.

REFRIGERATING PLANTS

CORROSION. Corrosion in the Refrigerating Industry, W. G. Whitman, E. L. Chappell and J. K. Roberts. Ice & Refrigeration, vol. 70, no. 1, Jan. 1926, pp. 46-51, 11 figs. Reports submitted to committee on corrosion of Am. Soc. of Refrig. Engrs., covering general principles of corrosion, corrosion in condenser systems and in brine systems. Bibliography.

EFFICIENCY. Limits of Refrigerating Plant Efficiency. V. J. Azbe. Ice & Refrigeration, vol. 70, no. 1, Jan. 1926, pp. 33-40, 8 figs. Also Power, vol. 63, no. 4, Jan. 26, 1926, pp. 138-139, 4 figs. Discusses that part where power is applied to compress ammonia to produce refrigeration and factors which determine range through which ammonia is to be compressed.

HEAT BALANCE. Heat-Balance in a Refrigerating Plant, W. S. Huntington. Refrigeration, vol. 38, no. 1, Jan. 1926, pp. 44-46, 2 figs. Attempts to construct a heat-balance diagram; discusses freezing tank, tank insulation, daily storage, ratio of refrigeration and ice tonnage, distribution of refrigerating cost in cents per dollar expended.

HEAT LEAKAGE. Heat Leakage in the Refrigerating Plant, W. H. Huntington. Power, vol. 63, no. 3, Jan. 19, 1926, pp. 96-97, 1 fig. Chart showing leakage from bare and insulated tanks; permits calculation for most efficient thickness of covering.

INSULATION. The Insulation of Cold Stores. Ice & Cold Storage, vol. 29, no. 334, Jan. 1926, pp. 3-5, 4 figs. Discusses question of insulation of refrigerating installations as affecting machinery. piping and buildings, and gives results of experiments and experience. Translated from Sulzer Techl. Rev.

REFUSE DISPOSAL

DESTRUCTORS AND TIPS. Disposal of Refuse at Destructors and Tips. Surveyor, (Lond.), vol. 69, no. 1773, Jan. 8, 1926, pp. 31-32. Relative cost of systems, operating refuse destructor or closing it down and diverting all refuse to tips.

RESEARCH

INDUSTRIAL. The Adminstration of Industrial Research, E. R. Weidlein. Indus. & Eng. Chem., vol. 18, no. 1, Jan. 1926, pp. 98-101. General absence of scientific research methods in chemical technology led to formulation in 1906 of Indus. Fellowship System of Mellon Inst.; review of gradual development; scope of research management; definition of research organization; principles of research laboratory management; functions of organization; selection; selection of research men.

ROADS

STRENGTHENING AND WIDENING. The Economics of Strengthening and Widening of Pavements, W. H. Connell. Am. Highways, vol. 5, no. 1, Jan. 1926, pp. 10-17, 8 figs. Discusses traffic capacity of roads and traffic data, strengthening and widening in Pennsylvania, economic thickness and surfacing, etc.

ROADS, CONCRETE

CONSTRUCTION. Efficiency in Concrete Road Construction, J. L. Harrison. Pub. Roads, vol. 6, no. 11, Jan. 1926, pp. 241-250, 1 fig. Report of observations made on going projects by Division of Control, Bureau of Public Roads, covering efficiency of equipment, proper use of stock pile and modern steel bins, cement handling inefficient, subgrade practice recommended, finishing method, etc.

ROADS, GRAVEL

ASPHALT SURFACING. Gravel Roads Cheaply Surfaced with Asphalt. Eng. News-Rec., vol. 96, no. 1, Jan. 7, 1926, pp. 14-17, 11 figs. Michigan is covering old gravel roads with sheet asphalt at a cost of about a dollar a yard; reports and cost records.

ROOFS

SLATE SURFACE ASPHALT-PREPARED. United States Government Master Specification for Slate-Surfaced Asphalt Prepared Roofing and Shingles. U. S. Bur. Standards—Circular, no. 285, Nov. 17, 1925, 6 pp. Rag roofing felt saturated and coated on both sides with asphalt and surfaced on the weather side with granulated slate of similar material, methods of inspection and testing, packing and marking.

ROLLING MILLS

CONTINUOUS. Ford Merchant Mill in Operation. Iron Age, vol. 117, no. 3, Jan. 21, 1926, pp. 197-201, 8 figs. First unit of new steel works is 14-in. motor-driven continuous mill: unusual features.

S

SAFETY

ENGINEERING. The Problems and Functions of a Safety Engineer, K. C. Monroe. Am. Mach., vol. 64, no. 5, Feb. 4, 1926, pp. 197-198, 2 figs. Selection of proper safety devices; co-operation of employees most necessary for establishment of safe practices; safety bulletins and accident records.

SEWAGE DISPOSAL

PERCOLATING FILTERS. The Cost of Sewage Disposal Works in Relation to Volume and Strength of Sewage, L. F. Mountfort. Surveyor, (Lond.), vol. 69, no. 1772, Jan. 1, 1926, pp. 305, 1 fig. Use of percolating filters for final stage of purification, suggests an approximate method of ascertaining rapidly variation of cost in relation to strength of sewage.

SLUDGE, HEAT DRYING. The Heat-Drying of Sludge at the Baltimore Sewage Works, C. E. Keefer. Eng. News-Rec., vol. 96, no. 6, Feb. 11, 1926, pp. 238-240. Plant for converting sludge into fertilizer shut down after 6½ years operation by company under contract with city.

SHAFTS

CRITICAL SPEEDS. Determination of Critical Angular Velocity (La Détermination des Vitesses angulaires critiques), F. H. Van den Dugen. Assn. des Ingénieurs de l'Ecole Polytechnique de Bruxelles—Bul. Technique, vol. 21, no. 1, 1925, pp. 1-15, 3 figs. Discusses formulation of integral equation, phenomenon of resonance, various methods of calculation, and examples: physical properties of critical speed, stabilizing speeds; problems with several parameters.

DIAGRAMS. Shaft Diagrams, J. R. Hurford. Power, vol. 63, no. 2, Jan. 12, 1926, pp. 59-61, 5 figs. Presents charts constructed by author to solve formula proposed by A. L. Jenkins for shaft made of ductile material.

SPRINGS

RING. The Ring Spring, O. R. Wikander. Mech Eng., vol. 48, no. 2, Feb. 1926, pp. 139-143, 8 figs. Characteristics and advantages of type of compression spring consisting of assembly of alternate inner and outer rings, each coating with adjacent ones along conical surfaces; design formulae and illustrative calculation.

STEAM

CHARTS AND TABLES. Progress Report on the Development of Steam Charts and Tables from the Harvard Throttling Experiments, J. H. Keenan. Mech. Eng., vol. 48, no. 2, Feb. 1926, pp. 144-151, 9 figs. partly on supp. plate.

RESEARCH. Progress in Steam Research. Mech Eng., vol. 48, no. 2, Feb. 1926, pp. 151-160, 19 figs. Reports presented at session on Progress in Steam Table Research, Dec. 2, 1925, as follows: Report of Executive Committee of Steam Table Fund; Report on Progress in Steam Research at the Bureau of Standards, N. S. Oshorne and H. F. Stimson; Report on Progress in Stéam Research at Massachusetts Institute of Technology, L. B. Smith; Notes on Steam-Research Work Carried out at Harvard University, R. V. Kleinschmidt; Temperature Scale and Pressure Standard Employed in M. I. T. Steam-Research Measurements, F. G. Keyes; Progress Made in Technique of Computing a Steam Table from the Harvard Data, H. N. Davis; Comparison with the Formulations, R. C. H. Heck. These reports are supplementary to those published in same journal, Feb. 1924 and Feb. 1925.

STEAM ACCUMULATORS

RUTHS. Ruths Steam Accumulators (L'accumulateur de vapeur Ruths), H. Schrenk. Revue Universelle des Mines, vol. 8, no. 6, Dec. 15, 1925, pp. 347-361, 16 figs. Details of examples of applications in coal mines, central stations, and metallurgical works.

STEAM ENGINES

DEVELOPMENT. Conversion of Reciprocating Steam Engines to Combined Steam and Internal Combustion Engines. Diesel & Oil Engine Jl., vol. 2, no. 1, Jan. 1926, pp. 13-18, 6 figs. Discusses invention by Cox and Lagergreen with the object of improving economy of the old steam power plant of ship and to provide the vessel with such power as to make it independent as to the kind of fuel at the ports of call, giving a cost ratio of 1 to 5 in favor of the converted engine.

STEAM POWER PLANTS

RESEARCH. Bureau of Mines Aids Power Plant Practice. Power Plant Eng., vol. 30, no. 4, Feb. 15, 1926, pp. 246-249, 7 figs. U. S. Government station at Pittsburgh conducts intensive research in combustion, feedwater treatment and refractory problems.

STAND-BY STATIONS. Recent Refinements in Power-plant Auxiliary Apparatus and Operating Methods. Southern Power Jl., vol. 44, no. 1, Jan. 1926, pp. 1-10, 13 figs. Discusses stand-by steam stations of various electric power plants for generating electric energy during summer and method of operation.

STEAM TURBINES

SMALL. A New Line of Small Turbines, R. R. Lewis. Power, vol. 63, no. 5, Feb. 2, 1926, pp. 178-180, 4 figs. Describes series of small turbines developed by Gen. Elec. Co. to meet demand for small units of refined design.

STEEL

BENDING STRESSES, EFFECT OF. Safe Loads and Endurance of Steels under Repeated Pending Stresses. Engineering vol. 141, no. 3657, Jan. 29, 1926, p. 130. Review of article by V. Prever and E. Balma, published in Ingegneria, giving results of number of alternating bending-stress tests on series of 42 steels comprising wide range of compositions and including several nickel and nickel-chromium-tungsten steels with varying carbon contents.

HIGH TEMPERATURES, EFFECT OF. Behavior of Steel at Elevated Temperatures, O. A. Knight. Forging—Stamping—Heat Treating, vol. 12, no. 1, Jan. 1926, pp. 36-40. Comprehensive report covering behavior of cold-drawn mild steel at elevated temperatures; experiments discusses were confined to tensile tests.

STEEL CASTINGS

ELECTRIC. Discussion on Mr. Melmoth's Paper on "Some Metallurgical Points on Electric Steel Castings and Notes on Defects." Foundry Trade Jl., vol. 33, no. 490, Jan. 7, 1926, pp. 13-15. Discusses contraction in wheel castings; liquid contraction; actual contraction determined; cost of electric steel castings; fluidity and light emission; shape of risers.

STEEL, HIGH-SPEED

MANUFACTURE. Making High Grade Steel, J. A. Coyle. Iron Trade Rev., vol. 78, nos. 4 and 6, Jan. 28, Feb. 11, 1926, pp. 261 and 268-269, 3 figs., and 397-399, 1 fig. Jan. 28: Production of high-speed steel, and difficulties met with; chemical analyses of typical tool steels. Feb. 11: History of heat, with full information on analyses, practice, etc.

STEEL WORKS

BETHLEHEM STEEL WORKS. Modernization at Bethlehem's Lackawanna Steel Works. Iron Age, vol. 117, nos. 1 and 6, Jan. 7 and Feb. 11, 1926, pp. 40-45 and 404-410, 25 figs. New coke ovens, blowing engines, two structural mills and scrap plant, rebuilt openhearth furnaces and blooming mill; extensive electrification.

SUPERHEATERS

PRINCIPLE OF. Getting Added Power from Waste Heat, F. Juraschek. Indus. Mgmt. (N. Y.), vol. 71, no. 1, Jan. 1926, pp. 55-59, 5 figs. Discusses use of superheaters.

SURVEYING

INSTRUMENTS. The Owens Bore-Hole Alignment Indicator. Engineering, vol. 121, no. 3133, Jan. 15, 1926, p. 87, 3 figs. Surveying instruments designed by J. S. Owens and constructed by C. F. Casella & Co., London.

T

TELEPHONY

AUTOMATIC. How Dial Impulse Directs Automatic Switching, F. J. Dommerque. Telephone Engr., vol. 30, no. 1, Jan. 1926, pp. 34-36, 8 figs. Explains principle underlying impulse sending by aid of dial type for step by step system represented by Strowger type of switching, and for power drive system represented by panel type machine switching system of the Western Electric.

CARRIER SYSTEM. Carrier Telephone System Installed Between Sydney and Melbourne, F. A. Hubbard. Elec. Communication, vol. 4, no. 3, Jan. 1926, pp. 153-160, 8 figs. Details of new carrier system installed on an existing 600 lbs. per mile copper circuit between two cities whcih are nearly 600 miles apart by circuit route, providing three telephone channels for simultaneous telegraph and telephone operations, carried out under supervision of Bell Telephone Laboratories.

INDUCTIVE INTERFERENCE. Two International Conferences and the Inductive Interference Problem, S. C. Bartholomew. Post Office Elec. Engrs.—Jl., vol. 18, Jan. 1926, pp. 370-380. Review of international conferences on large electric high tension systems, third session in Paris and conference of International Advisory Committee on long distance telephony; protection of telephone lines against absorbing influences from strong currents at bigh tension power installations.

TERMINALS, RAILWAY

ST. PAUL, MINN. The Saint Paul Union Depot, G. H. Wilsey. Minn. Federation Architectural & Eng. Soc.—Bul., vol. 11, no. 1, Jan. 1926, pp. 11-50, 17 figs. Design and construction of new Union Station, electrical and mechanical equipment, platforms, trains sbed and tracks, elevators and ramps, subways, engine terminals, machine sbops, etc.

TERRA COTTA

PRODUCTION. Monograph and Bibliograpby on Terra Cotta, H. Wilson. Am. Ceramic Soc.—Jl., vol. 9, no. 2, Feb. 1926, pp. 94-145, 1 fig. Discusses terra cotta classes, mining, handling and mixing; drafting and plaster work; pressing and finishing; drying; slips, glazes and spraying; color work; kilns and firing, etc., Bibliography.

TESTING MACHINES

UNIVERSAL HORIZONTAL. Universal Horizontal Testing Machine. Engineering, vol. 121, no. 3133, Jan. 15, 1926, pp. 85-86, 3 figs. Details of 100-ton macbine made by A. J. Amsler & Co., Scbaffhausen, Switzerland, designed for making tensile, compression and transverse bending tests.

POWER FOR. Power for Textile Mills, Cbas. T. Main. Mech. Eng., vol. 48, no. 2, Feb. 1926, pp. 125-127 and (discussion) 127-128. Survey of possibilities of production of power by water and steam and of purchase of electric current, with conclusions as to plans to be followed by various types of mills.

TRANSFORMERS

EFFICIENCY. Transformer Efficiencies, A. Stingant. Elec. Times, vol. 69, no. 1786, Jan. 7, 1926, pp. 5-7, 3 figs. Explains by means of calculations and curves significance of statement tbat maximum transformer efficiency occurs at a load on which iron loss is equal to copper loss.

TRANSPORTATION

RAILWAY AND MOTOR-VEHICLE. Bus and Truck Operation Should Be Co-ordinated. Ry. Age, vol. 80, no. 3, Jan. 16, 1926, pp. 231-233. Abstracts of papers presented before Am. Road Bldrs.' Assn., as follows: Highway Transportation Problems, C. H. Markham; Coördination of Steam Railway and Motor-Vehicle Transportation, F. H. Alfred.

TUNNELLING

MOFFAT TUNNEL COLO. Will Hole Through Moffat Tunnel in July 1926, C. A. Betts. Eng. News-Rec., vol. 96, no. 7, Feb. 18, 1926, pp. 284-285, 1 fig. Notes on construction progress and conditions to date, construction being more than three-fourths finished.

V

VALVES

AIRPLANE-ENGINE. Internal Combustion Engine Valves, M. Mahoux. Iron Age, vol. 117, no. 5, Feb. 4, 1926, p. 339. Results of Frencb investigation to determine alloy steels best fitted to meet severe conditions; discussion of exbaust valves for airplane engines. Translated abstract form Revue de Métallurgie.

MANUFACTURE. Making Valves for Many Purposes, R. G. Skerrett. Compressed Air Mag., vol. 31, no. 1, Jan. 1926, pp. 1499-1504, 22 figs. Describes plants and equipment of the Cbapman Valve Mfg. Co. at Indian Orchard, Mass.; especially equipment using compressed air.

VENTILATION

BUILDINGS. Tbe Neutral Zone in Ventilation, J. E. Emswiler. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 1, Jan. 1926, pp. 1-16, 8 figs. Explains relation between position of neutral zone and motive heads arising from temperature differences available for causing a flow, and shows bow idea of neutral zone is helpful to a better understanding of ventilating problems, particularly bow it may be applied advantageously in ventilating large factory buildings by natural means.

TEXTILE MILLS. Ventilation of Textile Mills, C. L. Hubbard. Textile World, vol. 49, no. 1, Jan. 2, 1926, pp. 75-79, 5 figs. Discusses theory of ventilation, pure air depending upon physical conditions rather tban on chemical composition; humidity control, air movement, removal of dust and odors.

VOLTAGE REGULATION

REGULATORS. Operation of Counter-E.M.F.-Type Voltage Regulator, F. A. Byles. Power, vol. 63, no. 5, Feb. 2, 1926, pp. 171-174, 4 figs. Notes on proper protection of generators; putting regulator in and out of service; parallel operation of generators; main control and relay magnet adjustments; operation of regulating motor.

W

WASTE UTILIZATION

METHODS. The Problem of Industrial Waste Disposal, C. M. Baker. Cornell Civil Engr., vol. 34, no. 1, Oct. 1925, pp. 3-4. Discusses metbods of disposing of sewage and factory effluents; results of improper handling on public bealtb and comfort, fish, livestock, etc.; classification and analysis of different wastes; treatment and by-product recovery.

WATER FILTRATION

PLANTS. Water Filtration and Softening as Applied to Clay Products Plants, H. M. Marsh and W. J. McLelland. Contract Rec., vol. 39, no. 49, Dec. 9, 1925, pp. 1161-1163, 4 figs. Filtering and softening installation at plant of Don Valley Brick Works; fuel losses caused by scale; zeolite water softening system.

RAPID SAND. Rapid Fine Sand Filtration, H. W. Blaisdell. Am. Water Works Ass.—Jl., vol. 14, no. 6, Dec. 1925, pp. 581-597, 3 figs. Discusses filtering capacity of dry, wet or wasber consolidated sand; Montreal filtration plant, construction and testing; concludes tbat when rapid fine sand filtration is more generally understood, its use sbould increase, for cost of installation and operation is less than one-half tbat of filters now in use.

WATER MAINS

LAYING. Sterilizing a Main Laid in Polluted Ground Water, W. W. Brush. Water Wks. Eng., vol. 79, no. 1, Jan. 1, 1926, pp. 9-10 and 48, 3 figs. Discusses problem of laying pipes under leaking sewers in Rockaway, N.Y.

WELDING. Welding A Cracked 48-incb Cast Iron Pipe Under 20 Feet of Earth, W. W. Brusb, Am. Water Works Assn.—Jl., vol. 14, no. 6, Dec. 1925. pp. 550-562, 5 figs. Details of preliminary work and welding work to repair crack from the inside of pipe, operation being completely successful.

WATER PIPES

INTAKE LINE. Building a Large Intake Pipe Line in Lake Michigan, C. R. Knowles. Ry. Eng. & Maintenance, col. 21, no. 12, Dec. 1925, pp. 488-489, 5 figs. Unsual construction required to meet wave action and settlement of future embankment.

WATER POLLUTION

SEWAGE, BY. Analytical Study of the Waters of Antietam Creek, T. C. Schaetzle. Md. State Dept. Health—Bul., vol. 1, no. 2, Sept. 1925, pp. 105-141, 11 figs. Determination of degree of pollution of inland water courses by untreated and sewage, with special reference to relation of biological growths in stream to cbemical cbanges taking place therein.

WATER POWER

CANADA. Surface Water Supply of Canada, Atlantic Drainage (South of St. Lawrence River). Dominion Water Power & Reclamation Service (Canada)—Water Resources Paper no. 45, 1925, 108 pp. 1 fig. Hydrometric data on Nova Scotia, New Brunswick, Prince Edward Island, and miscellaneous measurements; meteorological data, precipitation and evaporation.

HYDRAULICS, APPLICATION OF. The Principles of Hydraulic Power, F. Johnstone-Taylor. Power House, vol. 18, nos. 19, 20, 21, 22, 23 and 24, Oct. 5, 20, Nov. 5, 20, Dec, 5 and 20, 1925, pp. 19-20, 94 19, 27-28, 23-24 and 19-20, 28 figs. Explanation of their application to power generation. Deals with flow of water in pipes and channels, effect of friction on flow, effect of inertia of water columns and application of safety devices to overcome it, power of water and measurement of flow and hydraulic gradient.

WATER SUPPLY

LAWRENCE, MASS. Lawrence Water Supply, Investigations and Construction, M. Knowles, M. Mansfield and P. Nugent. New England Water Works Assn. —Jl., vol. 39, no. 4, Dec. 1925, pp. 345-369, 2 figs. Discusses growth and population, original water works and tbeir various periods of development, needs of increased supplies, emergency constructions; types of filters, etc.

RATES. Effect of Water Rates and Growtb in Population upon per Capita Consumption, L. Metcalf. Am. Water Wks. Assn.—Jl., vol. 15, no. 1, Jan. 1926, pp. 1-21, 7 figs. Discusses determination of growth of population, increasing water 1-21, 7 figs. Discusses determination of growtb of population, increasing water consumption, per capita, decrease of per capita consumption witb increase in rates, etc.

SURFACE, CANADA. Pacific Drainage, British Columbia & Yukon Territory. Can. Dept. of Interior—Water Resources Paper, No. 47, 1925, 192 pp., 2 figs. Detail of stream flow data for year ending Sept. 30, 1924 covering Nanaimo, Fraser, Tbompson, Columbia, Kootnay, Kettle, Okanagan, Similkameen and other rivers.

VICTORIA. Supplying Water to an Area of 10,000 Square Miles, Commonwealth Engr., vol. 13, no. 4, Nov. 2, 1925, pp. 132-136, 5 figs. Details of Wimmera-Mallee scheme of domestic and stock water supply to 12,000 farm boldings in area of 11,000 sq. mi. witb 5,000 miles of channel distributing water, also supplies 31 towns.

WATER TREATMENT

CHLORINATION. Tbe Sensitivity of the Ortho-Tolidine and Starch-Iodide Tests for Free Chlorine, A. M. Buswell and C. S. Boruff. Am. Water Works Assn.—Jl., vol. 14, no. 5, Nov. 1925, pp. 384-405, 1 fig. Shows that both tests are equally sensitive, each giving positive test for 0.005 p.p.m. of excess Cl in a 50-cc. Nessler tube at room temperature; ortho-tolidine test becomes less sensitive in lower temperature, starcb-iodide test more so; behavior in presence of nitrites, iron, organic compounds, etc.

METHODS. Progress in the Purification of Water Supplies, N. J. Howard. Contract Rec., vol. 39, no. 52, Dec. 30, 1925, pp. 133-138, Advantages of double filtration, sedimentation of turbid waters pipe incrustations, goiter control, chlorination, standards for purity, etc.

WATT-HOUR METERS

CONNECTIONS. Checking the Accuracy of Watt-Hour Meter Connections, W. F. Walsb. Power, vol. 63, no. 6, Feb. 9, 1926, pp. 206-208, 12 figs. Points out some of the likely connection errors and methods of detecting them.

WELDING

ELECTRIC. *See Electric Welding, Arc.*

OXYACTEYLENE. *See Oxyacetylene Welding.*

RODS. Western Company Manufactures New Type Welding Rods, Miles C. Smith. West. Machy. World, vol. 16, no. 11, Nov. 1925, pp. 452-453, and 459, 9 figs. Describes self-hardening welding rod and "Stoodite," made by Stoody Co. of Southern California; latter is product of electric furnace and is claimed to be, after it bas been welded on, hardest known metallic substance.

STAMPINGS. Stampings Assembled by Welding, L. S. Love. Iron Age, vol. 117, no. 2, Jan. 14, 1926, pp. 123-127, 13 figs. Jigs facilitate operations and assure alignment to close limits, in one case to 0.0005 in.; press work at times more economical.

WELDS

PIPE JOINTS. Welds Made Stronger than tbe Welded Material, H. A. Woodworth. Power Plant Eng., vol. 30, no. 2, Jan. 15, 1926, pp. 149-151, 3 figs. Tests on ordinary welds show bow tbey fail; metbod by wbich welds were made that tested stronger than body of material.

WOODWORKING

TECHNICAL TRAINING IN. Technical Training in Woodworking, Thos. D. Perry. Mech. Eng., vol. 48, no. 2, Feb. 1926, pp. 108-110. Summary of replies to questionnaire sent to 750 public schools, colleges, and universities by Wood Industries Division of Am. Soc. Mech. Engrs.

X

X-RAYS

RÖENTGEN. Industrial Application of Röetgen Rays, P. W. Priestley. Indus. Chemist, vol. 1, no. 7, Aug. 1925, pp. 331-336, 10 figs. Discusses x-ray generation, Röentgen rays, photographic properties of x-rays, and application.

Engineering Index

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A

AERONAUTICS

British Development, 1925. Aeronautics in 1925. Engineer, vol. 141, nos. 3653 and 3654, Jan. 1 and 8, 1926, pp. 10-12, and 32-35 and 44, 25 figs. partly on supp. plates. Account of work undertaken during past year by British firms engaged in aeronautical industry. Jan. 1: Civil aviation; British military and civil airplanes. Jan. 8: Military and civil airplanes; helicopters; airships.

AIR COMPRESSORS

Centrifugal. Study of Centrifugal Compressors (Etude sur les compresseurs centrifuges), C. Charton. Revue Universelle des Mines, vol. 9, no. 3, Feb. 1, 1926, pp. 110-137, 28 figs. Determination of speed of compression; distribution of speed in runners; shape of blades; diffusers; power absorbed by compressors; cooling, etc.; characteristics of types of compressors; use of compressors in mines, steel works, navy yards, etc.

The Heat-Balance Method of Testing Centrifugal Compressors, M. G. Robinson. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 256-259 and (discussion) 259-260, 5 figs.

Rotary Compressors (Comment réaliser élégamment la suralimentation dans les moteurs à grande vitesse). Revue de l'Ingenieur, vol. 23, no. 1, Jan. 1926, p. 14, 1 fig. Compressor designed by Cozette particularly for use in supercharging highspeed internal-combustion engines, but suitable for other purposes as well.

AIR CONDITIONING

Aerozon System. The Aerozon Air-Conditioning System. Cold Storage, vol. 29, no. 335, Feb. 18, 1926, pp. 80-81, 2 figs. This unit consists of metal casing, with adjustable conical front nozzle and is provided with central atomizer so that combined air and water jet can be projected through front nozzle.

Carrier System. Air-Conditioning in Modern Industry. Cold Storage, vol. 29, no. 335, Feb. 18, 1926, pp. 75-79, 3 figs. Application of Carrier system, which can control any temperature within 1 deg. fahr. over range extending from zero to 300 deg., and humidity within 2 per cent.; details of hygrostat or humidity-control instrument in this system and Carrier centrifugal refrigeration.

Developments. Air-Conditioning and Cleaning, A. G. Clausen. Cold Storage, vol. 29, no. 335, Feb. 18, 1926, pp. 71-73. Notes on air-borne pests; temperature and humidity; vapor pressures; hygrometric tables; humidifier spray units; air drying; refrigeration; hot climates.

AIR COOLING

Buildings. Refrigerated Air is Cooling Buildings and Increasing Use of Coal, R. D. Hall. Coal Age, vol. 29, no. 6, Feb. 11, 1926, pp. 221-223, 6 figs. Use of refrigerated air in cafes, restaurants, dance halls, amusement palaces and hospitals.

AIR FILTERS

Developments. Air Filters Protect Equipment, W. B. Spooner. Iron Trade Rev., vol. 78, no. 9, Mar. 4, 1926, pp. 573-575, 3 figs. Damage to internal-combustion engines, turbo-generators, mill motors and air-cooled transformers by dust is prevented by passing air through cellular structures coated with sticky fluid; description of unit.

AIRPLANE ENGINES

Air-Cooled. Installation Problems on Radial Air-Cooled Engines, A. H. R. Fedden. Roy. Aeronautical Soc.—Jl., vol. 30, no. 182, Feb. 1926, pp. 83-111 and (discussion) 111-127, 26 figs. Remarks applying particularly to 9-cylinder single-row air-cooled radial.

The Advent of the Radial Air-Cooled Engine, W. L. LePage. Aviation, vol. 20, no. 8, Feb. 22, 1926, pp. 257-259, 1 fig. Great possibilities for air cooling; type supplements rather than competes with water-cooled engine.

Specifications, American and British. American and British Aero Engine Specifications. Automotive Industries, vol. 54, no. 7, Feb. 18, 1926, p. 327. Tabular data arranged alphabetically according to makes.

AIRPLANES

Airfoils. On the Pressure Distribution Round Certain Aerofoils of High Aspect Ratio, D. M. Wrinch. Roy. Aeronautical Soc.—Jl., vol. 30, no. 182, Feb. 1926, pp. 129-142, 12 figs. Records types of pressure-distribution curves obtained in a set of simple sections when characteristics of small camber, rounded leading edge and thin trailing edge found in all airfoils so far used, are retained.

Report on Aerofoil Tests at National Physical Laboratory and Royal Aircraft Establishment. Aeronautical Research Committee—Reports and Memoranda, no. 954, May 1925, 46 pp., 5 figs. Tests made in England on airfoil model.

Tests on an Aerofoil with Two Slots Suitable for an Aircraft of High Performance, F. Handley Page. Flight, vol. 18, no. 4, Jan. 28, 1926, pp. 48a—48d, 4 figs. Results of series of tests on airfoil fitted with front and rear slots; rear slot formed between portion of plane aft of rear spar and forward portion of flap; measurements of lift, drag, rolling and yawing moment.

The Effect of Sweep Back and Sweep Forward on an Airfoil, P. M. Lyons. Air Service Information Circular, vol. 6, no. 547, Jan. 25, 1926, 6 pp., 5 figs. Test to determine aerodynamic characteristics of U. S. A.-35 airfoil as result of sweeping tip section backward and forward with respect to root section.

Bending Moments. Bending Moments Obtained Graphically, M. Watter. Aviation, vol. 20, no. 8, Feb. 22, 1926, pp. 254-256, 2 figs. Graphical method of determining allowable stress in uniform section members.

Wind-Tunnel Tests. Wind Tunnel Test of Six Horizontal Tail Surface Designs Having the U.S.A.-47 Airfoil Section, P. M. Lyons. Air Service Information Circular, vol. 6, no. 511, Jan. 25, 1926, 4 pp., 5 figs. Test to determine effect of plan form and elevator size on aerodynamic characteristics.

Wing Flap Test of a DH-4B Wind Tunnel Model, P. M. Lyons. Air Service Information Circular, vol. 6, no. 552, Jan. 25, 1926, 9 pp., 12 figs. Test to determine aerodynamic characteristics of this model as affected by adjustable wing flaps.

Wings. A Study of Wing Weights, C. J. Rowe. Air Service Information Circular, vol. 6, no. 541, Oct. 1, 1925, 17 pp., 13 figs. Detail weights of various structural parts of wings and relation of these parts to whole; calculation of formula by E. P. Warner, based upon knowledge of gross weight of airplane, wing area, aspect ratio, etc.; and formula by F. S. Barnwell, requiring knowledge of only wing area and chord.

AIRSHIPS

Bracing. An Experimental Investigation Into the Properties of Certain Framed Structures Having Redundant Bracing Members, A. J. S. Pippard and G. H. W. Clifford. Aeronautical Research Committee—Reports & Memoranda, no. 977, Sept. 1925, 12 pp., 10 figs. Continuation of earlier experimental work on hexagonal braced tube, three bays in length, fitted in present case with solid keel; experiments show that with efficient bracing in plane of applied load system, stresses tend quickly to become independent of arrangement of that system and with additional bracing elsewhere a much quicker equalization of stress is produced.

ALLOY STEELS

Airplane-Engine Valves. Influence of the Thermal Zone of Working on Selection of Steels for the Valves of Airplane Engines (Influence de la zone thermique de travail sur la sélection des aciers pour soupapes de moteurs d'aviation), C. Grard. Académie des Sciences—Comptes Rendus, vol. 181, no 26, Dec. 28, 1925, pp. 1143-1145. Most suitable alloy examined was steel containing 0.4 per cent. carbon, 2.5 per cent. silicon, and 12 per cent. chromium, quenched in air at 1200 deg. and reheated to 900 deg.; valves made of this alloy retained their original polish and texture after continuous operation for 50 hours.

ALLOYS

Aluminum. *See Aluminum Alloys.*

Elastic Properties. Elastic Properties of Alloys: Variation with Composition (Propriétés élastiques des alliages: Variation en fonction de la composition chimique), P. Chevenard and A. Portevin. Académie des Sciences—Comptes Rendus, vol. 181, no. 21, Nov. 23, 1925, pp. 780-782, 2 figs. Presents curves for elastic properties of annealed carbon steels and gold-silver alloys; modulus of elasticity varies almost linearly with composition, both in alloys of two structural constituents and also in solid solutions, this being confirmed for alloys of copper with zinc, aluminum or nickel; on other hand, elastic contraction is always much less than that of pure metals.

Lead. *See Lead Alloys.*

Magnesium. *See Magnesium Alloys.*

Nickel. *See Nickel Alloys.*

ALUMINUM

Cast-welding. Cast-Welding Aluminum. Machy. (N.Y.), vol. 32, no. 7, Mar. 1926, p. 572. Process of repairing broken castings by cast-welding or burning on.

ALUMINUM ALLOYS.

Aluminum-Copper. Equilibrium Relations in Aluminum-Copper Alloys of High Purity, E. H. Dix, Jr., and H. H. Richardson. Am. Inst. Min. & Met. Engrs.—Trans., no. 1534-E, Feb. 1926, 21 pp., 5 figs. Investigation undertaken because of discrepancies in previously published results and to establish metallography and constitution of aluminum alloys free from contaminating impurities which have hampered earlier investigators.

Quenching of Light Aluminum-Copper Alloys Containing More than 5 Per Cent. of Copper (Sur la trempe des alliages légers aluminium-cuivre renfermant plus de 5 pour 100 de cuivre), L. Guillet and J. Galibourg. Académie des Sciences—Comptes Rendus, vol. 181, no. 26, Dec. 28, 1925, pp. 1107-1108. Tabulation of data on hardness and electric resistivity of castings containing 7 to 45 per cent. copper, after quenching and subsequent reheating.

Aluminum-Manganese. Sand-Cast Aluminum-Manganese Alloys, S. Daniels. Indus. & Eng. Chem., vol. 18, no. 2, Feb. 1926, pp. 125-130, 14 figs. Composition and characteristics of aluminum alloys to which manganese is added.

Aluminum-Silicon. Aluminum-Silicon Alloys (Contribution à l'étude des alliages aluminum silicium), A. Petit. Académie des Sciences—Comptes Rendus, vol. 181, no. 20, Nov. 16, 1925, pp. 718-719. Records influence of various metals and alloys on physical properties of aluminum-silicon alloys.

Castings. Aluminium-Alloy. Permanent-Mould Castings, Rob. J. Anderson. Foundry Trade, Jl., vol. 33, nos. 494, 495 and 496, Feb. 4, Feb. 11 and 18, 1926, pp. 93-94, 105-108 and 125-128, 13 figs. Feb. 4: Permanent-mold and semi-permanent-mold casting process; die-casting process; sand founding. Feb. 11: Advantages and disadvantages in comparison with sand and die castings. Feb. 18: Uses and field of application; specific kinds of castings produced in permanent molds.

Copper-Rich. The Copper-Rich Aluminum-Copper-Tin Alloys, D. Stockdale. Inst. Metals—advance paper, no. 14, for mtg. Mar. 10-11, 1926, 27 pp., 49 figs. Investigation of number of ternary alloys.

Piston. Effect of Reheating on the Al-Cu-Ni-Mg and the Al-Cu-Fe-Mg (Piston) Alloys, S. Daniels. Am. Inst. Min. & Met. Engrs.—Trans., no. 1519-E, Feb. 1926, 26 pp., 24 figs. Deals with these piston materials when tested at room temperature after having been reheated both in sand-cast and in quenched and artificially aged condition to various temperatures and different periods of time up to 50 hours.

Sand-Cast. Modification and Properties of Sand-Cast Aluminum-silicon Alloys, R. S. Archer and L. W. Kempf. Am. Inst. Min. & Met. Engrs.—Trans., no. 1544-E, Feb. 1926, 39 pp., 30 figs. Result of work bearing on control of modifying process, and of investigation of effects of alloy composition with respect to silicon and iron.

AMMONIA COMPRESSORS

Efficiency. Factors Affecting Ammonia Compressor Efficiency, J. H. H. Voss. Power, vol. 63, no. 9, Mar. 2, 1926, pp. 334-335, 2 figs. Presents G. Lehnert's 14 indicator diagrams showing mistakes in design, maintenance or operation. (Abstract.) Paper presented before Nat. Assn. Practical Refrig. Engrs.

AQUEDUCTS

Hetch Hetchy, San Francisco. San Francisco Bay Crossing of Hetch Hetchy Aqueduct. Eng. News-Rec., vol. 96, no. 11, Mar. 18, 1926, pp. 434-438, 10 figs. Methods used in laying flexible 42-in. pipe on channel bottom and in building bridge over shallows and large pier between channel and bridge sections.

AUTOMOBILE ENGINES

Turbine. Internal Combustion Turbines. Autocar, vol. 56, no. 1581, Feb. 5, 1926, pp. 207-208, 3 figs. Design evolved by Paris engineer and submitted to French government; possibilities of such an engine for both car and aviation service.

AUTOMOBILE FUELS

Tetraethyl Lead. Report of Surgeon General's Committee on Tetraethyl Lead. Indus. & Eng. Chem., vol. 18, no. 2, Feb. 1926, pp. 193-196, 2 figs. Methods used, results and conclusion.

AUTOMOBILE INDUSTRY

World Statistics. 4,608,331 Cars and Trucks Now in Use Outside U.S. Automotive Industries, vol. 54, no. 7, Feb. 18, 1926, pp. 255-258. Gain of 26.8 per cent. over last year; total in world 24,452,267, representing 14.5 per cent. increase over 1925; world registration of cars and trucks, alphabetically listed; statistics of North and South America, Europe, Asia, Africa and Oceana.

ARCHES

Concrete. Progress Report of the Special Committee on Concrete and Reinforced Concrete Arches. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 3, March 1926, pp. 136-145. Report of Conneaut (Ohio) and Danville (Ill.) bridges; pier movements, skew arches; theoretical and laboratory investigations; forecast of work still to be done.

ARMATURES

Rewinding. Rewinding Railway Armatures, J. M. Zimmerman. Elec. Ry. Jl., vol. 67, no. 8, Feb. 20, 1926, pp. 315-316, 2 figs. Descriptions, functions and location of armature rewinding insulation, core insulation and banding material will help repairman to do better job.

ASBESTOS

Uses. Asbestos—Non-Conductor of Heat, R. C. Rowe. Power House, vol. 19, no. 4, Feb. 20, 1926, pp. 26-29,4 figs. Points out that uses of asbestos are varied, but depend mostly on its remarkable heat-resisting qualities, although it is used in soaps and for other purposes; production in 1924.

AVIATION

Beacons. The Air Service Radio Beacon. Aviation, vol. 20, no. 10, Mar. 8, 1926, pp. 331-332, 3 figs. Unique method of aiding aerial navigation, developed by Radio Laboratory at McCook Field, Dayton, O.

Design Tendencies. Aviation at the Beginning of 1926 (L'aviation au début de 1926), C. Martinot-Lagarde. Technique Moderne, vol. 18, no 4, Feb. 15, 1926, pp. 103-110, 9 figs. Recent developments as to arrangement of engines, water and air cooling; power increase, compression, speed of revolution; new ideas as to most powerful engines; air screws and their control; engines of high performance; accessories, etc.

Development. High Spots in Aviation Development, J. F. Boyle. Soc. Indus. Engrs.—Bul., vol. 8, no. 2, Feb. 1926, pp. 15-24. Brief history of aviation; safety factor; comparison with Europe; air-cooled engines; light planes; 10 years' development; high-altitude flights; supercharger; bombing and racing airplanes; high speeds; propellers; future of commercial aviation; safety of airships.

B

BALANCING MACHINES

Vertical. Olsen-Lundgren Vertical Balancing Machine, no. 3, Am. Mach., vol. 64 no. 10, Mar. 11, 1926, pp. 417-418, 1 fig. Machine brought out for balancing flywheels, pulleys, clutch parts, disks and bodies that are easily handled on vertical spindle.

BEAMS

Reinforced Concrete. Bond and Anchorage in Reinforced Concrete Beams, T. D. Mylrea. West. Soc. Engrs.—Jl., vol. 31, no. 1, Jan. 1926, pp. 11-31, 30 figs. Shows fallacy of placing too much reliance upon hooks which have decided tendency to split concrete.

BELTING

Tension Ratio. The Tension Ratio and Transmissive Power of Belts, C. A. Norman. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 240-245, 9 figs. Points brought out in discussion of annual-meeting paper presented by C. A. Norman.

BLASTING

Ditch. Largest Blast Ever Made in Canada, E. Godfrey. Contrat Rec., vol. 40, no. 7, Feb. 17, 1926, pp. 140-143, 11 figs. How course of river was diverted with 205,479-lb. of explosives; details of intricate piece of construction work in connection with Isle Maligne development.

BOILER EXPLOSIONS

Gas-Fired Boilers. Explosion in the Flues of a Gas-Fired Boiler (Rauchgasexplosion in Kesselzügen), V. Hundertmark. Glückauf, vol. 61, no. 51, Dec. 19, 1925, pp. 1634-1635, 1 fig.

BOILER FEEDWATER

Conditioning. Boiler Water Conditioning, R. E. Hall. Gas Age-Rec., vol. 57, no. 8, Feb. 20, 1926, pp. 255-257. Results of 4 years' research on boiler-water conditioning with special reference to high operating pressure and corrosion (Abstract.) Paper presented at Midwest Power Conference.

Oil Elimination. Oil Elimination. Eng. & Boiler House Rev., vol. 39, no. 7, Jan. 1926, p. 342, 1 fig. Describes Paterson oil eliminator with fluxograph flow recorder and feed tank.

BOILER FURNACES

Draft. Mechanical Draught. Eng. & Boiler House Rev., vol. 39, no. 7, Jan. 1926, pp. 334-335, 3 figs. Notes on Prat system for boiler house.

Pulverized-Coal-Fired. Powdered Coal at Ashley Street Station, E. H. Tenney. Power, vol. 63, no 11, Mar. 16, 1926, pp. 404-407, 7 figs. Experiences with eight boilers equipped with unit pulverizers, water-cooled furnace walls and radiant-type superheaters at St. Louis station.

Pulverized Coal, Radiation from. Radiant Heat, E. G. Ritchie. Combustion, vol. 14, no. 3, Mar. 1926, pp. 170-175, 6 figs. Its significance in relation to pulverized-coal furnace design.

Radiation In. Radiation in Boiler Furnaces, G. A. Orrock. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 218-220, 2 figs. Radiant-heat data on locomotive and water-tube boilers fired with various fuels, and development therefrom of simple formula that permits of results being predicted with considerable degree of accuracy.

Screenings as Fuel. Loads of 200 Per Cent. Rating Carried with Screenings as Fuel, J. E. Kilker. Combustion, vol. 14, no 3, Mar. 1926, pp. 169-170. Survey provides definite, reliable and unbiased performance data in Ewing Avenue, St. Louis, and other plants.

BOILER OPERATION

Chain Grate and. Notes on Boiler and Chain Grate Operation, J. T. Ruddock-Eng. & Boiler House Rev., vol. 39, no. 6, Dec. 1925, pp. 273-274 and 277-278, 1 fig., and nos. 7 and 8, Jan. and Feb. 1926, pp. 340-341, and 388-390. Dec. 1925: Deals only with solid fuels; notes on combustion, ignition point, air for combustion, heat values and weights involved in combustion. Jan.: Practical values for coal and oil; arches and brickwork. Feb.: Side sealing with minimum supply of air; growth of cast-iron links; wet coal.

BOILER PLANTS

Equipment. New Boiler Equipment at the Interborough Rapid Transit Co.'s Fifty-Ninth Street Power Station, H. B. Reynolds, J. M. Toggart and R. S. Lane. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 246-250, 4 figs. New boilers operating at normal high load of 300-per cent. rating and supplying steam to 35,000-kw. turbines now in place will develop a capacity of approximately 7000 kw.; stokers are of Taylor HC7 type, 7 retorts and 37 tuyeres long; hand and automatic controls, boiler meters, economizers, etc.; test results.

BOILERS

Corrosion. Sidelights on Scale and Corrosion. Power, vol. 63, no. 10, Mar. 9, 1926, pp. 362-364, 6 figs. How calcium-sulphate crystals entangle calcium carbonate; simple experiment shows effectiveness of sodium hydroxide in preventing corrosion.

Locomotive. *See Locomotive Boilers.*

Scale Removal. Eliminating Boiler Scale by Agfil Process, D. A. Gardner. Power, vol. 63, no. 7, Feb. 16, 1926, pp. 261-262, 2 figs. Process invented in Europe has been in use for 3 years; apparatus consists of 3 pieces, a thermopile, vibrator and ammeter.

Stoker-Fired. Stoker-Fired Boiler Unit Develops High Efficiency. Power. vol. 63, no. 11, Mar. 1o, 1926, pp. 398-399, 3 figs. Interesting departures from usual practice are believed to be principal causes contributing to efficiency of 83 per cent. under normal plant conditions at plant of Brown & Sharpe Mfg. Co., Providence, R.I.

Waste-Heat Boilers in Steel Mills, F. H. Wilcox and J. C. Hayes. West Soc. Engrs.—Jl., vol. 31, no. 1, Jan. 1926, pp. 1-10, 5 figs. Shows that designs must be different from those used with furnaces; records of economy which have been established; use of these boilers with internal-combustion engines offers promising fields for further study.

Water-Tube. *See Boilers, Water-Tube.*

BOILERS, WATER-TUBE

Heat Transmission in. Heat Transmission in Water-Tube Boilers, C. F. Wade. Combustion, vol. 14, no. 3, Mar. 1926, pp. 163-164, 3 figs. Author believes that considerable improvement is possible in conduction stages of gas passages, in fact to possible extent of relieving radiation section from some of heavy duty now being imposed upon it; with this end in view he has devised system ot water-tube boiler construction in endeavor to get maximum possible duty from all parts of boiler alike.

BONUS SYSTEMS

Practical Application. Bonus Systems in Practice, C. F. Wade. Eng. & Boiler House Rcv., vol. 39, no. 7, Jan. 1926, pp. 325-326. Application of systems to boiler-house operators.

BORING MILLS

Side-Head. 42-inch Side-head Boring Mill. Machy. (Lond.), vol. 27, no. 693, Jan. 7, 1926, pp. 478-479, 3 figs. Important development by Webster & Bennett, Coventry.

BRAKES

Power. Power Brake Investigation Now Making Rapid Progress. Ry. Age., vol. 80, no. 6, Feb. 6, 1926, pp. 377-380, 6 figs. Progress made by Am. Ry. Assn. in investigation of power brakes and power-brake, operating appliances for freight trains of 100-car test rack located at Purdue Univ., Lafayette, Ind. See also account by H. A. Johnson in Ry. Rev., vol. 78, no. 7, Feb. 13, 1926, pp. 320-305, 5 figs.

Testing. Poser Brakes Tested at Purdue. Ry. Mech. Eng., vol. 100, no 3, Mar. 1926, pp. 151-154, 6 figs. Investigation by Am. Ry. Assn., of power brakes and brake-operating appliances for freight trains on 100-car test rack located at Purdue University, Lafayette, Ind.

BRASS

Mixing For Billets. Mixing Brass for Billets, W. J. Pettis. Metal Industry (N.Y.), vol. 24, no 3, Mar. 1926, p. 99. Ingenious, quick and practical method for controlling zinc contents of 60-40 brass.

Zinc Oxide in. Determination of Zinc Oxide in Brass, B. S. Evans and H. F. Richards. Inst. Metals—advance paper, no. 4, for mtg. Mar. 10-11, 1926, 7 pp., 1 fig. Method worked out in attempt to account for presence of certain inclusions in samples of brass.

BRASS FOUNDRIES

Methods and Equipment. From Prison Bakery to Brass Foundry, R. Micks. Can. Foundryman, vol. 17, no. 2, Feb. 1926, pp. 9-10, 3 figs. Methods and equipment of foundry in Hamilton, Ont.

BRIDGE ERECTION

Construction Methods. Use Novel Methods in Building Bridge Substructure. Ry. Age, vol. 80, no. 15, Mar. 13, 1926, pp. 795-799, 7 figs. Foundation work of unusual character and scientific methods of proportioning concrete are noteworthy features of Newark Bay projects.

BRIDGES, CONCRETE

Arch. Concrete Arch Bridge at Donner Summit, Calif. Eng. News-Rec., vol. 96, no. 9, Mar. 4, 1926, pp. 357-358, 5 figs. Bridge roadway curved on 360-ft. radius with 7-per cent. grade; new route replaces 20-per cent. grades.

BRIDGES, HIGHWAY

Cantilever. Large Cantilever Planned for Mount Hope Toll Bridge. Eng. News-Rec., vol. 96, no. 11, Mar. 18, 1926, pp. 438-439, 1 fig. Span of 1200 ft. recommended for Rhode Island bridge; trusses to have three chords.

BRIDGES, HIGHWAY

Impact Studies. Final Report of the Special Committee on Impact in Highway Bridges. Am. Soc. Civil Engrs.—Proc., vol. 52, no 3, Mar. 1926, pp. 442-453, 9 figs. Determination of observed stresses due to certain static and dynamic loads in steel floor systems, and in some cases of truss members of five steel bridges with concrete floor-slabs and seven steel bridges with plank flooring.

BRIDGES, RAILWAY

Anchorage. Anchorage and Bearing Details of Rigolets Bridge; L. & N. R.R. Eng. News-Rec., vol. 96, no. 7, Feb. 19, 1926, pp. 288-289, 3 figs. Removable anchor bolts facilitate landing spans on piers; oil boxes for roller bearings; bottom laterals.

Plate-Girder. Longest Ballasted-Deck Plate-Girder Bridge; E.J. & E. Ry. Eng. News-Rec., vol. 96, no. 8, Feb. 25, 1926, pp. 328-331, 5 figs. Girders 126 ft. 10 in. long; one end supports adjacent span; bridge with track complete erected on carriages and rolled into place; cranes remove old truss span.

Wooden. Report of Committee VII—Wooden Bridges and Trestles. Am. Ry. Eng. Assn.—Bul., vol. 27, no. 284, Feb. 1926, pp. 829-912. Commercial names for lumber and timber cut from principal species of softwoods; American lumber standards for softwood lumber; standard grades of red cedar shingles; softwood factory and shop lumber; structural grades of lumber and timber and method of their derivation; specifications for structural joist plank, beams, stringers and posts; structural grades and reference code; coded specifications for structural grades; notes on tables of working stresses; safe loads for wooden columns; value of treated timber in wooden bridges and trestles. See also (Abstract) in Ry. Age, vol. 80, no. 14, Mar. 12, 1926, pp. 775-778, 1 fig.

BRIDGES, SUSPENSION

Bear Mountain, Hudson River. The Design and Construction of the Bear Mountain Bridge Over the Hudson River, H. D. Leopold, Bklyn. Engrs. Club—Proc., vol. 24, Part 2, Jan. 1926, pp. 14-26 and (discussion) 27-30, 10 figs. Design and methods of erection of very long, high level suspended span having special anchorages, towers and floor construction; details of cable making, erection of structural steel and adjustments of anchorages and cables.

BRONZES

Brittle Ranges. The Brittle Ranges of Bronze, W. L. Kent. Inst. Metals—advance paper, no. 9, for mtg. Mar. 10-11, 1926, 8 pp., 4 figs. Brittle ranges of bronze containing up to 25 per cent. of tin have been investigated in both cast and annealed alloys by carrying out Izod impact tests at temperatures up to 700 deg. cent.; it was observed that limit of solid solubility of tin and copper is greater than had been supposed.

Properties. Physical Properties of Engineering Materials. Power Engr., vol. 21, no. 240, Mar. 1926, pp. 101-102, 3 figs. Effect of high temperatures and heat treatment on bronze corrosion.

BUSBARS

Tubular. Selection of Tubular Bus Material, J. V. Wall. Elec. World, vol. 87, no. 6, Feb. 6, 1926, pp. 299-302, 1 fig. Mechanical characteristics essential to selection; tables showing deflections, carrying capacities and other characteristics of tubular buses; test results made available.

C

CABLES, ELECTRIC

Ducts for. Chicago Ducts Ready for 132-kv. Cable. Elec. World, vol. 87, no. 7, Feb. 13, 1926, pp. 351-353, 4 figs. Will allow tying stations inside and outside city by high-voltage circuits without usual number of costly intermediate transformations; will also increase cable capacity six-fold, reduce line drop and loss and incidentally improve power factor.

Insulation. Experiments on Cable Insulation, E. G. Gilson. Elec. World, vol. 87, no. 6, Feb. 6, 1926, pp. 297-298. Laboratory tests on insulating compounds used in high-tension paper-insulated cables show effect of temperature in forming voids; methods devised to neutralize temperature changes.

Telephone. The Technics of Long-Distance Telephone Cables, E. Zopf. Eng. Progress, vol. 7, no. 1, Jan. 1926, pp. 17-20, 13 figs. Latest progress and plants.

CANALS

Problems. The Problem of the Canals, J. Eaglesome. Inst. Transport—Jl., vol. 7, no. 1, Nov. 1925, pp. 38-48. Pre-canal period; suggested lines of development; rates and wages; use of waterways; future of canals.

CARS

Hot-Box Lubrication. A Good Record on Lubrication and Hot Boxes. Ry. & Locomotive Eng., vol. 39, no. 2, Feb. 1926, pp. 53. Large increase in car mileage and reduction in number of hot boxes on Delaware, Lackawanna & Western.

CAST IRON

Corrosion. Corrosion of Cast Irons in Sulphuric Acid of Varying Concentration (Etude comparée de la corrosion des fontes dans l'acide sulfurique à divers degrés de concentration), G. Delbart. Académie des Sciences—Comptes Rendus, vol. 181, no. 21, Nov. 23, 1925, pp. 786-788. Loss in weight of different kinds of cast iron in sulphuric acid has been determined, concentration varying from 1.6 to 92.6 per cent. total SO; phosphoric or impure cast irons are more rapidly attacked than pure or malleable cast irons, difference being greatest for dilute acids; cast irons are more rapidly attacked than cold-drawn steel in dilute acid, but in concentrated oleum results are comparable, and cast irons may even be better.

Grain Growth. Further Comments on the Growth of Cast Iron at High Temperatures Brown Boveri Rev., vol. 13, no 2, Feb. 1926, pp. 58-59, 1 fig. Results of latest chemical research on structure of different substances and its application to graphitic iron.

CASTING

Problems. Some Iron Foundry Problems, J. G. Pearce. Metal Industry (Lond.), vol. 28, no. 7, Feb. 12, 1926, pp. 160 and (discussion) 161. As effective way of showing value of research knowledge in explaining difficulties met with in everyday practice, author quotes number of practical examples dealing chiefly with structural constitution of faults concerned. (Abstract.) Paper read at Manchester Assn. of Engrs.

CASTINGS

Macrostructure. The Interpretation of the Macrostructure of Cast Metals, R. Genders. Inst. Metals—advance paper, no. 6, for mtg. Mar. 10-11, 1926, 21pp., 14 figs. Deals with influence of factors which need to be taken into consideration to bring interpretation of macrostructure of non-ferrous alloys into line with that of steel; in steel ingots, commonly known regular distribution of different types of macrostructure to be due largely to relatively low conductivity of metal and resulting low rate of solidification; ingot may be considered as having solidified from volume of liquid metal of uniform temperature; where thermal conductivity of cast alloy is high, solidification is rapid, occurring concurrently with pouring; macrostructure is also partly governed by physical characteristics of alloy.

Transverse Testing. A Home-made Transverse Testing Machine, Vallishe. Foundry Trade Jl., vol. 33, no. 495, Feb. 11, 1926, p. 109, 1 fig. Details of construction and how to use machine; points out that results of this transverse test should be invaluable to many foundries; by use of it satisfactory mixing for certain classes of castings may be determined.

CATALYSTS

Industrial Application of. Principles and Methods of Catalytic Investigation, H. S. Taylor. Can. Chem. & Metallurgy, vol. 10, no. 2, Feb. 1926, pp. 35-38. List of more important industrial catalytic reactions classified as to type of reaction and type of catalyst; form of catalyst and catalyst support materials; reactions at boundaries of phases and problem of promoter action.

CEMENT

Research. Progress Report of the Special Committee on Cement. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 210-222, 1 fig. Recommendations of committee.

CEMENT MILLS

Electric Drive. Application of Electrical Equipment to Operations of a Cement Mill, R. H. Rogers and A. C. Turnbull. Can. Chem. & Metallurgy, vol. 10, no. 2, Feb. 1926, pp. 27-29, 6 figs. Discusses new plant of Natl. Cement Co. of Montreal; quarrying and crushing operations, grinding equipment, kiln operation, storage and reclaiming system, etc.

CENTRAL STATIONS

Australia. The Morwell-Yallourn Power Project. Power, vol. 63, no. 10, Mar. 9, 1926, pp. 373-374, 3 figs. New 62,500-kw. steam plant, located at Australian coal fields, burns brown coal running up to 60-per cent. moisture; chain-grate stokers, return arches and waste-heat driers are employed.

Chicago. Electric Power Development in the Chicago District, Wm. S. Monroe. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 292-293. (Abstract.) Paper read before Midwest Power Conference, Chicago.

Toronto, Ont. Toronto Station Designed for Base Load, J. H. Wells. Elec. World, vol. 87, no. 7, Feb. 13, 1926, pp. 354-356, 4 figs. Boilers use pulverized fuel; house turbines operate with automatic heat balance; unit-type control for main generators and auxiliaries.

CHAIN DRIVE

Application. Application of Chain Drives. Power, vol. 63, no. 7, Feb. 16, 1926, pp. 258-259, 8 figs. Various types of link belts and silent chain drives and how they are used in power plant.

CHIMNEYS

Capacity. How to Figure the Capacity of Chimneys, J. G. Mingle. Power, vol. 63, nos. 7, 8 and 9, Feb. 16, 23 and Mar. 2, 1926, pp. 247-248, 288-289 and 332-333. Feb. 16: Fundamental draft equation. Feb. 23: Factors determining area or diameter of chimney. Mar. 2: How to calculate draft requirements and design of chimney of minimum cost.

Design. The Importance of Proper Chimney Design, J. G. Mingle. Combustion, vol. 14, no. 3, Mar. 1926, pp. 166-168. Factors influencing design; theory for economical determination of chimney size.

CITY PLANNING

Street Planning. Arterial Street Planning in Cities, E. S. Taylor. Roads & Streets, vol. 65, no. 3, Mar. 3, 1926, pp. 145-146. Experiences in Chicago. (Abstract.) Paper before Am. Road Bldrs. Assn.

CLAY

China. Developing China Clay Deposit in Ontario, H. S. Hancock, Jr., Eng. & Min. Jl.—Press, vol. 121, no. 11, Mar. 13, 1926, pp. 441-442, 1 fig. Deposit of china clay of unusual purity is being developed on east bank of Mattagami River.

CLUTCHES

Magnetic. Magnetic Clutches. Power Engr., vol. 21, no. 240, Mar. 1926, pp. 99-100, 2 figs. Principles of operation and application.

COAL

Ash Composition. Relation of Ash Composition to the Uses of Coal, A. C. Fieldner and W. A. Selvig. Am. Inst. Min. & Met. Engrs.—Trans., no. 1529-F, Feb. 1926, 13 pp. Nature and composition of coal ash; sulphur forms in coal and coke, iron forms in coal; gas and cooking coal; coal for steam purposes; pulverized coal; manufacture of water gas; domestic use.

Briquetting. Effect of Sulfur in the Briquetting of Sub-bituminous Coal, H. K. Benson, J. N. Borglin, and R. K. Rourke. Indus. & Eng. Chem., vol. 18, no. 2, Feb. 1926, pp. 116-117, 1 fig. Attempt was made in preliminary way to modify structure of Tono (Wash.) coal, so that its fuel values and its form and structure alike enhance its commercial use; results of tests and conclusion.

By-Product Processing. The By-Product Processing of Coal, H. W. Brooks. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 233-239, 13 figs. Methods of by-product processing and converting coal into more valuable forms; carbonization of coal; complete gasification; high and low-temperature carbonization; typical low-temperature retorts.

Carbonization. Relation of Origin and State of Carbonization of Coal to Problems of Low-Temperature Carbonization, S. W. Parr. Am. Inst. Min. & Met. Engrs. —Trans., no. 1543-F, Feb. 1926, 6 pp., 2 figs. Types of coal; conditions of carbonization.

Distillation. Suggested Method of Estimating the Quantity of Heat Required for the Distillation of Coal, N. E. Rambush. Fuel, vol. 5, no. 1, Jan. 1926, pp. 12-16. By application of well-known physical laws it is possible to estimate heat required for distilling bituminous coal accurately enough for practical purposes; relation between liquor of decomposition, its temperature range of formation and internal heat of decomposition at such temperature does not yet seem to have been subject of reliable research; distillation heat required for certain coal depends principally upon design of apparatus and carbonization process used.

Spontaneous Combustion. Application of Gas Analysis to the Detection of Heatings, C. E. Morgan. Iron & Coal Trades Rev., vol. 112, no. 3022, Jan. 29, 1926, pp. 175-178, 2 figs.: also Colliery Guardian, vol. 131, nos. 3396 and 3397, Jan. 29 and Feb. 5, 1926, pp. 251-252 and 316-318, 2 figs.

Thermal Decomposition. The Initial Decomposition of Coal by Heat, M. J. Burgess and R. V. Wheeler. Fuel, vol. 5, no. 2, Feb. 1926, pp. 65-68, 1 fig. Experiments on thermal decomposition of Lancashire coking coal, showing that, whereas gases removed under vacuum up to 200 deg. cent. appeared to be occluded gases, character of gases evolved between 270 and 300 deg. pointed to their being products of decomposition of coal substance.

COAL HANDLING

EQUIPMENT. The Mechanical Handling of Coal, G. E. Titcomb. Black Diamond, vol. 76, no. 6, Feb. 6, 1926, pp. 140-141 and 147, 6 figs. Special types of equipment developed for different purposes; trend is toward larger units; economies effected by huge machines.

SYSTEM. The Installation of a Coal Handling Screening and Storing System at the Nassau Works of the Brooklyn Union Gas Co., L. S. Stiles. Bklyn. Engrs' Club—Proc., vol. 24, part 2, Jan. 1926, pp. 31-53, 19 figs. Brings out engineering features; operation of plant; construction details.

COAL INDUSTRY

BITUMINOUS. Report of Coal and Coke Committee. Am. Inst. Min. & Met. Engrs.—Trans., no. 1540-F, Feb. 1926, 16 pp., 11 figs. Capacity and over-development; growth of items of costs; fuel for railroads; past and future fuel production in United States.

COAL MINES

WASTE TREATMENT. Colliery Waste and Its Treatment, S. H. North. Colliery Eng., vol. 3, no. 24, Feb. 1926, pp. 87-89. An examination of existing conditions and possible methods of improvement.

DIRT DISPOSAL. A method of Mine Dirt Disposal, G. E. Stewart. Colliery Eng., vol. 3, no. 24, Feb. 1926, pp. 65-67, 3 figs. System developed by author in which simple cantilever, suitably braced, is substituted for elaborate built-up headgear.

SUBSIDENCE. Report of Subcommittee on Coal Mining to Committee on Ground Movement and Subsidence. Am. Inst. Min. & Met. Engrs.—Trans., no. 1546-F, Feb. 1926, 65 pp., 33 figs. Considers effects of subsidence under following heads: (1) those due to squeezes, or subsidence where pillars have not been withdrawn; (2) those in upper seams, due to mining seams beneath them; (3) those due to mining by room and pillar system; (4) those due to mining by longwall system.

COAL STORAGE

BITUMINOUS COAL. Design of Stores for Bituminous Coals, G. Gardiner. Gas Jl., vol. 173, no. 3273, Feb. 3, 1926, pp. 283-288, 8 figs. Considers proper method of storing coal, and describes design for ideal coal storage plant. Paper read before Junior Gas Assn. See also Gas World, vol. 84, no. 2168, Feb. 6, 1926, pp. 121-125, 3 figs.

COILS

WINDING. Some Mechanical Principles in Coil Winding. Machy. (Lond.), vol. 27, no. 694, Jan. 14, 1926, pp. 502-508, 11 figs. Their application for small coils for electrical and wireless purposes.

COLUMNS

BATTEN-PLATE. Batten-Plate Columns: Their Status and a Design Theory, R. Fleming and W. H. Weiskopf. Eng. News-Rec., vol. 96, no. 10, Mar. 11, 1926, pp. 412-414, 9 figs. American and European attitudes; faults in tests of Am. Ry. Eng. Assn.; proposed method of calculation.

STEEL. Progress Report of the Special Committee on Steel Column Research. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 146-209, 17 figs. Relation of strength of relatively short columns to elastic properties of metal; tabular data on relation of strength of short columns to yield point of metal; mill and laboratory tests for elastic limit; comparison of tensile and compressive useful limit points; results of tests on columns of all lengths and showing integral action; effect of various details of strength of columns.

COMBUSTION

CONTROL. Automatic Combustion Control, H. W. Hollands. Eng. & Boiler House Rev., vol. 39, no. 8, Feb. 1926, pp. 375-376. Discusses problems of control. (Abstract.) Paper read before Elec. Power Eng.'s Assn.

CONCRETE

CURING. Studies of Curing Concrete in a Semi-Arid Climate, C. L. McKesson. Eng. News-Rec., vol. 96, no. 11, Mar. 18, 1926, pp. 452-453, 2 figs. Use of substitutes for water curing justified where no water can be had; seven days' water curing sufficient.

FROZEN. How to prevent and to Restore Frozen Concrete, A. M. Bouillon. Eng. News-Rec., vol. 96, no. 10, Mar. 11, 1926, pp. 408-410, 2 figs. Effect of frost upon freshly made concrete with suggestions on how to discover and restore frozen concrete.

CONDUITS

WATER-SUPPLY. The Queen Mary Reservoir Conduit. Engineer, vol. 141, nos. 3657 and 3658, Jan. 29 and Feb. 5, 1926, pp. 131-133 and 142-145, 19 figs. Details of aqueduct or conduit which is to convey water from reservoir to various works of Metropolitan Water Board, where it will be treated before being distributed; arrangement of gage basin; method of constructing conduit; method employed for excavating trench and putting in conduit.

CONTRACTING

CONTRACTING. Standard Construction Contracts. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 225-241. Standard agreement for engineering construction; standard general conditions.

CONVERTERS

ROTARY. A Rotary Converter Experience, J. Simpson-Tyler. Power Engr., vol. 21, no. 240, Mar. 1926, pp. 105-106. Discussion, in simple terms, of steps taken to improve operation of unstable machine.

SYNCHRONOUS, VS. MOTOR GENERATORS. Synchronous Converters Versus Motor Generators, C. O. Mills. Power, vol. 63, no. 10, Mar. 9, 1926, p. 364. Studies question of which is more economical to use for converting alternating into direct current for industrial loads.

CONVEYORS

FACTORY. Controlling Production Mechanically, Wm. F. Bailey. Factory, vol. 36, no. 2, Feb. 1926, pp. 262-265, 340, 342, 344, 346, 348 and 350, 14 figs. Details of conveyor system designed and laid out at plant of Hoover Co., North Canton, O., to permit accurately timed dispatch of stock from central stores and control department to machine and assembly operations, handling of active stock in course of manufacture with minimum amount of physical labor, cutting down number of inspectors required, use of ceilings as trucking aisles, eliminating 75 per cent. of trucks, etc.

MACHINE-HOUR RATE SYSTEM. New Cost Basis for Material Handling, F. E. Moore, Mfg. Industries, vol. 11, no 3, Mar. 1926, pp. 169-170, 4 figs. Modified form of machine-hour rate system applied to conveyors.

COOLING TOWERS

DESIGN. Design of Cooling Towers (Considerations générales sur les tours réfrigeration: éléments de calcul et essais), J. Vassiliere-Arlhac. Revue Générale de l'Electricité, vol. 19, no. 1, Jan. 2, 1926, pp. 22-29, 9 figs. Presents theoretical examination of problem of cooling towers, which leads to graphical and mathematical method of dimensioning such towers for given amount of water and desired temperature gradient; an actual example reduces writer's formulas to concrete facts; recommends employment of electrical remotely indicating thermometers as means to gain permanent control of power performance of these towers.

COPPER

ANNEALING. Annealing of Commercial Copper to Prevent Embrittlement by Reducing Gases, S. B. Leiter. Am. Inst. Min. & Met. Engrs.—Trans., no. 1525-F, Feb. 1926, 7 pp., 15 figs. Results of investigations begun in 1921, which seem to show that although cuprous oxide may be only slightly soluble (1) this solubility is sufficient to allow coalescence of cuprous oxide globules, (2) that by proper annealing of copper, cuprous oxide that exists at grain boundaries in solid solution or in finely divided state can be brought together into larger globules and when so coalesced this reduction by hot reducing gases does not cause embrittlement.

CASTINGS. Exudations on Copper Castings, W. H. Bassett and J. C. Bradley. Am. Inst. Min. & Met. Engrs.—Trans., no. 1520-E, Feb. 1926, 6 pp., 21 figs. Beads of metal frequently appear at ends of cast-copper wire bars and on sides of wedge cakes near top; these are richer in cuprous oxide than rest of casting; micrographical study of exudations; suggests that material is forced through surface while copper is solidifying; photomicrographs.

COLD-ROLLED. The Hardness of Cold-Rolled Copper, S. L. Hoyt and T. R. Schermerhorn. Inst. Metals—advance paper, no. 7, for mtg. Mar. 10-11, 1926, 24 pp., 6 figs. Results of hardness tests of 2 series of cold-rolled copper bars, one which had received a 2-per cent. and one a 10-per cent. reduction in thickness per pass.

HARDNESS. Hardness of Copper, and Meyer's Analysis, S. L. Hoyt and T. R. Schermerhorn. Am. Inst. Min. & Met. Engrs.—Trans., no. 1527-E, Feb. 1926, 15 pp., 4 figs. Tests of two bars of annealed electrolytic copper in which methods of Meyer's analysis of ball indentation tests were employed.

SCRAP RECOVERY. The Recovery of Scrap Copper, A. Bregman. Metal Industry (N.Y.), vol. 24, no. 3, Mar. 1926, pp. 102-104. Sources of scrap copper; sampling; methods of recovering clean copper; eliminating metallic impurities; refining brass scrap; metal melting precautions; recovering pickling solutions.

SOLDERING. Some Experiments on the Soft Soldering of Copper, T. B. Crow. Inst. Metals—advance paper no. 3, for mtg. Mar. 10-11, 1926, 14 pp., 20 figs. Experimental work upon soldering of copper, using tin-lead solder of eutectic composition; certain facts, microscopic evidence and theories on soldering of copper.

COST ACCOUNTING

SMALL FACTORIES. Summarizing Costs for the Directors, R. Rosenthal. Mfg. Industries, vol. 11, no. 3, Mar. 1926, pp. 179-184, 4 figs. General review of work of compiling production and cost figures for monthly closing; explaining more explicitly how final presentation of them is worked out.

CULVERTS

JACKING THROUGH EMBANKMENT. Jacking Culvert Through Embankment Cuts Cost Two-Thirds, W. C. Swartout. Ry. Eng. & Maintenance, vol. 22, no. 3, Mar. 1926, pp. 101-104, 3 figs. Missouri Pacific demonstrates marked economy of this practice in two instances.

CUTTING METALS

INGOTS. Cutting Ingots and Heavy Metal Masses, E. E. Thum. Forging—Stamping—Heat Treating, vol. 12, no. 2, Feb. 1926, pp. 57-59, 1 fig. Outlines methods whereby large masses or blocks of iron and steel may be cut to handling size for oxygen lance.

D

DAMS

EARTH AND MASONRY. Sennar Dam on the Blue Nile in Egypt Completed. Eng. News-Rec., vol. 96, no. 8, Feb. 25, 1926, pp. 316-317, 3 figs. Earth and masonry structure nearly 2 miles long; water diverted to extensive irrigation system.

LAKE KENOGAMI, QUEBEC. Eleven Dams Make Storage Reservoir of Lake Kenogami, A. F. Dyer. Eng. News-Rec., vol. 96, no. 10, Mar. 11, 1926, pp. 404-408, 8 figs. Dams, dikes and fills are making Lake Kenogami into 15,000,000,000-cu. ft. storage reservoir for water power on Ausable and Chicoutimi rivers; muck and boulder formation make difficult excavation; winter concreting; embankment cofferdams.

MULTIPLE-ARCH. Multiple Arch Reinforced Concrete Dam, H. Speight. Can. Engr. vol. 50, no. 6, Feb. 9, 1926, pp. 201-204, 7 figs. Granby Consolidated Mining, Smelting & Power Co. build interesting type of dam at Anyox, B.C.; it is 138 ft. high and 680 ft. across crest; consists of 26 arches supported by 27 buttresses with walls for end connections; siphon spillways, etc.

OVERFLOW. High Overflow Dam Main Unit of Baker Power Plant (Wash.). Eng. News-Rec., vol. 96, no. 9, Mar. 4, 1926, pp. 360-362, 5 figs. Part of diversion tunnel also serves power uses; final tunnel blast admits water; features of dam and plant.

DIE CASTING

ALUMINUM ALLOYS. The Die-Casting of Aluminium Alloys—A Review of Current Methods, G. Mortimer. Inst. Metals—advance paper, No. 11, for mtg. Mar. 10-11, 1926, 27 pp., 13 figs. Deals with slush, gravity, centrifugal, Cothias and pressure casting.

DIESEL ENGINES

INDUSTRIAL PLANTS. The Diesel Engine in the Industries, M. Rotter. Power, vol. 63, no. 10, Mar. 9, 1926, pp. 369-370. Evaluates Diesel engine in meeting, various factors that enter into selection of prime mover for industrial-plant service; suggestions as to suitability of oil, quantity and quality of cooling water, maintenance and fixed charges. Articles based on paper before Midwest Power Conference.

DILATOMETERS

DIFFERENTIAL. A New Universal Differential Dilatometer (Ein neues Universal-Differential-Dilatometer), H. Esser and P. Oberhoffer. Stahl. u. Eissen, vol. 46, no. 5, Feb. 4, 1926, pp. 142-147, 9 figs. Design and operation of new dilatometer with which relation between dilatometric, magnetic and electric properties and temperature can be investigated photographically by self-recording means.

DRILLING MACHINES

DIAMOND. The Diamond Drill and its Methods, J. A. MacVicar. Colliery Guardian, vol. 131, nos. 3398 and 3399, Feb. 12 and 19, 1926, pp. 374-375 and 444-445, 5 figs. Machine and methods for testing of mineral deposits by boring. Paper read before Min. Soc. of Leeds Univ.

E

ELECTRIC CONDUCTORS

CYLINDRICAL. Problems in Connection with Two Parallel Electrified Cylindrical Conductors, A. Russell. Instn. Elec. Engrs.—Jl., vol. 64, no. 350, Feb. 1926, pp. 238-242, 2 figs. Electrostatic problems in connection with two unequal parallel cylinders and with single-core cables when axes of cores are parallel but not coincident with axes of outer cylinders; solutions are given by formulas.

ECONOMICAL SIZE. Economical Wire Size for Lighting Secondaries, H. S. Litchfield. Elec. World, vol. 87, no. 9, Feb. 27, 1926, pp. 449-452, 4 figs. New circuit cost equation based upon loss in lighting revenue due to secondary line drop; development and use of charts for ready application.

MECHANICAL ENGINEERING. The Mechanical Engineering Curriculum, J. L. Harrington. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 201-204. Summary of replies to questionnaire sent to 500 members of the Am. Soc. Mech. Engrs. indicating need for particularly sound training in all subjects given, and for more cultural and elementary scientific subjects in the usual four-year course.

ELECTRIC DRIVE

FRACTIONAL MOTORIZING. Search for Economy Alters Motor Drive, R. H. Rogers. Mfg. Industries, vol. 11, no. 3, Mar. 1926, pp. 171-174, 9 figs. Practice of motorizing of each power-using part of single machine is being rapidly adopted for machines of complex nature with gratifying results; typical examples.

GROUP VS. INDIVIDUAL MOTOR. Group Versus Individual Motor Drive, L. F. Leurey. Elec. World, vol. 87, no. 7, Feb. 13, 1926, pp. 347-351, 4 figs. Process of manufacture largely determines most suitable type of drive to be employed; basic principles given.

ELECTRIC FURNACES

ANNEALING. Annealing Iron and Steel Electrically, H. Fulwider. Blast Furnace & Steel Plant, vol.14, no. 3, Mar. 1926, pp. 130-132, 4 figs. Aging, normalizing and annealing of iron and steel, and typical electric-furnace installations; aging large castings. Report prepared for Nat. Elect. Light Assn.

ARC. Builds Arc Furnaces in Small Sizes. Iron Trade Rev., vol. 78, no. 10, Mar. 11, 1926, p. 635, 2 figs. Device of small units, made by Pittsburgh Electric Furnace Corp. for use in technical schools, research laboratories and industrial plants.

ECONOMIC OPERATION. Economic Operation of Electric Furnaces, R. S. Kerns. Blast Furnace & Steel Plant, vol. 14, no. 3, Mar. 1926, pp. 133-135, 6 figs. Results of tests and records made during operation of 5 standard sizes of well-known melting furnaces.

STEEL. Electrical Furnace Competes with Oil for Annealing Steel Castings. Elec. World, vol. 87, no. 10, Mar. 6, 1926, pp. 512-513, 2 figs. 250-kw. resistance type of furnace built by Electric Furnace Co. and installed in foundry of Milwaukee Steel Foundry Co., Milwaukee, Wis.; comparison with oil-fired furnace.

ELECTRIC LOCOMOTIVES

CLASSIFICATION. Electric Locomotive Classification, D. C. Hershberger. Ry. Age, vol. 80, no. 9, Feb. 27, 1926, pp. 525-526, 1 fig. New system proposed which is simple and does not have limitations of White system; it is modification of that used by continental European manufacturers.

THREE-PHASE. Three-Phase Electric Locomotive, Italian State Railways. Ry. Gaz., vol. 44, no. 8, Feb. 19, 1926, p. 246, 1 fig. Experimental design to meet special requirements.

ELECTRIC METERS

HIGH-TENSION EXCHANGE POWER FOR. Metering Exchange Power, J. H. Paget and R. P. Crippen. Elec. World, vol. 87, no. 10, Mar. 6, 1926, pp. 503-504, 3 figs. Practice of Great Western Co. for measuring high-tension exchange energy; high-tension metering equipment and methods; metering when using tertiary winding.

ELECTRIC MOTORS, D.C.

COMMUTATION. Commutation Troubles in Direct Current Motors and Generators, E. B. Stavely. Modern Min., vol. 3, no. 2, Feb. 1926, pp. 32-36, 7 figs. Causes and remedies of troubles in motors and generators; eliminating sparking, basic causes of sparking, reddish-brown sparks, bluish-white sparks, grooving of commutator, etc.

ELECTRIC MOTORS

INTERPOLES. Checking the Polarity of Interpoles, C. O. Mills. Power, vol. 63, no. 8, Feb. 23, 1926, p. 284, 3 figs. Shows relation between interpole polarity and that of main poles; points out that it is necessary that interpoles have correct polarity if machine is to operate satisfactorily; position of brushes.

ELECTRIC RAILWAYS

COMBINATION LOCOMOTIVE-CAR. Combination Locomotive-Car Developed in Switzerland. Elec. Ry. Jl., vol. 67, no. 8, Feb. 20, 1926, pp. 321-322, 3 figs. Twelve-wheel vehicle consists of 6-wheel passenger coach permanently coupled to 6-whee motive power unit; unusual safety devices are provided.

DEVELOPMENTS. Ten-Year Statistics Show Gain in Electric Railway Conditions, A. S. Richey. Elec. Ry. Jl., vol. 67, no. 7, Feb. 13, 1926, pp. 281-282. In decade, electric railways in large and small cities have had increases in revenue and traffic per inhabitant and show more economical use of cars.

ELECTRIC TRANSMISSION LINES

CALCULATIONS. Circuit Constants in Transmission-Line Calculations, A. C. A. Caldwell. Instn. Elec. Engrs. Jl., vol. 64, no. 350, Feb. 1926, pp. 243-252, 7 figs. Deals with use of circuit constants for calculation of transmission-line problems; develops formulas for calculating constants of series and parallel circuits; methods for dealing with more complex cases of lines supplying more than one substation and branching lines.

GROUNDING OF NEUTRAL. Grounding Bank for Neutral Resistor, L. A. Terven. Elec. World, vol. 87, no. 10, Mar. 6, 1926, pp. 497-500, 10 figs. Has advantages over use of tertiary windings; West Penn. Co. uses about 20 ohms in neutral resistor for large 25-kv. system; details of installation and design.

132-KV. Toronto Plant Tied in by 132-Kv. Line, J. H. Wells. Elec. World, vol. 87, no. 9, Feb. 27, 1926, pp. 455-456, 2 figs. Forty-mile line connects station with Boardman substation at Youngstown, O.; insulator strings equipped with rings and horns; substation designed for ultimate capacity of 500,000 kva.

OVERHEAD. Overhead Pole Lines. Elec. Times, vol. 68, no. 1772, Oct. 1, 1925, pp. 365-367, 7 figs. Stobie steel and concrete pole used in Australia for cross country-lines, consisting of two light standard rolled steel joists or channel sections, forming main outside tension and compression members; held at their correct distances apart, and with their proper taper from base to top of pole, by bolts passing through webs of sections at carefully determined intervals.

ELECTRICAL MACHINERY

MAINTENANCE. Handling Maintenance and Repairs on 4000 Motors, W. Rassmussen. Industrial Engr., vol. 84, no. 2, Feb. 1926, pp. 50-56 and 81, 9 figs. Methods of maintenance at Studebaker Corpn., South Bend plant, equipment of which comprises motors ranging in size from ⅛ to 700 h.p., portable electric hand tools, battery tractors, cranes, etc.; motor record systems and forms used, battery charging and repair, etc.

ELEVATORS

LOCATING FAULTS. Locating Faults in Electric Elevators—Mechanical Equipment, C. A. Armstrong. Power, vol. 63, no. 7, Feb. 16, 1926, pp. 249-252, 6 figs. Mechanical troubles that may develop in drum and in traction-type elevator machine and what to do to overcome these difficulties.

EMPLOYEES

STOCK OWNERSHIP. The Rise of Employee Stock-Ownership, O. Tead. Indus. Mgmt. (N.Y.), vol. 71, no. 3, Mar. 1926, pp. 157-160. Possibilities and dangers of this trend in business and industry.

EMPLOYMENT MANAGEMENT

DAY AND NIGHT SHIFTS. Need for Greater Co-operation Between Day and Night Shifts. Indus. Mgmt. (Lond.), vol. 13, no. 1, Jan. 1926, pp. 20-21. Plea for better co-operation between day and night shifts in works and factories; points out that complaints concerning heavy expense involved in running night shifts would be minimized if executives would encourage spirit of closer co-operation between workmen and officials in shops.

EMPLOYMENT PLANS. Guaranteeing Full Time Earnings, H. Feldman. Indus. Mgmt. (N.Y.), vol. 71, no. 3, Mar. 1926, pp. 133-138, 2 figs. Plan of Crocker-McElwain Co.; rewarding length of service; comparison with plans of other firms; effect upon employees' length of service; worker protected against arbitrary discharge.

METHODS. The Management of Men in Industry, J. S. Gray. Machy. (N.Y.), vol. 32, no. 6, Feb. 1926, pp. 445-447. Methods of managing employees; relieving monotony of repetition work; keeping a man interested in his job; providing opportunity for promotion.

ENGINEERING

ECONOMICS. Economics of Engineering, D. Adamson. Instn. Mech. Engrs.—Proc., no. 1, 1926, pp. 27-33. Deals with internal economics of workshop which come within technical administration, and external economics of business or commercial administration. (Abridged.)

ENGINEERS

INDUSTRIAL OPPORTUNITIES. Opportunities for Engineers in Industry, J. O. G. Gibbons. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 261-262. Necessity of advising preparatory-school and engineering-college graduate about the duties, opportunities, and responsibilities of engineer, so that he may make more intelligent choice of his profession.

RIGHTS AND DUTIES. The Engineer: His Due and His Duty in Life, T. Carter. Instn. Elec. Engrs.—Jl., vol. 64, no. 350, Feb. 1926, pp. 193-220 and discussion 220-233. Rise of modern engineering; finding and training of engineers; principles and problems; engineers and public life.

STATUS, 1815 AND 1918. The Engineer's Prospects After 1815 and 1918, J. W. Hall. Instn. Mech. Engrs.—Proc., no. 1, 1926, pp. 13-26, 4 figs. Review of England's position during past century; industrial conditions; engineers' wages, etc.

EXPLOSIVES

LIQUID OXYGEN. Liquid Oxygen as an Explosive, F. W. O'Neill and H. VanFleet. Am. Inst. Min. & Met. Engrs.—Trans., no. 1562-A, Feb. 1926, 42 pp., 40 figs. Present status and possibilities of liquid oxygen as explosive based upon investigations, research and practical work of Ingersoll-Rand Co. and Air Reduction Co. from 1922 to date. See also Coal Age., vol. 29, no. 10, Mar. 11, 1926, pp. 358-362, 6 figs.

F

FANS

CENTRIFUGAL. Operating Characteristics of Centrifugal Fans and Use of Fan Performance Curve, L. W. Huber. Am. Inst. Min. & Met. Engrs.—Trans., no. 1542-A, Feb. 1926, 14 pp., 6 figs. Definite pressure necessary to force given quantity of air; manometric efficiency; improvement in design; classification of fans; performance under mine conditions; effect of increase in pressure; horsepower required by mine fan; Illinois statistics.

FILTRATION PLANTS

OPERATION. Operation of Waterworks Filter Plants, A. V. Graf. Can. Engr., vol. 50, no. 8, Feb. 23, 1926, pp. 249-252. Points out that success depends in great measure on care exercised in operation; filtering action of sand-washing periods and procedure to be followed; application of chemicals. Paper presented before Missouri Conference on Water Purification.

FLOOD CONTROL

PROBLEMS. Flood Control in the Southwest and Elsewhere. Eng. News-Rec., vol. 95, no. 10, Mar. 11, 1926, p. 411. Abstracts of papers at meeting of National Drainage Congress.

FLUIDS

RESISTANCE TO MOVING SPHERES. Fluid Resistance to Moving Spheres, R. G. Lunnon. Roy. Soc.—Proc., vol. 110, no. A754, Feb. 1, 1926, pp. 302-326, 8 figs. Measurement of times of fall of spheres from 0.2 to 10.2 cm. diam. through distances up to 537 m.; analysis of motion has provided new data on variation of resistance with speed and acceleration; experiment in which roughening of surface reduced resistance to motion.

FOREMEN

DUTIES. The Foreman's Place in an Organization, J. S. Gray. Machy. (N.Y.), vol. 32, no. 7, Mar. 1926, pp. 547-549. Foreman's position in business and his responsibilities; methods of supervising work; required qualifications.

FORGING

SWAGE BLOCKS. Swage Blocks, (Les matrices d'estampage à chaud), R. Barat. Arts et Metiers, vol. 78, no. 62, Nov. 1925, pp. 462-472, 30 figs. Discusses behavior of swage blocks, wear by heat and impacts; steels for blocks and their composition and properties; tapering; power required, dimensions of swage blocks, etc.

FOUNDRIES

STANDARDIZATION. Standardization in Modern Foundry Practice, M. J. Cooper. Foundry Trade Jl., vol. 33, no. 496, Feb. 18, 1926, pp. 129-132, 6 figs. Operations calling for standardization, such as sand density, preparation of facing sand, standardization of rammers and molding boxes, loam-molding equipment, runner plugs and skimmers, cupola practice, foundry cranes, etc., standardization of foundry accessories and materials.

FUELS

INDUSTRIAL PROCESSES. The Economy of High Cost Fuels, L. H. George. Indus. Mgmt. (N.Y.), vol. 71, no. 2, Feb. 1926, pp. 85-87, 2 figs. Cost per B.t.u. is not determining factor in industrial processes; in many cases most expensive fuel proves to be, paradoxically, the least expensive.
(*See also Coal; Oil Fuel.*)

FURNACES, INDUSTRIAL

GAS-FIRED. Furnaces. J. Fallon. Gas. Jl., vol. 173, no. 3273, Feb. 3, 1926, pp. 281-283. Advantages of burning coal gas in industrial furnaces; describes small universal-type furnace; recuperation in small furnaces; heavy-type recuperative billet-heating furnaces; cost relationship of furnaces operated by various fuels. Paper read before Junior Gas. Assn. See also Gas World, vol. 84, no. 2169, Feb. 13, 1926, pp. 150-152.

G

GAS ENGINES

EXHAUST-GAS UTILIZATION. Steam Generation and Low Temperature Carbonization by Means of Gas Engine Exhausts, D. Brownlie. Eng. & Boiler House Rev., vol. 39, no. 8, Feb. 1926, pp. 370-372 and 374, 2 figs. Describes installation at works of Staveley Coal & Iron Co.; exhaust of gas engine is being used experimentally for low-temperature carbonization of coal and refuse.

GASES

Explosive Gas-Air Mixtures. Gaseous Combustion at Medium Pressures, R. W. Fenning. Roy. Soc. of London—Philosophical Trans., vol. 225, no A633, pp. 331-356, 17 figs. Details of experiments with air-fuel explosions at the Natl. Physical Laboratory, giving results as to influences of hydrogen-air and water vapor on carbon monoxide-air explosion, and on methane-air explosion over comparatively wide range of initial temperature and pressure.

GEAR CUTTING

Automobile Gears. Hobbing Automobile Transmission Gears. Machy. (N.Y.), vol. 32, no. 6, Feb. 1926, pp. 483-484, 5 figs. High-production methods used in roughing out gears at the new Ajax automobile plant.

GEARS

Internal. A New Development in Interal Gearing. A. Fisher. Machy. (Lond.), vol. 27, 697, Feb. 4, 1926, pp. 616-618, 5 figs. Discussion based on article by H. Walker, published in Nov. 26, 1925, issue of same journal.

Involute or Enveloping Tooth. Involute or Enveloping Tooth? H. Walker. Machy. (Lond.), vol. 27, no 694, Jan. 14, 1926, pp. 509-511, 3 figs. Comparison shows that enveloping tooth avoids friction of approach; tooth form is suitable for load carrying and permits better lubrication than involute, but it is doubtful whether their wearing properties would differ greatly; for equal obliquities and depths of tooth, involute has greater arc of contact than enveloping gear, and consequently less load per tooth to withstand; enveloping gear is not well adapted for reversing driving shafts.

Long-Toothed. Long-Toothed Gears—Comment, H. Walker. Machy. (Lond.), vol. 27, no. 695, Jan. 21, 1926, pp. 556-559, 9 figs. Outline of simplest methods to be pursued when designing varying center distance gears; based on article under above title in Nov. 19, 1925, issue of same journal.

Maintenance. When Should Pinions and Gears be removed for Tooth Wear? E. S. Sawtelle. Elec. Ry. Jl., vol. 67, no. 8, Feb. 20, 1926, pp. 323-324, 4 figs. Points out that gages can be used successfully on large majority of present-day gears and pinions to determine when teeth are worn out.

Manufacture. A Western Plant for Quantity Production of Gears. West Machy. World, vol. 17, no. 2, Feb. 1926, pp. 57-60, 8 figs. Practice and machine tools of Ralph N. Brodie Co., Oakland, Cal., in manufacture of gears for automotive replacement trade.

Ratchet and Screw-and-Nut. Link-Work, Cams and Tappets and Ratchet and Screw-and-Nut Gearing. Abridgements of Specifications, class 80 (iii), period 1916-20, 1925, 82 pp. Patents for inventions.

Spacing. Excessive Gear Spacing Causes Trouble. Elec. Ry. Jl., vol. 67, no. 8, Feb. 20, 1926, pp. 317-318, 5 figs. Model shows how noise and wear and breakage of teeth follow rapidly with increases in distance between centers of gear and pinion.

GOLD MINING

Nova Scotia. Gold Mining in Nova Scotia, J. C. Murray. Can. Inst. of Min. & Metallurgy.—Bul., no. 166, Feb. 1926, pp. 271-286, 6 figs. Discusses causes of decline of gold mining; Rickard report to the Government on its condition; advocates opening up large bodies of low and medium grade ores.

GOLD METALLURGY

Milling and Cyanidation. Treatment of the Telluride-Bearing Gold Ores of the Wright-Hargreaves Mines, Ltd., W. A. Mueller, J. E. Grant and C. L. Heath. Am. Inst. Min. & Met. Engrs.—Trans., no. 1549-D, Feb. 1926, 12 pp., 2 figs. Present milling system; experiments of flotation of mill tails; flotation of mill pulp in cyanide circuit; nature and treatment of concentrate; bromocyanide process for telluride ores.

GRAPHITE

Properties and Uses. Graphite a Mineral of Increasing Value, R. C. Rowe. Compressed Air Mag., vol. 31, no. 3, Mar. 1926, pp. 1569-1573, 11 figs. Chemical nature of mineral; flotation process; various uses.

GRINDING

Disk. Modern Applications of Disk Grinding, F. W. Curtis. Am. Mach., vol. 64, no 10, Mar. 11, 1926, pp. 385-389, 10 figs. Variety of examples of work being successively ground on hand, semi-automatic and automatic grinding machines.

Flyhobs. A New Method of Grinding Flyhobs, H. E. Merritt. Machy. (Lond.), vol. 27, no. 694, Jan. 14, 1926, pp. 518-520, 6 figs. Method of finish-grinding relief of such tools.

GRINDING MACHINES

Internal. Herald "Size-matic" Internal Grinding Machine. Am. Mach., vol. 64, no. 9, Mar. 4, 1926, pp. 377-378, 2 figs. By use of this machine, holes that are parallel or tapered, plain or splined, may be ground continuously and automatically to size within very close limits.

GYPSUM

Mining and Refining. The Mineral Gypsum and Its Uses, R. C. Row Can. Machy., vol. 35, no. 7, Feb. 18, 1926, pp. 11-14, 3 figs. Discusses origin, composition and uses in smelting of copper and lead ores; plaster of Paris as a retarder for portland cement.

Ontario. Gypsum in Ontario, G. E. Cole. Ontario Dept. of Mines—Annual Report, vol. 34, pt. 2, 1925, pp. 1-34, 5 figs. Occurrences; geology; variety of gypsum mined; use of uncalcined and calcined gypsum, plaster mill and classification of plaster, etc.

H

HEAT TREATMENT

Fuel for. Fuel for Heat-Treatment of Metal, C. D. Barnhart. Can. Machy., vol. 35, no. 6, Feb. 11, 1926, pp. 19-20. Discusses quality and cost of finished product as determinative tests, not cost of fuel, labor, etc.; proper field of use for each form of fuel and its limitations; determining suitable combination for given requirements.

HEATING

Liquids and Gases. Heating Liquids and Gases. Abridgements of Specifications, class 64 (i), period 1916-20, 1925, 110 pp. Patents for inventions.

HIGHWAYS

Maintenance. Resurfacing and Maintenance by Contract, G. F. Schlesinger. Roads & Streets, vol. 65, no. 3, Mar. 3, 1926, pp. 155-159, 6 figs. Possibilities of future field for contractor. Paper before Am. Road Bldrs. Assn.

HOUSES

Iron and Steel. The Dwellings of To-morrow, P. Winchell. Iron Age, vol. 117, nos. 9 and 10, Mar. 4 and 11, 1926, pp. 613-615 and 686-687, 7 figs. Economic study in residential construction showing why growing use of iron and steel is inevitable. Points out that use of iron and steel in residential construction will result in safer and healthier homes.

HYDRAULIC PRESSES

Patent Specifications. Hydraulic Presses, Meters, Motors and Like Apparatus for Use with High Pressures. Abridgements of Specifications, class 69 (ii), period 1916-20, 1925, 103 pp. Patents for inventions.

HYDRAULIC TURBINES

Governors. Hydraulic-Turbine Governing Commercial Practice, S. L. Kerr. Power, vol. 63, no. 7, Feb. 16, 1926, pp. 255-257, 4 figs. Governor traversing time; rating of self-contained and actuator type of governors; commercial regulating standards; inherent speed changes in load; making governor adjustments.

High Specific Speed. Water Turbines of High Specific Speed, DeKeyser. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 268-269. Mathematical discussion of factors entering into design and operation of turbines having high specific speed such as Kaplan and Bell. (Abstract.) Translated from Bl. Technique de l'Assn. des Ingénieurs sortis de l'Ecole Polytechnique de Bruxelles, vol. 20, no. 5-6, 1924, pp. 167-182.

Propeller-Type. Propeller-Type Turbines (Le piu recenti costruzioni di turbine idrauliche per basse cadute), N. Ratti. Elettrotecnica, vol. 12, no. 25, Sept. 5, 1925, pp. 611-618, 20 figs. Account of properties of these turbines, followed by historical account of their development; principal designs are considered and illustrated.

HYDRAULICS

Hydrostatic Pressure. The Center of Hydrostatic Pressure of Plane Surfaces (Il centro di pressione idrostatica delle superficie piane e delle superficie rigate), A. Cecconi. Annali della, R. Scuola d'Ingegneria di Padova, vol. 1, no. 4, Nov. 1925, pp. 314-319, 10 figs. Calculation and graphic construction for plane surface, rectangular, triangular, quadrilateral and cylindrical surface; also application to prismoids.

HYDRO-ELECTRIC PLANTS

Automatic. Automatic Plants Added After Experience, A. G. Carson and E. D. Lilja. Elec. World, vol. 87, no. 9, Feb. 27, 1926, pp. 445-448, 5 figs. Three plants on Peshtigo River, Wis., rated at 17,200 kva. total already have automatic equipment; unit of 625 kva. at another plant being so equipped; supervisory control supplements automatic operation.

Kentucky. $7,000,000 Power Project Completed in Kentucky, D. MacMurphy. Mfrs.' Rec., vol. 89, no. 7, Feb. 18, 1926, pp. 78-80, 6 figs. Dix River dam has height of 22-storey office building and is over 1,000 ft. long; tunnel 24 ft. in diameter, used to divert river water while construction proceeded; 1,800,000 cu. yds. of rock handled; annual capacity of 77,000,000 kw-hr. contracted for.

Montana. A Rocky Mountain Hydro-Electric Plant, M. E. Buck. Elec. World, vol. 87, no. 6, Feb. 6, 1926, pp. 289-290, 3 figs. Details of plant at Mystic Lake located 45 miles southwest of Columbus, Mont.; hydraulic features, powerhouse construction, waterwheel and electrical-equipment capacities; tunnel opening into lake is blasted out.

Pondage for Peak Loads. Pondage Operation to Carry Peak Loads, J. W. Shuman. Elec. World, vol. 87, no. 10, Mar. 6, 1926, pp. 506-507, 1 fig. Formulae for regulating water drawn to permit carrying maximum load for short periods.

Storage. Hydroelectric Storage Plants of Recent Design in France and Other Countries (Quelques Installations d'Accumulation par pompage récemment réalisées en France et à l'Etranger,) M. Martin. Houille Blanche, vol. 24, nos. 105-106 and 107-108, Sept.-Oct. and Nov.-Dec. 1925, pp. 129-135 and 172-175, 25 figs. Describes plant at Viverone, for pumping water from Lake Viverone into Lake Bertignano located at a higher level, thus making use of two natural reservoirs with 140-m. difference in level; pumping installation consists of 2-stage, high-pressure centrifugal pumps. Plant of Hartmann works at Munster for supplying energy at periods of low water. Nov.-Dec.: Plants of Belleville in France and Wäggital in Switzerland.

I

INDUSTRIAL MANAGEMENT

Budgeting. Novel Budgets Cut Indirect Expenses, U. L. Harmon. Mfg. Industries, vol. 11, no. 3, Mar. 1926, pp. 189-192. Plan of budget control inaugurated by Mason Tire & Rubber Co.; methods used and results accomplished.

Financial and Industrial Investigation. Analyzing Net Worth in the Financial and Industrial Investigation, A. Anderson. Mfg. Industries, vol. 11, no. 3, Mar. 1926, pp. 201-206. Sources of net worth; operating aspect; analysis of original capitalization and subsequent capitalization; net worth from capital profits; analysis of stock dividends and capital stock; comparison between bonds preferred and common stocks.

Inventory Control. The Control of Inventory Through the Scientific Determination of Lot Sizes, H. S. Owen. Indus. Mgmt. (N.Y.), vol. 71, nos. 2 and 3, Feb. and Mar. 1926, pp. 117-118 and 164-166, 2 figs. Feb.: Purchase and control of raw material. Mar.: Process routing of piece parts.

Output and Sales Co-ordination. Market Analysis Checks Over-Production, J. N. Willys. Mfg. Industries, vol. 11, no. 3, Mar. 1926, pp. 165-168, 3 figs. Advocates policy of co-ordinating production with sales demands, which in automobile industry, author believes, has led to strengthening of once weak faith of public in manufacturers.

Purchasing. Buying Factory Equipment. Indus. Mgmt. (Lond.), vol. 13, no. 1, Jan. 1926, pp. 15-16. Emphasizes importance of employing technical man for purchase of tools and equipment and advances plea that primary attention be given to technical merits of products and not to their initial cost.

We make Purchasing a Real Job of Management, C. W. Nash. Factory, vol. 36, no. 2, Feb. 1926, pp. 259-261, 288, 290 and 292. Methods employed by purchasing department of Nash Motors Co.

Successful. Successful Industrial Management, J. S. Gray. Machy. (Lond.), vol. 27, no. 699, Feb. 18, 1926, pp. 684-685. Lack of information is cause of much dissatisfaction; foreman's place in organization; matter of wages; rules and regulations in factory; avoiding great cost of labor turnover.

INDUSTRIAL ORGANIZATION

Co-operation with Complementary Plants. Learning a Lesson from the Vertical Trust, J. A. Piquet. Indus. Mgmt. (N.Y.), vol. 71, no. 2, Feb. 1926, pp. 80-84, 5 figs. Cutting costs by co-operating with complementary plants.

INDUSTRIAL PLANTS

Engineering System for. An Engineering System for the Average Size Plant, G. L. Hedges. Indus. Mgmt. (N.Y.), vol. 71, no. 3, Mar. 1926, pp. 138-140. Gives derivation of numbers as worked out in manufacturing plant employing 250 men; description of forms and how they are used.

Planning Additions. The Intelligent Planning of Plant Additions, N. L. Sammis. Indus. Mgmt. (N.Y.), vol. 71, no. 3, Mar. 1926, pp. 161-163. Factors to analyze in advance of actual construction.

INDUSTRIAL RELATIONS

Co-operation between Groups. Purpose as a Psychological Factor in Management, O. T. Tead. Taylor Soc.—Bul., vol. 10, no. 6, Dec. 1925, pp. 254-263 and (discussion) 263-267. Discussion of methods by which integration of group purposes can be effected in industry; considers what line can be followed by managers to get industry upon basis where good will is manifested, where co-operation between groups is willing and not enforced, where conflict is creative and not destructive force.

Employee Team Work. Promoting Employee Team Work and Welfare Without Paternalism, C. A. Lippincott. Indus. Mgmt. (N.Y.), vol. 71, no. 3, Mar. 1926, pp. 146-150, 5 figs. How Studebaker Corp. handles problem of industrial relations.

PROBLEMS. Creating Better Understanding in Industry, C. D. Dietz. Machy. (N.Y.), vol. 32, no. 7, Mar. 1926, pp. 541-542. Discusses new problems, presented by present industrial system; combating erroneous and misleading propaganda by accurate information.

INTERNAL-COMBUSTION ENGINES

CYLINDERS, TEMPERATURE DETERMINATION IN. Cylinder Temperature, R. W. Bailey. Automobile Engr., vol. 16, no. 212, Feb. 1926, pp. 47-48, 2 figs. A graphical method for determining temperatures from indicator diagram.

ELECTRIC TRANSMISSION FOR. Electric Transmission for Internal-Combustion Engines, H. Lemp. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 205-217, 20 figs. Principal features of mechanical, pneumatic, hydraulic, and electric transmissions; application of automatic speed-torque control to gas-electric motor buses, rail motor cars, and switching locomotives.

(See also Airplane Engines; Automobile Engines; Diesel Engines; Gas Engines ; Oil Engines.)

INVENTION

FALLACIES CONCERNING. Some Fallacies Concerning Invention, G. F. Charnock. Instn. Mech. Engrs.—Proc., no. 1, Jan. 1926, pp. 35-36. Author points out that some few inventions of note may have been hit upon by accident, but such cases are rare, and are certain to become more so; it is shown that profits lie in pioneer work, and in utilization of research and experiment as leading up to invention. (Abridged.)

IRON

CORROSION. Rusting of Iron (Ueber das Rosten des Eisens), W. Kistiakowsky; Zeit. für Elektrochemie, vol. 31, no. 12, Dec. 1925, pp. 625-631. Electrodes of iron may exist in 5 distinct conditions ranging from superactive, attainable only in alkaline electrolytes, to passive; in former condition there is unbroken coating of hydride, in latter, of oxide, and in neither is it possible for iron to rust; when coating of oxide is ruptured, which may occur through mechanical or chemical attack, or by crystallization of oxide film, local currents are produced and rusting sets in; acceleration of rusting by CO_2 is attributed to its depolarizing action in local currents.

NOMENCLATURE. What is Iron, What is Steel? A. Sauveur. Mich. Technic, vol. 39, no. 2, Jan. 1926, pp. 119 and 125. New short definitions offered in light of modern developments, for commercial, ingot and wrought iron and steel.

IRRIGATION

DEVELOPMENTS. Irrigation Developments Through Irrigation Districts, E. C. Eaton and F. Adams. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 423-433, 5 figs. Present status of irrigation districts; state control of organization and financing; typical irrigation districts.

DEVELOPMENTS, WESTERN STATES. History and Problems of Irrigation Development in the West, J. A. Widtsoe. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 396-402. Problems of irrigation; extension of irrigated area; completion of existing projects; means for solving irrigation problems.

FINANCING. The Financing of Irrigation Developments by Private Capital, R. E. Shepherd. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 403-410. Conclusions based on experience in solving problems of Twin Falls North Side Project which is a privately financed enterprise.

HYDRAULIC. Progress Report of Special Committee on Irrigation Hydraulics. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 242-246. Results of investigation, evaporation losses from reservoirs; losses in canal conversions; water movement pressure under dams; losses in siphon spillways; scouring below dams; measuring irrigation deliveries, etc.

L

LATHES

AUTOMATIC SPEED CONTROL. Hard Spots and Automatic Control, J. O. Knowles. Machy. (Lond.), vol. 27, no. 693, Jan. 7, 1926, pp. 476-477, 2 figs. Points out that problem of hard spots is now reduced to one of control of speed; discusses electrical mechanisms required.

CENTER. 9-Inch Centre Friction Double Back-Geared Lathe. Machy. (Lond.), vol. 27, no. 699, Feb. 18, 1926, p. 679, 2 figs. Constructed by C. Redman & Sons, Ltd.,. Halifax, for India office; new features include friction double back-geared headstock and quick-change screw-cutting and feed-gear box.

COMPRESSED-AIR MOTORS FOR. Compressed-Air Motor Applications. Machy. (Lond.), vol. 27, no. 698, Feb. 11, 1926, pp. 641-642, 3 figs. Application of air motors, manufactured by Globe Pneumatic Eng. Co., London, to railway-wheel lathe.

TURRET. Machining Hoist Load Wheels. Machy. (N.Y.), vol. 32, no. 6, Feb. 1926, pp. 479-480, 7 figs. Turret lathe used by Wright Mfg. Co., Lisbon, O., to finish sheaves or load wheels for chain hoists.

LEAD ALLOYS

HARDENING. The Lead-Antimony System and Hardening of Lead Alloys, R. S. Dean and F. C. Nix. Am. Inst. Min. & Met. Engrs.—Trans., no. 1539-E, Feb. 1926, 55 pp. 29 figs. Lead-antimony equilibrium diagram; presents evidence showing that solid solubility of antimony in lead at room temperature is at least as low as 0.5 per cent; lead-antimony alloys of approximately eutectic composition behave normally with regard to volume change on solidification; age hardening may be observed in all lead-antimony alloys containing more than 0.5 per cent. antimony; rate and degree of age hardening is determined by rate of cooling.

LEAD, METALLURGY

ROASTING AND LEACHING. The Durango Lead Smelter and Sulphating Plant, E. H. Robie. Eng. & Ming. Jl.-Press, vol. 121, no. 7, Feb. 13, 1926, pp. 288-290, 1 fig. Roasting and leaching process for lead-zinc concentrating at Durango plant of American Smelting & Refining Co.; standard Dwight & Lloyd sintering machines.

LIGHTING

COSTS ALLOCATION. Peak Responsibility as a Basis for Allocating Fixed Costs, A. S. Knight. Elec. World, vol. 87, no. 10, Mar. 6, 1926, pp. 495-496. Discusses important factors which affect distribution of costs; maximum demand of class is said to be better line of analysis than peak responsibility.

LIME

HYDRATED. The Hydration of Lime, W. G. Whitmen and G. H. B. Davis. Indus. & Eng. Chem., vol. 18, no. 2, Feb. 1926, pp. 118-120, 3 figs. Study of effect of various hydration methods on properties of hydrated lime.

LOCOMOTIVE BOILERS

PITTING. Pitting, A Myth or a Menace? D. A. Steel. Ry. Age, vol. 80, no. 8, Feb. 20, 1926, pp. 467-474, 9 figs. Detailed survey reveals progress being made in eliminating corrosion of boiler steel.

SUPERHEAT FOR. Superheat for Locomotive Boilers, C. A. Seley. Ry. Rev., vol. 78, no. 6, Feb. 6, 1926, pp. 259-264, 3 figs. Graphical study of evaporation tests which show very interesting results.

LOCOMOTIVES

DEVELOPMENTS, 1925. Steam Locomotives of 1925. Engineer, vol. 141, no. 3653, Jan. 1, 1926, pp. 2-5, 14 figs. London & North-Eastern, Great Western, Southern, and London, Midland & Scottish railways; makers' locomotives; French locomotives.

DIESEL-ELECTRIC. Diesel-Electric Develops Great Power. Ry. Rev., vol. 78, no. 9, Feb. 27, 1926, pp. 374-376, 4 figs. Largest locomotive of this type built in United States was turned out recently by Baldwin Locomotive Works, Phila.; it develops 1,000 h.p.; total weight 275,000 lbs.

The Diesel-Electric Locomotive. Min. & Met., vol. 7, no. 231, Mar. 1926, pp. 129-130. Discussion of its merits; its value in special field already demonstrated; no immediate probability of its displacing steam locomotive or heavy electrification in trunk-line service.

FUTURE DESIGN. Some Suggestions for Future Locomotive Development, Wm. A. Newman. Ry. Mech. Engr., vol. 100, nos. 1 and 2, Jan. and Feb. 1926, pp. 13-15 and 85-88, 6 figs. Jan.: Weak points of design in modern locomotive; fundamentals defined for proposed locomotive; design of boiler and frame; forward and rear driving units. Feb.: Details of boiler construction and its advantages; side water legs stayed with cable wire.

IMPROVEMENT POSSIBILITIES. Possibilities of Improving Present Steam Locomotives (Considerazioni sulle possibilita di perfezionamento della locomotiva a vapore attuale), T. Jervis. Industria Rivista Tecnico-Scientifica ed Economica, vol. 39, no. 21, Nov. 15, 1925, pp. 564-566. Shows that piston locomotive has still good future; examines vertical water-tube boilers; double-expansion, superheated-steam, 4-cylinder and compound engines.

INTERNAL-COMBUSTION. Self-Propelled Cars and Locomotives, A. H. Candee. Ry. Age, vol. 80, no. 7, Feb. 13, 1926, pp. 443-446, 1 fig. An analysis of limitations and possibilities of internal-combustion engines for railroad service. Paper presented before Iowa Eng. Soc.

OIL-ELECTRIC. 100-ton Oil-Electric Locomotive. Ry. Mech. Engr., vol. 100, no. 2, Feb. 1926, pp. 92-95, 7 figs. Built for freight and switching service on Long Island; develops tractive force of 60,000 lb. at 1 mi. per hr.

M

MACHINE SHOPS

WORK ORDERS AND SKETCHES. Methods of Increasing Output in Small Machine Shops, R. B. Robison. Ry. Mech. Eng., vol. 100, no. 3, Mar. 1926, pp. 181-182, 4 figs. Application of sytematic methods which have assisted greatly in putting the work on economical basis.

MACHINE TOOLS

AUTOMATIC. 4-Spindle Automatic. Machy. (Lond.), vol. 27, no. 697, Feb. 4, 1926, pp. 609-612, 10 figs. New machine for bar and chucking operations; examples of tooling; developed by A. H. Schutte, Cologne, Germany.

REPLACEMENT POLICY. Getting the Most Out of Your Machine Tool Dollar, J. R. George. Am. Mach., vol. 64, no. 10, Mar. 11, 1926, pp. 381-383. Discusses equipment problems in plant where product is rolling-milll and wire-drawing machinery.

TESTING EQUIPMENT. Service and Taking Over Control for Machine Tools, M. Kurrein. Eng. Progress, vol. 7, no. 1, Jan. 1926, pp. 8-10, 6 figs. Equipment of test beds, their functions and aims.

MAGNESITE

TREATMENT. Pyro and Hydro-treatment of Magnesite and Dolomite, H. M. Henton. Am. Inst. Min. & Met. Engrs.—Trans., no. 1573-H, Mar. 1926, 34 pp., 12 figs. Conclusions based on laboratory experiments: dolomite may be semi-calcined in rotary kiln; gas cooling is practicable with waste-heat boilers and other water devices; dust recovery from gases after cooling is practicable by means of filters; for brick or other products where purity is not essential, dust will not necessarily be detriment in carbonator; it may help by acting as catalyzer or gas carrier; carbonation and bi-carbonation are possible in four stages or less; etc. Bibliography.

MAGNESIUM ALLOYS

BINARY. A Preliminary Study of Magnesium-Base Alloys, B. Stoughtom and M. Miyake. Am. Inst. Min. & Met. Engrs.—Trans., no. 1538-E, Feb. 1926, 17 pp., 28 figs. Study of binary magnesium-aluminum and magnesium-zinc alloys.

MALLEABLE CASTINGS

EMBRITTLEMENT. A Process for the Prevention of Embrittlement in Malleable Cast-Iron, L. H. Marshall. Am. Inst. Min. & Met. Engrs.—Trans., no. 1572-C, Feb. 1926, 8 pp., 4 figs.; also (abstract) in Iron Age, vol. 117, no. 8, Feb. 25, 1926, pp. 558-560, 3 figs. Simple heat treatment developed to prevent brittleness due to hot-dip galvanizing; application of process in plant on production basis.

MANOMETERS

LOW-PRESSURE AND VACUUM MEASUREMENT. Measuring Low Pressure and Vacuum, F. Johnstone-Taylor. Power House, vol. 19, no. 3, Feb. 5, 1926, pp. 19-20, 9 figs. Describes simple and useful instrument known as manometer which forms basis of draft gages, blast-pressure indicators and other devices dealing with gas, air, and water.

MATERIALS HANDLING

BUCKET ELEVATORS. Centrifugal Bucket Elevators, N. Tate. Mech. World, vol. 79, no. 2039, Jan. 29, 1926, pp. 82-84, 4 figs. By centrifugal elevators is meant that type which throws its material clear of preceding bucket by virtue of its speed and not continuous; importance of correct feeding; practical speeds; when to use belt elevators.

FOUNDRIES. Material Handling Revolutionized Our Production. A. Weber. Factory, vol. 36, no. 2, Feb. 1926, pp. 282-284, 330, 334 and 338, 10 figs. Method, equipment, and results obtained in foundry of Wilson Foundry & Machine Co. (Willys-Overland), Pontiac, Mich.

INTERMITTENT HANDLING DEVICE. A New Intermittent Handling Device. Indus. Mgmt. (Lond.), vol. 13, no. 1, Jan. 1926, pp. 3-5, 3 figs. Describes handling innovation which has some affinity to Hunt or gravity railway, and is power-driven; curves and gradients can be negotiated with good facility by means of distant contrivance.

LABOR-SAVING DEVICES. Labor-Saving Devices at Shipping, Engineering and Machinery Exhibition. Indus. Mgmt. (Lond.), vol. 13, no. 1, Jan. 1926, pp. 5-7, 1 fig. Details of chief handling appliances on view at exhibition at Olympia, London.

METALS

COLD-WORKED. Crystal Growth in Recrystallized Cold-Worked Metals, W. Feitknecht. Inst. Metals—advance paper, no. 5, for mtg. Mar. 10-11, 1926, 35pp., 51 figs. Experiments primarily undertaken to investigate causes of formation of very large crystals; experiments were mainly carried out with pure commercial aluminum; some work was also done with very pure aluminum and very pure silver.

COLD WORKING, INFLUENCE OF. Influence of Cold Working and Quenching on the Elastic Properties of Various Metals and Alloys (Influence de l'écrouissage de la trempe sur les propriétés élastiques de divers métaux et alliages), A. Portevin and P. Chevenard. Académie des Sciences—Comptes Rendus, vol. 181, no. 20, Nov. 16, 1925, pp. 716-718, 2 figs. Influence of thermal and mechanical treatment on elastic properties of pure metals and alloys was investigated by method previously described; in case of cold-drawn gold wires, relative torsion modulus diminishes with rising temperature; thermoelastic coefficient varies with rising annealing temperature; qualitatively similar results are obtained with normal solid s olutions (silver-gold alloys); minimum annealing temperature of ferro-nickels is about 550 deg.; in case of carbon steel, quenching diminishes torsion modulus, and increases thermoelastic coefficient and change in internal friction.

HARD SPOTS IN. Hard Spots in Metals. Machy. (Lond.), vol. 27, no. 696, Jan. 28, 1926, pp. 569-572, 5 figs. Causes and effects on machineability; hard spots in cast iron; conditions affecting machineability of steel; simple test for segregation; effect of slag on machining; effects of scale; cutting-tool design and hard spots; hard spots in non-ferrous alloys.

RECRYSTALLIZATION. A Photomicrographic Study of the Process of Recrystallization in Certain Cold Worked Metals, V. N. Krivobok. Am. Inst. Min. & Met. Engrs.—Trans., no. 1557-E, Feb. 1926, 30 pp., 43 figs. Results of investigation; progressive recrystallizztion in single crystals of iron-silicon alloy after cold working; critical strain and recrystallization; recrystallization in electrolytic iron.

STRAIN HARDENING. Note on the Softening of Strain-Hardened Metals and Its Relation to Creep, R. W. Bailey. Inst. Metals—advance paper, no. 1, for mtg. Mar. 10-11, 1926, 14 pp., 7 figs. Author believes that rational explanation of phenomenon of creep is to be found in balance of rate of production of strain hardening by distortion, and rate of its removal by thermal action; if this view be correct, importance in connection with creep phenomena of examining data available upon softening of strain-hardened metals will be understood.

MICROMETERS

SCREWS, WEAR OF. Wear of Micrometer Screws. Machy. (Lond.), vol. 27, no. 694, Jan. 14, 1926, pp. 521-522, 2 figs. Report of series of experiments made at Zeiss plant.

MINES

SURVEYING. Magnetometric Surveying as an Aid in Exploring Placer Gound, K. C. Laylander. Eng. & Min. Jl.-Press, vol. 121, no. 8, Feb. 20, 1926, pp. 325-328, 10 figs. Magnetometer and its operation; comparison of results with those obtained by drilling and actual mining leads to conclusion that areas of relative concentration can be determined; can not be used for finding gold.

MOLDS

INGOT, SHELL DEFECTS IN. The "Shell" Defect in Ingot Moulds, W. Rogers. Foundry Trade Jl., vol. 33, no. 495, Feb. 11, 1926, p. 119, 5 figs. Causes and prevention.

MOTION STUDY

APPLICATIONS. Some Recent Applications of Motion Study, Jos. A. Piacitelli. Taylor Soc.—Bul., vol. 10, no. 6, Dec. 1925, p. 268-273 and (discussion) 273-276, 3 figs. How study of processes of production and shipping of roofing materials led to standardization of methods and equipment with resultant economies.

MOTOR BUSES

DESIGN TRENDS. Trends in American Motor Bus Design. Automotive Industries, vol. 54, no. 7, Feb. 18, 1926, p. 287. Information graphically presented. See also Motor Bus Design Trends, p. 294.

SPEED, EFFECT ON FUEL CONSUMPTION. Effect of Speed on Fuel and Oil Consumption. Automotive Industries, vol. 54, no. 7, Feb. 18, 1926, pp. 272-273. Results of study of effect on increase in maximum speed on fuel and oil consumption of motor omnibuses made by M. A. Banlier, chief engineer in charge of buses of Société des Transports en Commun of Paris.

MOTOR TRUCKS

DESIGN TRENDS. Trends in American Truck Design. Automotive Industries, vol. 54, no. 7, Feb. 18, 1926, p. 298. Information graphically presented.

HORSE VS. Horse Trucking versus Motor Trucking, Arthur J. Peel. Indus. Mgmt. (N.Y.), vol. 71, no. 3, Mar. 1926, pp. 141-145, 8 figs. Author shows where in many cases horse truck is better than motor truck; and how to determine which method will prove more economical in given case.

N

NICKEL ALLOYS

NICKEL-COPPER. The Mechanical Properties at High Temperature of an Alloy of Nickel and Copper, with Special Reference to "Creep," H. J. Tapsell and J. Bradley. Inst. Metals—advance paper, no. 15, for mtg. Mar. 10-11, 1926, 19 pp., 10 figs. Deals with work carried out on 70 : 30 nickel-copper alloy.

NICKEL INDUSTRY

CANADA. The Nickel Industry, P. D. Merica. Can. Inst. of Min. & Metallurgy—Bul., no. 166, Feb. 1926, pp. 173-212, 5 figs. Discusses development work, nickel mining, nickel steels, nickel plating, monel metal and malleable nickel, alloys, nickel in cast-iron, nickel at brass foundry, etc.

NON-FERROUS METALS

ENDURANCE PROPERTIES. Endurance Properties of Non-ferrous Metals, D. J. McAdam. Am. Inst. Min. & Met. Engrs.—Trans., no. 1537-D, Feb. 1926, 10 figs. Presents stress-cycle graphs for five samples of monel metal and three high strength aluminum alloys; monel metal and duralumin are not exceptional among non-ferrous metals in endurance properties.

NOZZLES

PATENT SPECIFICATIONS. Spray-Producers and Liquid-Distributing Sprinklers and Nozzles. Abridgements of Specifications, class 69 (iii), period 1916-20, 1926, 63 pp. Patents for inventions.

STEAM-TURBINE, TESTING. A Machine for Testing Steam-Turbine Nozzles by the Reaction Method, G. B. Warren and J. H. Keenan. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 227-232, 10 figs. Explains apparatus used in reaction-nozzle tests, difficulties encountered, means of eliminating them, and methods of obtaining and developing test data; discusses underlying principles and type of results they would indicate; shows by sample test curves close agreement between expected and actual data.

O

OIL

REFINING. New Oil Refinery at Edmonton, Alberta, H. Norbury. Can. Min. Jl., vol. 47, no. 9, Feb. 26, 1926, pp. 211-212, 1 fig. Details of refinery built to cope with rapid development of Wainwright; it has nominal capacity of 1,000 barrels a day but is capable of 1,500 barrels.

OIL ENGINES

SKETCHES AND WORKINGS. Sketches andWorkings of Oil Engines. Motorship (N.Y.), vol. 11, no. 2, Feb. 1926, pp. 127-128, 133-136, and i-ii, 19 figs. Major bearings and their structure considered from viewpoint of maintenance and adjustment.

OIL FUEL

EXPLOSIONS OF, CLOSED VESSEL. Closed Vessel Explosions of Mixtures of Air and Liquid Fuel (Petrol, Hexane, and Benzene) over a Wide Range of Mixture Strength, Initial Pressure, R. W. Fenning. Aeronautical Research Committee—Reports & Memoranda, no. 979, Sept. 1925, 22 pp., 16 figs. Results of investigation at 100 deg. cent.; air-fuel ratio giving maximum explosion pressure is considerably less than required for complete combustion.

OPEN-HEARTH FURNACES

SULPHUR IN PRODUCER GAS. Reduction and Behavior of Sulphur Contained in Producer Gas in Open-Hearth Furnaces (Verringerung und Verhalten des im Generatorgas enthaltenen Schwefels im Siemens-Martin-Ofen), J. Bronn. Stahl u. Eisen, vol. 48, no. 3, Jan. 21, 1926, pp. 78-80. Also translated abstract in Iron & Coal Trades Rev., vol. 112, no. 3025, Feb. 19, 1926, p. 309. Sulphur content in producer gas and slag with and without lime addition; influence on slag and bath in open-hearth furnace; conclusions.

ORE

SINTERING. Iron Ore Sintering Spreads in East, E. C. Kreutzberg. Iron Trade Rev., vol. 78, no. 10, Mar. 11, 1926, pp. 641-643, 3 figs. Broader application of sintering process is most important development in eastern iron-ore industry in many years.

ORE DEPOSITS

ONTARIO, CANADA. The Matabitchuan Area, Ontario, E. W. Todd. Can. Min. Jl., vol. 47, no. 6, Feb. 5, 1926, pp. 139-142. Discusses territory adjoining South Lorrain silver area to the west; mapping of rocks and resurvey of prinicpal lakes and streams.

OXYACETYLENE CUTTING

FOUNDRIES. Influence of Oxy-Acetylene Cutting on Steel Foundry Practice, R. W. Thomas. Acetylene Jl., vol. 27, no. 7, Jan. 1926, pp. 339-340, 342 and 344, 6 figs. Advantages of process. Paper read before Int. Acetylene Assn.

P

PACKING

STANDARDIZATION APPLIED TO. How Standardization Solves Our Export Packing Problems, R. W. Chalmers. Factory, vol. 36, no. 2, Feb. 1926, pp. 272-275, 15 figs. Deals with exporting automobiles; shows how engineering principles can be applied to packing.

PAINTS

SETTLING AND PACKING. The Settling and Packing of Mixed Paints, Wm. C. Arsen. Indus. & Eng. Chem., vol. 18, no. 2, Feb. 1926, pp. 157-160, 1 fig. In mixed paints pigment grains are to some extent deflocculated and dispersed by free acids in the vehicle, and metallic soaps are maintained in sol conditions by same agency; in stored paint slow chemical reaction between basic pigments and free acids form basic soaps with little dispersing power.

TECHNOLOGICAL PROBLEMS. Problems in Paint and Varnish Technology. The Need for Experimental investigation, H. H. Morgan. Roy. Soc. of Arts—Jl., vol. 74, no. 3821, Feb. 12, 1926, pp. 271-291. Discusses problems of technology, storage and keeping qualities; experimental work necessary; raw materials for faded varnish manufacture; viscosity and drying capacities of varnishes; value of various pigments.

WHITE. Factors Determining the Brightness and Opacity of White Paints, F. H. Rhodes and J. S. Fonda. Indus. & Eng. Chem., vol. 18, no. 2, Feb. 1926, pp. 130-135, 5 figs. Formula developed to express relation between brightness of film of white paint and thickness of film, and experimental evidence in support of this formula is advanced.

PAVEMENTS

EXPERIMENTAL. Experimental Pavements in Queens Borough, New York, E. E. Butterfield. Roads & Streets, vol. 65, no. 3, Mar. 3, 1926, pp. 160-162. Methods of surfacing dirt roads and constructing bituminous and key block pavement. (Abstract.) Paper presented before Am. Soc. for Mun. Improvements.

PAVEMENTS, ASPHALT

REPAIR. Repair of Asphaltic Type Pavements in a Small City, H. W. Alexander. Pub. Wks., vol. 57, no. 2, Feb.-Mar., 1926, pp. 49-50, 1 fig. Manhattan, Kans., maintains nearly half million yards by use of portable repair plant at satisfactorily low cost.

PAVEMENTS, BRICK

THIN. Thin Brick Pavements. Pub. Wks., vol. 57, no. 2, Feb.-Mar., 1926, pp. 46-49. Data from fifteen cities that have laid 2½-in. brick and from more than 100 others with brick less than 4-in. thick; special reports concerning thin pavements ten or more years old.

PAVEMENTS, CONCRETE

JOINTS IN. Joints in Concrete Pavement, W. W. Lane. Roads & Streets, vol. 65, no. 3, Mar. 3, 1926, pp. 127-128, 1 fig. Method of securing 100 per cent. joint employed on Federal Aid job in Arizona.

PIPE, CAST-IORN

BRONZE WELDING. Effect of Heat of Bronze Welding on Cast Iron Pipe, A. R. Lytle. Acetylene Jl., vol. 27, no. 7, Jan. 1926, pp. 325-338, 35 figs. Advantages of bronze-welding process over that of actual welding with cast-iron welding rod. Photomicrographs. Paper read before Int. Acetylene Assn.

PISTONS

ALUMINUM-ALLOY. Bohn Alloy Piston Employs Struts; Has Low Expansion Rate, W. L. Carver. Automotive Industries, vol. 54, no. 9, Mar. 4, 1926, pp. 406-407, 3 figs. Details of two engine components placed in production by Bohn Aluminum and Brass Corp.; completely interchangeable bronze-back babbitt-lined bearing, and Nelson-type aluminum alloy piston in which expansion difficulties ordinarily associated with light-alloy pistons have been eliminated.

PLANERS

BEDS AND TABLES. Finishing the Inner Guides of Planer Beds and Tables, C. E. Linden. Machy. (N.Y.), vol. 32, no. 7, Mar. 1926, p. 554, 3 figs. Rough-planing inner guides of bed; gaging fixture for finish-planing guides.

BEVEL-GEAR. Planing Spiral Bevel Gears. Automobile Engr., vol. 16, no. 212, Feb, 1926, pp. 68-69, 4 figs. Machine consists essentially of continuously rotating work spindle, together with tool slide which reciprocates to and from cone center of gear.

LEVELING. Levelling a Planer, C. O. Lewis. Machy. (Lond.), vol. 27, no. 696, Jan. 28, 1926, pp. 577-578, 1 fig. Equipment required for leveling operations; rough leveling; running level; second-leveling operation; crosswise leveling; setting up work.

POWER TRANSMISSION

BUYING AND SELLING EQUIPMENT. Intelligent Buying and Selling of Transmission Equipment, W. Staniar. Indus. Mgmt. (N.Y.), vol. 71, no. 3, Mar. 1926, pp. 173-175, 2 figs. Points out that transmission service and not sales volume is important point.

PRESSURE VESSELS

WELDED. Tests on Welded Pressure Vessels, L. H. Roller. Refrig. Eng., vol. 12, no. 7, Jan. 1926, pp. 215-237 and (discussion) 237-241, 54 figs. Results of investigation by Bureau of Standards to determine strength of welded tanks made in commercial shops, and whether acceptance test of proposed A.S.M.E. code for unfired pressure vessels would reveal defects in tanks which would make them unsafe.

PROFIT SHARING

PERKINS PLAN. Better Than a Bonus Plan, M. Droke. Indus. Mgmt. (N.Y.), vol. 71, no. 2, Feb. 1926, pp. 115-116. Outline of Perkins plant of profit sharing.

PUBLIC UTILITIES

CONSTRUCTION COSTS. Trend of Construction Cost of Certain Public Utilities, W. Breuger. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 434-438. 5 figs. Valuation was recently made of one of largest public utilities in United States and in connection therewith a detailed study of trend, year by year. from 1914, to date, of construction cost of various public utility properties.

PUMPING STATIONS

WATER WORKS. Waterworks Pumps and Pumping Stations, R. W. Angus. Contract Rec., vol. 40, no. 10, Mar. 10, 1926, pp. 238-239. Outline of types of equipment in common use and their merits; centrifugal pumps now general type; simplified construction; field for high-speed, low-head pump.

R

RADIOTELEPHONY

AMPLIFIERS. The Performance of Amplifiers, H. A. Thomas. Instn. Elec. Engrs.—Jl., vol. 64, no. 350, Feb. 1926, pp. 253-268 and (discussion) 268-278, 31 figs. Research carried out at Nat. Physical Laboratory for Radio Research Board; standard method of testing amplification and input impedance of amplifier; analyses output wave-forms from audio-frequency amplifiers.

RAILS

HEAT TREATMENT OF. New Heat Treatment for Improving Quality of Rails (Nouveaux traitements thermiques pour l'amélioration de la tenue des rails), E. Marcotte. Revue Industrielle, vol. 55, no. 2195, Oct. 1925, pp. 439-449, 6 figs. Cause of wear in rails and how to deal with it, by changing shape and increasing profile, by chemical composition, and by heat treatment; pearlitic structures, sorbitic structure, meanganese steel, Sandberg process; sorbitic rails and their tests.

WELDED BONDS. Low Resistance Welded Bonds Result in Economy on Erie, C. A. Nichols. Ry. Signaling, vol. 19, no. 3, Mar. 1926, pp. 96-98, 5 figs. Cut section eliminated, battery consumption reduced, factor of safety increased, on 139 miles of track without a bond failure.

RAILWAY ELECTRIFICATION

DEVELOPMENTS. Railroad Electrification is Well Started, L. D. Moore. Elec. World, vol. 87, no. 10, Mar. 6, 1926, pp. 507-508. Except for traction, railroads are as completely electrified as any industry; large volume applications for shop power, illumination, freight handling, signals and control, and other uses.

ILLINOIS CENTRAL. Illinois Central Electrification Progress. Ry. Age. vol. 80, no. 7, Feb. 13, 1926, pp. 432-434, 6 figs. Details of overhead distribution system for part of territory included in electrification program; catenary structures also carry a.c. distribution system. See also account in Ry. Elec. Engr., vol. 17, no. 2, Feb. 1926, pp. 47-50, 10 figs.

RAILWAY MAINTENANCE

LABOR-SAVING METHODS. How We Are Cutting Our Maintenance of Way and Structures Payroll $50,000,000 a Year, C. C. Cook. Ry. Eng. & Maintenance, vol. 22, no. 3, Mar. 1926, pp. 93-96. Conservation of ties; devices for surfacing soft ballast; mechanical cranes and ditching machines; rail-laying machines; other labor-saving equipment.

RAILWAY MOTOR CARS

GASOLINE-ELECTRIC. Gas-Electric Cars for the Seaboard. Ry. Elec. Engr., vol. 17, no. 2, Feb. 1926, pp. 41-43, 6 figs. Dual-power-plant gas-electric rail motor cars made by Electro-Motive Co., Cleveland, Ohio; motor equipment permits rapid accelerations, high-speed operation and large hauling capacity.

SPECIFICATIONS. American Gasoline Rail Car Specifications. Automotive Industries, vol. 54, no. 7, Feb. 18, 1926, p. 297. Tabular data.

RAILWAY OPERATION

TRAIN CONTROL. Norfolk & Western Train Control Approved. Ry. Signalling, vol. 19, no. 2, Feb. 1926, pp. 51-54. Union Switch & Signal Co.'s 3-speed continuous induction type found to meet I. C. C. requirements.

RAILWAY REPAIR SHOPS

LOCOMOTIVE. Locomotive Repair Shop Labor Saving Devices. Ry. Mech. Engr., vol. 100, no. 2, Feb. 1926, pp. 109-114, 18 figs. Development of machine attachments, cutting tools and jigs, encouraged at Houston, Texas, shops of Southern Pacific Lines.

Maintenance of Motive Power on New England Railroads, E. Sheldon. Am. Mach., vol. 64, no. 8, Feb. 25, 1926, pp. 303-306, 11 figs. Boiler and tank work in Readville shops of New Haven road; system to salvage flues and tubes; punching, bending, flanging, and similar operations; device to clean and test superheater units.

RAILWAY SIGNALLING

A. C. FLOATING SYSTEM. Five Years of Success With the A. C. Floating System, C. F. Stoltz. Ry. Signaling, vol. 19, no. 3, Mar. 1926, pp. 91-93, 5 figs. Charges for maintenance, operation, and supervision amount to less than $5.00 per block signal per month.

AUTOMATIC STAND-BY POWER UNITS FOR. Automatic Gas-Electric Stand-by Power Units for Signals and Interlockings. Ry. Signaling, vol. 19, no. 3, Mar. 1926, pp. 101-103, 5 figs. Development that provides an emergency supply of current for a.c. installations or constant supply for apparatus located at isolated points.

COLORED-LIGHT SIGNALS. A New Development in Chromatic Light Signals, D. J. McCarthy. Ry. Signalling, vol. 19, no. 3, Mar. 1926, pp. 103-105, 4 figs. Ground-glass lens with five-watt lamp gives color-light signal indication at 4,000 ft.

MAINTENANCE AND OPERATION. Maintenance and Operation of A.C. Signals on the Southern. Ry. Signaling, vol. 19, no. 3, Mar. 1926, pp. 87-90, 5 figs. Average cost for current, labour and materials based on 868 signals on 700 miles of double track, is $10.61 per month per signal.

UNDERGROUND WIRING. Parkway Cable Reduces Maintenance, E. G. Stradling. Ry. Signaling, vol. 19, no. 3, Mar. 1926, pp. 105-107, 2 figs. Study of methods for more permanent construction of underground signal wiring.

RAILWAY TIES

PRODUCTION. Producers Discuss Crosstie Supply at Cleveland. Ry. Eng. & Maintenance, vol. 22, no. 2, Feb. 1926, pp. 63-68, 1 fig. Review of papers presented at Nat. Assn. of Railroad Tie Producers.

RAILWAYS

ENGINEERING PROBLEMS. Railroading and the Engineer, S. P. Bush. Ry. Rev., vol. 78, no. 7, Feb. 13, 1926, pp. 315-317. Points out that technically trained men are needed in transportation and industry. (Abstract.) Address delivered at regional meeting of Amer. Soc. of Mech. Engrs.

RAILWAY TRACK

GRADE-CROSSING ELIMINATION. Maryland Negotiates Agreement for Crossing Elimination, J. N. Mackall. Eng. News-Rec., vol. 96, no. 8, Feb. 25, 1926, pp. 314-315. Arrangements completed with three leading railways for 10-year program of grade-crossing elimination on state roads.

LAYING. How a Track Was Moved 500 Miles, G. E. Olson. Ry. Eng. & Maintenance, vol. 22, no. 2, Feb. 1926, pp. 53-54, 3 figs. In effort to complete extension of Bainville branch of Great Northern from Scobey, Mont., north 20 miles to Peerless in time to bring out wheat grown in that territory, novel expedient was adopted to laying of track in minimum time; track consisted of 80-lb. rail, full tie-plated; it was disconnected at every second joint and was handled in units of two panels or 60-ft. lengths.

REFRIGERATING MACHINES

ABSORPTION TYPE. Absorption Type Household Refrigerating Machines, H. E. Keeler. Refrig. Eng., vol. 12, no. 8, Feb. 1926, pp. 269-272 and (discussion) 272-274. Consideration of factors which have been operative in bringing about development of household refrigeration; lines of future development.

REFRIGERATING PLANTS

ERRORS IN, ANALYSIS OF. Avoiding Mistakes in the Refrigerating Plant, H. G. Venemann. Power, vol. 63, no. 8, Feb. 23, 1926, pp. 292-293, 2 figs. Errors of two different plants are reviewed. (Abstract.) Paper read before Nat. Assn. Practical Refrig. Engrs.

PURDUE UNIVERSITY. The Purdue Refrigerating Plant, E. F. Burton. Purdue Eng. Rev., vol. 21, no. 2, Jan. 1926, pp. 6-7, 2 figs. Working principles of University refrigerating equipment.

REFRIGERATION

CENTRIFUGAL. Centrifugal Compression as Applied to Refrigeration, W. H. Carrier. Refrig. Eng., vol. 12, no. 8, Feb. 1926, pp. 253-268 and 277, 17 figs. Résumé of principles involved in centrifugal refrigeration; effect of inlet angle of impeller blade; blade snape; ratio of compression; relation of temperature range to speed; performance characteristics.

ROAD CONSTRUCTION

SUPER-HIGHWAY. Building an Eight-Lane Paved Highway. Eng. News-Rec., vol. 96, no. 9, Mar. 4, 1926, pp. 350-353, 10 figs. Construction of 13 miles of super-highway out of Detroit, Mich., from Wayne County line to Pontiac; two 44-ft. concrete slabs in 200-ft. right-of-way being constructed to carry traffic averaging 14,000 vehicles in 24 hours.

ROADS, CONCRETE

CONSTRUCTION. Efficiency in Concrete Road Construction, J. L. Harrison. Pub. Roads, vol. 6, no. 12, Feb. 1926, pp. 269-276. Organization and equipment of concrete paving operations.

OVER-RUN OF CONCRETE. How to Stop Over-run of Concrete Material, R. E. O'Connor. Roads & Streets, vol. 65, no. 3, Mar. 3, 1926, pp. 135-140. Suggestions for preventing use of excess quantities of cement and aggregate. Paper presented before Am. Road Bldrs. Assn.

PAVING PRACTICE. Concrete Paving Practice, H. E. Surman. Roads & Streets, vol. 65, no. 2, Feb. 3, 1926, pp. 69-73, 5 figs. Recent developments outlined. Paper presented before Am. Road Bldrs. Assn.

WEIGHED AGGREGATES. Records on a Concrete Road Using Weighed Aggregates, W. E. Barker. Eng. News-Rec., vol. 96, no. 11, Mar. 18, 1926, pp. 440-441, 4 figs. Weighing simple and rapid; daily sieve analysis; aggregate moisture content tested often; full test control.

ROCK CRUSHING

PHENOMENA, INVESTIGATION OF. An Investigation of Crushing Phenomena, A. M. Gaudin. Am. Inst. Min. & Met. Engrs.—Trans., no. 1565-B, Feb. 1926, 58 pp., 84 figs. Study undertaken in order to condense information concerning comminution, and covering great variety of conditions into one or several rules which would be of use in development of sytematic theory and in many directly practical ways.

RECLAMATION

LAND. Present Policy of the United States Bureau of Reclamation Regarding Land Settlement, E. Mead. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 411-415. Review of main activity of reclamation services; relation of private ownership of land to social and economic value of works built with Government money.

RESERVOIRS

CONCRETE LINED. Design and Construction of Concrete-Lined Distributing Reservoirs, I. E. Flaa. Am. Water Wks. Assn.—Jl., vol. 15, no. 2, Feb. 1926, pp. 118-128, 3 figs. Distributing reservoirs are used for receiving water from long conduits, leading from source of supply into cities and there regulating flow into distributing system; type of reservoir depends upon physical character of available sites; examples of reservoirs in vicinity of San Francisco.

RIVERS

ST. LAWRENCE. Ice Conditions in St. Lawrence River, H. T. Barnes. Can. Engr., vol. 50, no. 6, Feb. 9, 1926, pp. 207-208. Effect of ice on water levels, advantages provided by nature; method being worked out for conservation of heat of Lake Ontario for ice prevention. (Abstract.) Paper presented before Shipg. Federation and Board of Trade, Montreal.

ROLLING MILLS

BLOOMING-MILL DRIVE. New Electric Blooming Mill Drive Installed in Record Time, A. L. Foell. Blast Furnace & Steel Plant, vol. 14, no. 3, Mar. 1926, pp. 115-117, 3 figs. Installation of new electric blooming-mill drive put in operation by Donner Steel Co.

NON-REVERSIBLE. Cascade Control, System Krämer, for Non-Reversible Rolling Mills (Groupes de reglage en cascade système Krämer), G. Wauthier. Revue Universelle des Mines, vol. 9, no. 3, Feb. 1, 1926, pp. 138-151, 6 figs. Details of Krämer and Scherbins systems; starting, speed control, braking. Advantages of cascade systems are: speed changes within wide limits, cos $\varnothing = 1$ for all loads and speeds, constant power at all speeds, etc.

STEEL ROLLING. The Theory and Practice of Rolling Steel, W. Tafel. Iron Trade Rev., vol. 78, nos. 5, 7 and 9, Feb. 4, 18 and Mar. 4, 1926, pp. 331-335, 457-460 and 570-572 and 575, 26 figs. Feb. 4: Development of roll-drawing outer collars; pass layouts for hoop steel. Feb. 18: Hand and guide rolling. Mar. 4: Determining of square to be entered into flat oval pass; types developed by author for overcoming production with improperly rolled material; difference between wire and other materials.

S

SAND

HANDLING. Handling Sand and Gravel Efficiently from Oregon Rivers, E. D. Roberts. Pit & Quarry, vol. 11, no. 11, Mar. 1, 1926, pp. 75-80, 5 figs. Methods and equipment required to deliver sand and gravel direct to barges of small retailing companies.

PREPARATION AND USE. Preparation and Use of Industrial Special Sands, W. M. Weigel. Am. Inst. Min. & Met. Engrs.—Trans., no. 1569-H, Feb. 1926, 14 pp., 10 figs. Definition of special sands; sources of supply; mining methods; preparation; uses and properties; possible by-products in preparation of sand; possible fields for research.

WASHING AND SIZING. Washing and Sizing Sand and Gravel, E. Shaw. Am. Inst. Min. & Met. Engrs.—Trans., no. 1528-H, Feb. 1926, 10 pp. Impurities to be washed out; standard and special washing method; washing sand by decantation; water required for washing; uniformf eeding; sizing and classification; future industry.

SAND, MOLDING

ANALYSIS. Analysis of Molding Sand; Some Physical and Chemical Tests, W. B. Vestal and H. L. Pierce. West. Machy. World, vol. 17, no. 2, Feb. 1926, pp. 73-75, 2 figs. Fundamentals of sand analysis, divided into physical and chemical characteristics for purpose of discussion.

RECLAMATION. Reclamation of Molding Sand in the Steel Foundry. West. Machy. World, vol. 17, no. 2, Feb. 1926, pp. 75-77, 1 fig. Economic system of sand reclamation; results of tests taken from several installations, give very complete analysis of what may be expected if rejected sand was analyzed in any steel foundry.

TESTS. The Use of Standard Tests of Molding Sands, H. Ries. Am. Inst. Min. & Met. Engrs.—Trans., no. 1522-H, Jan. 1926, 3 pp.; also (abstract) in Iron Age, vol.. 117, no. 9, Mar. 4, 1926, pp. 621-622. Research with object of obtaining reliable data on which formulation of standard methods of testing could be based.

SAWS

FRAMES. Multiple Blade Saw Frames and Their Requirements (Welche Anforderungen müssen an ein modernes Vollgatter gestellt werden?), Spatz. Maschinenbau, vol. 5, no. 2, Jan. 21, 1926, pp. 62-64, 4 figs. German and Swedish frames; frames with one or two connecting rods; overhanging of saw blades, deep-cutting, and high-speed frames.

SCREW MACHINES

AUTOMATIC. Automatic Screw Machine. Machy. (Lond.), vol. 27, no. 698, Feb. 11, 1926, pp. 652-653, 3 figs. New type machine of Swiss manufacture, for rapid production of screws in large or small quantities.

PURCHASING PRODUCTS. Buying Screw Machine Products, C. W. Bettcher. Iron Age, vol. 117, no. 10, Mar. 11, 1926, pp. 688-690. Suggestions from manufacturer aimed to produce better commercial understanding between buyer and seller.

SCREW THREADS

FIXING LIMITS. Limits of Accuracy in Repetition Work, H. Applegard. Am. Mach., vol. 64, no. 10, Mar. 11, 1926, pp. 389-390. Notes on fixing limits and turning of metals on automatic machine, on work to be threaded, for drilling, etc.

SEWAGE DISPOSAL

CHICAGO. Progress of the Sewage Disposal Progam at Chicago, E. J. Kelly. Eng. News-Rec., vol. 96, nos. 9 and 10, Mar. 4 and 11, 1926, pp. 363-366 and 394-400, 12 figs. Mar. 4: Entire Sanitary District has been divided into five areas for sewage treatment purposes. Mar. 11: Design and early construction methods of North Side activated sludge plant for 800,000 population; cableways handle concrete and equipment; bulk cement shipped in refrigerator cars.

PLANT TROUBLES. Some of the Tuning-Up Difficulties of the Milwaukee Sewage Plant, T. C. Hatton. Eng. News-Rec., vol. 96, no. 11, Mar. 18, 1926, pp. 446-447, 1 fig. All troubles so far have been found to be mechanical and not fundamental, and are gradually being eliminated; conveyor system for sludge handling has given most trouble; early difficulties and what is being done to overcome them.

SHAFTS

VIBRATION. Vibration Phenomena of Loaded Unbalanced Shaft While Passing through Its Critical Speed, A. L. Kimball, Jr., and E. H. Hull. Mech. Eng., vol. 48, no. 3, Mar. 1926, pp. 251-253 and (discussion) 254-255, 9 figs. Problem of shaft whirling considered in this article is reduced to simplest terms by assuming rotor to be disk-shaped flywheel, carried by straight, weightless shaft with unbalanced producer, for example, by drilling hole in one side of disk.

SLOTTING MACHINES

BUSH 4-INCH. The Bush 4-Inch Slotting Machine. Machy. (Lond.), vol. 27, no. 698, Feb. 11, 1926, p. 649, 3 figs. Machine for use with light and medium-size work in engineering works and in garages or small general repair shops.

SNOW REMOVAL

COST ANALYSIS. Cost Analysis of Snow Removal in Michigan, V. R. Burton. Roads & Streets, vol. 65, no. 2, Feb. 3, 1926, pp. 93-99, 5 figs. Results of condition survey. Paper presented before Am. Road Bldrs. Assn.

SPRINGS

HELICAL. Helical Springs, C. W. Hill. Machy. (Lond.), vol. 27, no. 697, Feb. 4, 1926, pp. 601-607, 7 figs. Investigations into relation of actual to calculated performance.

STANDARDS

GERMAN N.D.I. REPORT. Report of German Industrial Standards Committee (NDI.-Mitteilungen), Maschinenbau, vol. 5, no. 1, Jan. 7, 1926, pp. 45-52, 4 figs. Details of proposed standards for interchangeable gears for machine tools; milling cutters for wheel-tire profile of German Railway, with and without shank

STEAM

HIGH-PRESSURE. High Pressure Steam Working, Löffler. Eng. & Boiler House Rev., vol. 39, no. 7, Jan. 1926, pp. 315-318 and 324, 3 figs. Requirements of high-pressure steam generators; trials of new generator of Vienna Locomotive Works Corp., where testing plant has been erected in their shops.

Power and Process Steam from Higher Pressures, A. G. Darling. Paper Trade Jl., vol. 82, no. 8, Feb. 25, 1926, pp. 163-165, 4 figs. Increase of energy from higher pressures; application for pulp and paper mills; multi-stage condensing turbine; bibliography. Paper before Tech. Assn. Pulp & Paper Industry.

LONG-DISTANCE DISTRIBUTION. Economical Conveyance and Distribution of Steam over Long Distances, K. Hencky. Eng. Process, vol. 7, no. 2, Feb. 1926, pp. 43-51, 17 figs. Precaution against heat losses; influence of properties of steam on heat losses; delivery of steam of different pressures to large works.

UNDERGROUND HEAT, PRODUCTION FROM. Steam Apparatus for Using the Internal Heat of the Earth (Ancora sulle centrali di Larderello e di Torre del Lago). Industria, vol. 39, no. 18, Sept. 30, 1925, p. 481, 1 fig.

STEAM ENGINES

CYLINDERS. Water in Steam-Engine Cylinders, E. Ingham. Power Engr., vol. 21, no. 240, Mar. 1926, pp. 103-104. Discussion of ways and means whereby this may be avoided.

STEAM PIPES

CALCULATION. Calculation of Steam Pipe Lines (Nota sul calcolo delle condotte per vapore), T. Jervis. Industria, vol. 39, no. 23, Dec. 15, 1925, pp. 611-613, 2 figs. Calculation of coefficient of friction, viscosity; turbulent flow; diameter and velocity; pressures; develops equations.

STEAM POWER PLANTS

COMBINATION HEATING AND. Fuel Economy by Combined Services. Power Engr., vol. 21, no. 240, Mar. 1926, pp. 92-99, 13 figs. Through combination of heating and electricity supply at St. John's Hospital, Wandsworth, quite small plant has yielded striking results.

STEAM TURBINES

DEVELOPMENTS. Evolution of Steam Turbines. (L'évolution des turbines à vapeur), F. Fontanel. Arts et Metiers, vol. 78, no. 62, Nov. 1925, pp. 441-462, 25 figs. Use of high pressures and superheat; feed-water heating by absorbing steam; high powers and speeds attained with multicellular turbines; applications to turbo-alternators, turbo-pumps, turbo-blowers, etc.

STEEL

ALLOY. *See Alloy Steels.*

CARBON EXPANSION CURVES. A Simple Dilatometer for High Temperatures; Expansion of Carbon Steels at Critical Points (Ein einfacher Ausdehnungsapparat für hohe Temperaturen; das Ausdehungsverhalten der Kohlenstoffstähle im Umwandlungsbereich), F. Stablein. Stahl u. Eisen, vol. 46, no. 4, Jan. 28, 1926, pp. 101-104, 5 figs.

CARBON, PHYSICAL PROPERTIES. Influence of Temperature, Time and Rate of Cooling on Physcial Properties of Carbon Steel II, F. B. Foley, C. V. Clayton, and W. E. Remmers. Am. Inst. Min. & Met. Engrs.—Trans., no. 1545-C, Feb. 1926, 19 pp., 14 figs.

FATIGUE FAILURES. Fatigue Failures in Steel, F. W. Rowe. Metal Industry (Lond.), vol. 28, nos. 6, 7 and 8, Feb. 5, 12 and 19, 1926, pp. 133-135, 157-159 and 185-188, 18 figs. Duscusses, with examples, some of general problems of fatigue failure, especially in regard to concentration of stresses at sharp changes of section, including effect of surface scratches, and also in regard to lack of correlation between endurance limit of a steel and its chief static mechanical properties; examples of typical fatigue failures in service, in most of which defective metallurgical treatment as well as design and constructional problems are involved.

IMPACT RESISTANCE. Variation with Temperature of the Resistance to Impact of Steel (Sur la variation de la résistance des aciers ordinaires doux et dur, au chock par traction, avec la température), J. Cournot and R. Sasagawa. Académie des Sciences—Comptes Rendus, vol. 181, no. 25, Dec. 21, 1925, pp. 1065-1066.

MALLEABILITY. Limit of Malleability of Steel When Hot as a Function of Carbon Content (Limite de la malleabilite à chaud de l'acier en fonction de sa teneur en Carbone), E. Cotel. Revue Universelle des Mines, vol. 9, no. 1, Jan. 1, 1926, pp. 27-29, 1 fig.

PHYSICAL PROPERTIES. Some Physical Properties of Steel and Their Determination, J. H. Andrew, M. S. Fisher, and J. M. Robertson. Roy. Soc.—Proc., vol. 110, no. A754, Feb. 1, 1926, pp. 391-422, 19 figs. Investigation of constitution of steel by new methods; deals with electrode potential, electrical resistance, and change of resistance during tempering.

STAINLESS. Rustless Steel (Nichtrostender Stahl), E. Richards. Schweizerische Bauzeitung, vol. 87, nos. 5 and 6, Jan. 30 and Feb. 7, 1926, pp. 59-60 and 72-74, 8 figs.

STEEL CASTINGS

TEST BARS. Producing Test Bars in Quantities. Machy. (Lond.), vol. 27, no. 693, Jan. 7, 1926, p. 477, 1 fig. In a large works so many test bars of steel castings are made that it has been found economical to tool up a turret lathe for finishing them.

STEEL, HEAT TREATMENT OF

HARDENING. The Current Theories of the Hardening of Steel Thirty Years Later, A. Sauveur. Am. Inst. Min. & Met. Engrs.—Trans., no. 1532-C, Feb. 1926, 44 pp., 10 figs. Duscusses phenomenon of hardening of steel; appendix contains answers to questionnaires to eminent metallurgists in effort to ascertain prevailing views of those best qualified to express opinion.

TEMPERING LIQUIDS. Study of Quenching Liquids (Etude rationelle des liquides de trempe), J. Hebert. Technique Moderne, vol. 18, no. 3, Feb. 1, 1926, pp. 65-71, 13 figs. Concludes that it is always possible to impart to steel greater or inferior hardness than that resulting from pure water by dissolving a certain quantity of salts, acids or bases, capable of producing a desired effect.

STEEL MANUFACTURE

AUTOMOBILE STEELS. The Production of Automobile Steels. Automobile Engr., vol. 16, no. 212, Feb. 1926, pp. 59-61, 6 figs. Notes on works and manufacturing methods of Hadfields, Ltd., in England; making manganese steel, road springs, valves, and heat-resisiting steels.

BESSEMER AND BASIC PROCESSES. The Present Status of the Basic Bessemer Process in Comparison with the Thomas Process (Der heutige Stand der basischen Herdfrischverfahren im Vergleich zum Thomasverfahren), F. Bernhardt. Stahl u. Eisen, vol. 48, nos. 1, 2, 3 and 5, Jan. 7, 14, 21, and Feb. 4, 1926, pp. 1-7, 39-44, 73-78 and 137-142, including discussion.

HIGH-GRADE. Making High Grade Steel, J. A. Coyle. Iron Trade Rev., vol. 78, nos. 8 and 10, Feb. 25 and Mar. 11, 1926, pp. 514-516, 4 figs., and 636-637, and 640, 5 figs. Feb. 25: Metal for band, circular and gang saws, cutlery and engraving plates requires close control of melting and finishing processes; typical analyses of band-saw, circular-saw, and metal-cutting steels. Mar. 11: Shearing blanks for cross-cut saws from clogged or rolled blanks; clearance obtained by tilting top-roll of mill.

STOKERS

CHAIN-GRATE. Chain-Grate Stokers. Power Engr., vol. 21, no. 240, Mar. 1926, pp. 90-91, 3 figs. Factors affecting their operation.

HEATING PLANT. Stokers Pay Big Dividends in Heating Plant. Power, vol. 63, no. 7, Feb. 16, 1926, pp. 253-254, 1 fig. In three-boiler plant operating during heating season of seven months, installation of stokers saves more than $10,000 over hand firing and use of oil for short period.

SIDE-CLEANING. New Double Retort Side Cleaning Stoker, R. June. Combustion, vol. 14, no. 3, Mar. 1926, pp. 176-177, 4 figs. Stoker developed by Detroit Stoker Co., two retorts doing work which formerly had to be done by one.

STREAM POLLUTION

PROBLEMS. Some Viewpoints on Stream Pollution, H. P. Eddy. Can. Engr., vol. 50, no. 7, Feb. 16, 1926, pp. 223-226. Legal and engineering aspects discussed at conference of Engineering Profession of Michigan at Detroit; sanitary laws in various states and of health authorities quoted; theory and practice form main topic of discussion; American and Canadian viewpoints. See also discussion by Wm. Gore, pp. 226-227.

SUBSTATIONS

AUTOMATIC. Another Automatic Converter Sub-Station. Elec. Rev., vol. 98, no. 2513, Jan. 22, 1926, pp. 124-125, 3 figs. Demonstration of Reyrolle-Mather & Platt equipment at Park Works, Manchester.

SAFETY DEVICES. Substation Designed for Safety, N. B. Higgins. Elec. World, vol. 87, no. 6, Feb. 6, 1926, pp. 295-297, 5 figs. Violet Hill station of Pa. Water & Power Co. at York, Pa., uses ingeniously devised system of switch interlocks to prevent injury to persons or damage to equipment.

SUPERHEATERS

TYPES. Modern Superheaters. Eng. & Boiler House Rev., vol. 39, no. 7, Jan. 1926, 329-332, 4 figs. Details embodied in design of Superheater Co., Ltd.

SUPERPOWER

INTERCONNECTION. Conti Dwells on Advantages of Interconnection. Elec. World, vol. 87, no. 7, Feb. 13, 1926, p. 353. Review of address by Ettore Conti delivered before International Chamber of Commerce at Brussels, stating that social and economic pressure forces interconnection; national laws should permit developments to be made freely.

SURVEYING

AERIAL. The Brock Process of Making Topographic Surveys from the Air, F. E. Weymouth. Engineering, vol. 121, no. 3138, Feb. 19, 1926, pp. 245-248, 12 figs. Method of determining contour location from aerial photographs and translating photographic data to form of engineering maps with constant scale.

Aeroplane Topographic Surveys, G. T. Bergen. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 3, Mar. 1926, pp. 367-395, 13 figs. Method of making accurate contour maps directly from aerial photographs; method is applicable to wide range of conditions, it offers marked advantages in making maps of large areas for engineering studies and preliminary locations, particularly in country of bold relief and considerable growth of timber or brush.

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TERMINALS, LOCOMOTIVE

BATTLE CREEK, MICH. Grand Trunk Western Completes Modern Terminal. Ry. Mech. Engr., vol. 100, no. 2, Feb. 1926, pp. 115-119, 11 figs. Modern cinder storage and power plant are outstanding mechanical features of terminal at Battle Creek, Mich.

TERMINALS, RAILWAY

CHICAGO. I. C. Chicago Terminal Project Now One-Third Completed. Ry. Age, vol. 80, no. 9, Feb. 27, 1926, pp. 514-519, 9 figs. Project comprises complete reconstruction of passenger and freight facilities of road in Chicago, and electrification of all service other than that on its branch west to Sioux City.

ST. PAUL, MINN. St. Paul Union Depot Completed, G. H. Wilsey. Ry. Age, vol. 80, no. 7, Feb. 13, 1926, pp. 418-422, 6 figs. New passenger-terminal improvements; use of cellular retaining wall; track layout.

TIDAL POWER

UTILIZATION. Harnessing Tidal Power from Waves (La captation de la puissance des vagues), P. van Vloten. Génie Civil, vol. 88, no. 4, Jan. 23, 1926, pp. 80-83, 4 figs. Details of new method in which waves are directed up an incline provided with vertical divisions so that water collects in canals or chambers above sea-level for driving turbines.

TOLERANCES

SCREW-THREAD. Screw Thread Tolerances—Comment, R. E. Flanders. Machy. (Lond.), vol. 27, no. 696, Jan. 28, 1926, pp. 580-582, 7 figs. Discusses Hartness comparator, with reference to article by Elstub in Oct. 29, 1925, issue of same journal.

TOOLS

WEAR. The Effect of Wear on Small Tools. Indus. Mgmt. (L9nd.), vol. 13, no. 1, Jan. 1926, pp. 29-30. How normal wear affects accuracy.

TORSION

STEEL BARS. Theoretical and Practical Points on Torsion of Bars of Non-Circular Section (Quelques particularités théoriques et expérimentales de la torsion de barreaux à section non circulaire), M. J. Sigle. Revue de l'Industrie Minérale, no. 120, Dec. 15, 1925, pp. 557-566, 29 figs. Results of experiments; inferiority of non-circular cross sections in resisting torsion; lines of equal displacement and of equal sliding during deformation by torsion; appearance of steel bars subjected to extreme torsion; change of length, etc.

TRACTORS

FARM, AMERICAN SPECIFICATIONS. American Agricultural Tractor Specifications. Automotive Industries, vol. 54, no. 7, Feb. 18, 1926, pp. 312-315. Tabular data alphabetically arranged according to makes. See also data on American garden-tractor specifications, pp. 314-315.

TRANSFORMERS

CONNECTING METERS AND RELAYS. Connecting Meters and Relays to Transformers, J. B. Gibbs. Power, vol. 63, no. 9, Mar. 2, 1926, pp. 326-328, 13 figs. Simpler and common connections for single-phase and polyphase circuits; discusses accuracy of instrument transformers and factors that limit number of meters and relays that can be connected to same transformers.

TAP-CHANGING. Tap-Changing Transformer with Nine Steps, A. Palme. Elec. World, vol. 87, no. 10, Mar. 6, 1926, pp. 511-512, 2 figs. Details of installation in electrolytic copper-refining plant in Belgium.

TUNNELLING

ROCK. Recent Rock Tunneling Methods, Illinois Central R.R. Eng. News-Rec., vol. 96, no. 9, Mar. 4, 1926, p. 370, 2 figs. Longest of 3 rock tunnels on new line through Ozark Hills exemplifies best modern equipment practice.

TURBO-ALTERNATORS

INDIRECT COOLING. Indirect Cooling of Turbo-Alternators, F. S. Bennett. Power, vol. 63, no. 11, Mar. 16, 1926, pp. 400-403, 9 figs. Comparisons between type of air-cooler designed for using condensate and raw water and those using raw water only; improvements in design; suggestions on operating practice; brief reference to application of these coolers to synchronous condensers and frequency-changer sets.

V

VALVES

MULTIPLE-FLAP. Multiple-Flap Valve. Engineer, vol. 141, no. 3568, Feb. 5, 1926, p. 160, 2 figs. Details of Ismailia valve, which derives its name from fact that it was first used at Ismailia Pumping Station at Cairo, in connection with pumps designed to discharge crude sewage against head of 300 ft.; it is claimed for it that, it not only provides clear way for passage of liquid, but it has no hinge to collect fibrous matter, and can be removed and replaced by hand without use of tools.

VARNISHING

SPRAY METHOD. Modern Processes of Spray Varnishing (Newzeitliche Spritzlackierverfahren), R. Klose. Maschinenbau, vol. 5, no. 2, Jan. 21, 1926, pp. 65-71, 18 figs. Shows how work may be put on modern basis; types of atomizers for various kinds of work; automatic machines; precalculation, examples and curves; cost data.

W

WAGES

GROUP-PAYMENT SYSTEM. The Group System of Wage Payment, H. B. Maynard and G. J. Stegemerten. Indus. Mgmt. (N.Y.), vol. 71, nos. 2 and 3, Feb. and Mar. 1926, pp. 93-98 and 167-172, 6 figs. Feb.: Discussion of its advantages and applications. Mar.: Details of operation of group system at East Pittsburgh.

WATER HAMMER

PENSTOCK, EFFECT ON. Effect of Hydraulic Shock on Welded Drum. Power, vol. 63, no. 7, Feb. 16, 1926, pp. 260-261, 2 figs. Analyses of tests at plant of A. O. Smith Corp. indicate that about 7,000 repetitions of stress materially reduced strength of plate; initial stresses in unannealed drum may also have been a factor.

WATER MAINS

CAST IRON. Laying Cast Iron Mains: Organizations and Methods, H. V. Knouse. Am. Water Wks. Assn.—Jl., vol. 15, no. 2, Feb. 1926, pp. 129-136, 6 figs. Installation in Metropolitan Utilities District of Omaha, Nebr.

CLEANING. Cut Holes in Submerged Main for Cleaning, L. F. Hagglund. Water Wks. Eng., vol. 79, no. 4, Feb. 15, 1926, pp. 195-196, 2 figs. Manholes cut in supply pipe, submerged 50-ft. to remove incrustations; description of process.

WATER SUPPLY

GROUNDWATER. Increasing the Capacity of Ground Water Supplies, W. G. Kirchoffer. Am. Water Wks. Assn.—Jl., vol. 15, no. 2, Feb. 1926, pp. 144-151. Deals mainly with water supplies on wells, both deep and shallow.

WATER TREATMENT

SOFTENING OF COOLING WATER. Improved Cooling System for Oil-Engine Plants, E. J. Kates. Power, vol. 63, no. 11, Mar. 16, 1926, pp. 407-408, 2 figs. Zeolite water-softening system; heat exchanges for large plants.

WATERWAYS

FORMULA FOR. A General Formula for Waterways, C. S. Jarvis. Pub. Roads, vol. 6, no. 12, Feb. 1926, pp. 253-259, 2 figs. Modification of Myers formula; adaptability of Meyers scale; identical problems solved by various formulas; advantages of Myers scale.

WATER WORKS

BISMARCK, N.D. Single Building Houses Bismarck's New Pumps and Filters, T. Dickinson. Eng. News-Rec., vol. 96, no. 9, Mar. 4, 1926, pp. 371-373, 4 figs. Improvements made in water-works system include power plant, pumping station and water softening and filtration plant under one roof, for operation by two or three attendants; utilization of domestic service pumps in connection with high-level storage reservoirs to supply fire demands at increased pressure and at three times capacity of filtration plant.

JASPER, ALBERTA. Waterworks System at Jasper, Alta., J. M. Wardle. Can. Engr., vol. 50, no. 7, Feb. 16, 1926, pp. 221-222, 4 figs. New gravity system replaces old intake works and pipe line; concrete dam built at Cabin Creek to form new reservoir with capacity of 210,000-gals. Eight inch pipe line supplies town and 80,000-gal. tank for C.N.R. system.

PORT COLBORNE, ONT. Waterworks Plant, Port Colborne, Ont., E. H. Darling. Can. Engr., vol. 50, no. 8, Feb. 23, 1926, pp. 243-246, 6 figs. Abstract of engineer's report containing recommendations for filtration plant; water conditions in harbor; details of plant installed; pressure filter; two motor-driven centrifugal pumps and gasoline engine driven standby unit; pedestal type chlorinator; statement of costs.

PUMP CAPACITY VS. STORAGE REQUIREMENTS. Balancing Reservoirs to Supplement Pump Capacity During Peak Demands, E. K. Barnum. Am. Water Wks. Assn.—Jl., vol. 15, no. 2, Feb. 1926, pp. 109-117, 5 figs. Outlines method of determining relationship between maximum hourly demand and pump capacity versus storage requirements.

WAVES

WATER, PRODUCED BY WIND. On the Formation of Water Waves by Wind, H. Jeffreys. Roy. Soc.—Proc., vol. 110, no. A754, Feb. 1, 1926, pp. 241-247. On hypothesis that water waves may be considered irrotational, viscosity and other factors tending to change amplitude being small, it has been found possible to investigate conditions of growth of waves under action of wind, even when depth is finite and surface tension is allowed for; it is found that rate of decay of waves, in absence of wind, is independent of depth and surface tension.

WEIGHING MACHINES

HEAVY LOADS. The Geared Weighing Machine and Its Application for Heavy Loads, F. Rinecke. Eng. Progress, vol. 7, no. 1, Jan. 1926, pp. 6-8, 6 figs. Machine in which problem of determining moments acting on beam is solved in such manner that length of lever is constant and weight of load is determined by weight required to establish equilibrium; use of safety device on large weighing machines.

WELDING

BOILERS. Autogenous and Electric Welding of Boilers and Containers (Autogen und elektrisch geschweisste Kessel und Behälter), E. Höhn. Zeit. des Vereines deutscher Ingenieure, vol. 70, nos. 4 and 6, Jan. 23 and Feb. 6, 1926, pp. 117-122 and 194-196, 71 figs. Strength of autogenous and electrically welded seams and boiler parts; production of autogenous and electrically welded boilers and containers.

WELLS

GRAVEL-WALL. Gravel-Wall Well in Leamington. Contract Rec., vol. 40., no. 9, Mar. 3, 1926, pp. 200-201, 2 figs. One 18-in. well of this type produces nearly as much water as three 10-in. wells of old kind; comparison of production curves.

WIND TUNNELS

AIR CURRENTS. Change of 180 deg. in the Direction of a Uniform Current of Air, J. Bonder. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 350, 31 pp., 8 figs. Determination of rational form for turn at change of direction by 180 deg. of horizontal uniform current.

NEW YORK UNIVERSITY. The N. Y. University Wind Tunnel, Wm. H. Miller. Aviation, vol. 20, no. 9, Mar. 1, 1926, pp. 293-295, 4 figs. N. P. L.-type, 4-ft. wind tunnel equipped for extensive research and test work in aerodynamics.

VARIABLE-DENSITY. The Variable Density Wind Tunnel of the National Advisory Committee for Aeronautics, M. M. Munk and E. W. Miller. Nat. Advisory Committee for Aeronautics—Report, no. 227, 1926, 18 pp., 19 figs. Discusses novel features of this tunnel and gives general description.

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A

ACCELEROMETERS

AUTOMOBILE TESTING. Riding Qualities. Soc. Automotive Engrs.—Jl., vol. 18, no. 3, Mar. 1926, pp. 248-251, 7 figs.

ACCIDENT PREVENTION

ECONOMIC SOCIAL ASPECT. Does Accident Prevention Pay? G. A. Orth. Safety Eng., vol. 51, no. 3, Mar. 1926, pp. 145-150, 2 figs.

AERONAUTICAL INSTRUMENTS

TYPES. New Types of Aircraft Instruments, F. L. Hunt. Optical Soc. of Am. & Rev. of Sci. Instruments—Jl., vol. 12, no. 3, Mar. 1926, pp. 227-269, 40 figs.

AIR

VISCOSITY. The Effect of Temperature on the Viscosity of Air, F. A. Williams. Roy. Soc.—Proc., vol. 110, no. A753, Jan. 1, 1926, pp. 141-167, 3 figs. Coefficient of viscosity of dry air free from CO_2 has been studied by means of comparative method of transpiration from 15 to 1002 deg. cent.; results show Sutherland's formula for temperature coefficient of viscosity to hold with great accuracy between 250 and 1000 deg. cent.; value of carbon falls off as temperature decreases and Sutherland's law is no longer true.

AIR CONDITIONING

HUMIDITY CHART. A New Psychrometric or Humidity Chart, C. A. Bulkeley. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 4, Apr. 1926, pp. 237-244, 3 figs. Fundamental principles underlying subject on which any psychrometric chart or tables must be based; presents Bulkeley chart based on Carrier's rational psychrometric formula; examples in use of chart.

HUMIDITY CONTROL IN TEXTILE MILLS. Importance of Fixed Regulation of Humidity in the Textile Industry (Die Bedeutung einer bestimmten Regulierung der Feuchtigkeit in den textiltechnischen Betrieben), J. Obermiller. Zeit. für angewandte Chemie, vol. 39, no. 2, Jan. 14, 1926, pp. 46-51, 1 fig.

AIRCRAFT

PRESSURE-DISTRIBUTION MEASUREMENT. The Spacing of Orifices for the Measurement of Pressure Distributions, M. M. Munk. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 230, Jan. 1926, 48 pp., 10 figs. on supp. plates.

AIRPLANE ENGINES

AIR-COOLED. Removable Cylinders Simplify Maintenance of Air-Cooled Airplane Engines, A. Black, Automotive Industries, vol. 54, no. 12, Mar. 25, 1926, pp. 528-531, 4 figs.

AMERICAN DEVELOPMENT. Modern American Aircraft Engine Development, C. L. Lawrence. Aviation, vol. 20, nos. 11 and 12, Mar. 15 and 22, 1926, pp. 364-367, and 411-415, 12 figs.

DESIGN TREND. The Trend of Aircraft Engine Development, E.E. Wilson. Am. Soc. Naval Engrs.—Jl., vol. 38, no. 1, Feb. 1926, pp 130-143, 5 figs.

MANUFACTURE. Aero Engine Manufacture. Machy. (Lond.), vol. 27, no. 703, Mar. 18, 1926, pp. 793-806, 30 figs.

SPEED REDUCER. French Airplane Speed Reducing Gear to be Used Here, W. F. Bradley. Automotive Industries, vol. 54, no. 14, Apr. 8, 1926, p. 615, 2 figs.

SUPERCHARGERS. Description and Laboratory Tests of a Roots Type Aircraft Engine Supercharger, M. Ware. Nat. Advisory Committee for Aeronautics—Report, no. 230, 1926, 13 pp., 13 figs.

TORSIONAL VIBRATION. Torsional Vibration, B. C. Carter and A. Swan. Automobile Engr., vol. 16, no. 213, Mar. 1926, pp. 86-88, 1 fig.

AIRPLANE PROPELLERS

TESTS. Comparison of Tests on Air Propellers in Flight with Wind Tunnel Model Tests on Similar Forms, W. F. Durand and E. P. Lesley. Nat. Advisory Committee for Aeronautics—Report, no. 220, 1926, 29 pp., 29 figs.

THRUST DISTRIBUTION. The Best Thrust Distribution for Airplane Propellers Taking Profile Resistance into Consideration (Die günstigste Schubverteilung für die Luftschraube bei Berücksichtigung des Profilwiderstandes), T. Bienen. Zeit. für Flugtechnik u. Motorluftschiffahrt, vol. 17, no. 1, Jan. 14, 1926, pp. 4-6, 2 figs. Corrected reprint of portion of author's article published in nos. 10 and 11, May 28 and June 13, 1925, issues of same journal, which contained error in one of the equations.

AIRPLANES

AUTOGIRO. De la Cierva's Autogiro (Ueber den Autogyro von de la Cierva). Zeit. für Flugtechnik u. Motorluftschiffahrt, vol. 17, no. 4, Feb. 27, 1926, pp. 69-73, 10 figs.

DURALUMIN. Duralumin Construction on Original Lines. Flight, vol. 18, no. 10, Mar. 11, 1926, pp. 139-141, 2 figs. Methods employed at works of Short Bros., Rochester, England.

JOINTS AND FITTINGS. Aeroplane Joints and Fittings, F. M. Green. Flight (Aircraft Engr.), vol. 18, no. 12, Mar. 25, 1926, pp. 178f-178h, 4 figs.

METAL STRUCTURE. Relationship of Metallurgy to the Development of Aircraft, J. B. Johnson. Am. Soc. Steel Treating—Trans., vol. 9, no. 4, Apr. 1926, pp. 517-538, 13 figs.

SEAPLANES. *See Seaplanes.*

SLIPSTREAM EFFECT. Slipstream Effect, C. N. Monteith. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 355, Mar. 1926, 7 pp., 4 figs.

SPINNING. Some Experiments on a Model of a B.A.T. "Bantam" Aeroplane with Special Reference to Spinning Accidents, H. B. Irving, A. S. Batson, H. C. H. Townsend and T. A. Kirkup. Aeronautical Research Committee—Reports & Memoranda, no. 976, Nov. 1925, 21 pp., 17 figs.

TECHNICAL PROGRESS. Technical Progress in Aeronautics, E. E. Aldrin. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 309-316, 15 figs. Trend in airplane construction; increasing use of metal in fuselage and wing structures; lighter, more rigid, and more powerful engines; metal propellers; improvements in navigating instruments; roll reduction through braking, etc.

TESTS. Some Aspects of the Comparison of Model and Full-Scale Tests, D. W. Taylor. Nat. Advisory Committee for Aeronautics—Report, no. 219, 1926, 23 pp., 19 figs. Author considers general case applying to motion of objects in fluid medium.

WINGS. Tests for Determining the Effect of a Rotating Cylinder Fitted into Leading Edge of an Airplane Wing, E. B. Wolff and C. Koning. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 354, Mar. 1926, 15 pp., 8 figs.

ALIGNMENT CHARTS

CONSTRUCTION AND USE. Designation, Graphic Development and Use of Alignment Charts (Bemerkungen zur Bezeichnung, zur zeichnerischen Ausgestaltung und zum Gebrauch von graphischen Rechentafeln), P. Werkmeister. Bauingenieur, vol. 7, no. 9, Feb. 26, 1926, pp. 162-165.

MATHEMATICAL PRINCIPLES. Mathematical Bases of Most Simple Nomographic Charts, Their Construction and Use in Locomotive Work (Die mathematischen Grundlagen der einfachsten nomographischen Rechentafeln, ihre Herstellung und praktische Anwendung im Lokomotivmaschinenbau), U. Barske. Glasers Annalen, vol. 98, no. 2, Jan. 15, 1926, pp. 17-22, 12 figs.

ALLOYS

ALUMINUM. *See Aluminum Alloy.*
IRON. *See Iron Alloys.*
MAGNESIUM. *See Magnesium, Properties.*

ALUMINUM ALLOYS

ALUMINUM-LITHIUM. Aluminum-Lithium Alloys (Ueber vergütbare Aluminium-Lithiumlegierungen), P. Assmann. Zeit. fur Metallkunde, vol. 18, no. 2, Feb. 1926, pp. 51-54, 3 figs.

SAND-CAST. Properties of Some Sand-Cast Alloys of Aluminium Containing Silicon and Magnesium, S. Daniels. Indus. & Eng. Chem., vol. 18, no. 4, Apr. 1926, pp. 393-398, 14 figs.

AMMONIA COMPRESSORS

OIL-ENGINE-DRIVEN. Oil-Engine-Driven Ammonia Compressors, F. W. Green. Refrg. Eng., vol. 12, no. 9, Mar. 1926, pp. 311-316, 5 figs. Discusses oil-engine-driven compressor which has been specially designed for service under consideration; consists of horizontal, double-acting ammonia cylinder driven directly through connecting rod and crosshead by single-cylinder, horizontal single-acting oil engine.

POWER-DRIVE EQUIPMENT. Power-Drive Equipment for Ammonia Compressors, G. Fox. Indus. Engr., vol. 84, no. 3, Mar. 1926, pp. 106-109, 4 figs. Factors to consider when selecting equipment, including type and capacity of motor required, kind of control apparatus necessary and type of mechanical connection that should be used for coupling motor to compressor.

SPEED, EFFECT OF. Effect of Speed on Compressor Capacity and Power, L. H. Jenks. Refrg. Eng., vol. 12, no. 9, Mar. 1926, pp. 291-310 and 316-317, 32 figs. Results of test was to note performance of compressor known to makers as Type J, having plate valves arranged radially to cylinder circumference.

APPRENTICES, TRAINING OF

MORAL VALUE. The Moral Side of Apprentice Training, F. E. Lyford. Ry. Mech. Engr., vol. 100, no. 4, Apr. 1926, pp. 214-215, 1 fig. Vital factors in apprentice training; contacts with officials.

ARCHES

MASONRY. A Review of the Theory of Masonry Arch Analysis, J. Rathbun. Black Hills Engr., vol. 14, no. 1, Jan. 1926, pp. 3-13, 11 figs. Approximate analysis of arch rings, elastic theory of arch analysis; limitations of analysis; large natural bridges.

ASH HANDLING

MECHANICAL. A Recent Development in the Mechanical Handling of Ashes, G. F. Zimmer. Indus. Mgmt. (N.Y.), vol. 71, no. 4, Apr. 1926, pp. 242-244, 3 figs. Details of system recommended because of its simplicity, long life and efficiency.

ATOMS

DIMENSIONS. Atomic Dimensions, R. G. Lunnon. Physical Soc. of London—Proc., vol. 38, no. 212, Feb. 15, 1926, pp. 93-108, 7 figs. Deals with diameters of atoms of elements and compares estimates obtained by various methods. Bibliography.

AUTOMOBILE ENGINES

CARBURETORS. *See Carburetors.*

CYCLES, CALCULATION OF. Explosion Cycles, Calculation of Efficiency and Heat Balance (Remarques sur les cycles a explosions. Calcul du rendement et du bilan thermique), A. Planiol. Technique Automobile et Aérienne, vol. 16, no 131, 1925, pp. 97-109, 6 figs.

MACHINING PARTS. Machining Automotive Engine Parts, A. Murphy. Can. Machy., vol. 35, nos. 8 and 9, Feb. 25 and Mar. 4, 1926, pp. 14-17 and 15-18, 13 figs.

OIL FILTERS. New Engine Oil Filter Built for Quick Cleaning by Compressed Air. Automotive Industries, vol. 54, no. 13, Apr. 1, 1926, pp. 570-571, 4 figs. Foreign matter collecting in H-W-filtrator can be blown out; new air filter also introduced by Rich Tool Co.

OPERATING TEMPERATURES. High Average Operating Temperature and Engine and Car Operation. Soc. Automotive Engrs.—Jl., vol. 18, no. 3, Mar. 1926, pp. 255-267, 17 figs. Part 1, A. Taub: Deals with laboratory tests to prove by comparative data that higher average operating temperature maintained in engine by constant temperature or evaporation system of cooling have negligible detrimental effects. Part 2, L. P. Saunders: Gives results of road tests of cars operated under same conditions when fitted with standard water-cooling radiator core and with constant-temperature cross-flow condenser core.

SLEEVE-VALVE. Sleeve-Valve Engines, P. M. Heldt. Soc. Automotive Engrs.—Jl., vol. 18, no. 3, Mar. 1926, pp. 303-314, 15 figs.

AUTOMOBILE FUELS

ANTI-KNOCK COMPOUNDS. Anti-knock Materials, W. H. Church, E. Mack, Jr., and C. E. Boord. Indus. & Eng. Chem., vol. 18, no. 4, Apr. 1926, pp. 334-340, 7 figs.

DEVELOPMENTS. Present-Day Automotive Fuel, R. F. Lybeck. Soc. Automotive Engrs.—Jl., vol. 18, no. 3, Mar. 1926, pp. 282-284, 1 fig.

SYNTHETIC. A New Automotive Fuel (Ein neuer Motorbrennstoff). Motorwagen, vol. 29, no. 2, Jan. 20, 1926, p. 35. New synthetic fuel, developed by two Norwegians, Wittke and Selvin, obtained from sulphite alcohol and gas tar as by-product; it can be utilized directly in ordinary gasoline engine and in Norway it is cheaper than gasoline.

VOLATILITY. Progress in the Measurement of Motor-Fuel Volatility, T. S. Sligh, Jr. Soc. Automotive Engrs.—Jl., vol. 18, no. 4, Apr. 1926, pp. 393-496, 2 figs. Laboratory test methods of indicating volatility characteristics and starting capability of fuels used in internal-combustion engines; testing apparatus and procedure.

AUTOMOBILES

AMERICAN AND EUROPEAN DESIGN. Lessons of the American and European Automobile Industry (Lehren des amerikanischen und europäischen Automobilbaus), G. Becker. Zeit. des Vereines deutscher Ingenieure, vol. 70, nos. 8 and 10, Feb. 20 and Mar. 6, 1926, pp. 245-252 and 323-326, 18 figs.

CHASSIS DESIGN. Modern Chassis-Frame Design and Body Mounting, T. D. Carpenter. Automobile Engr., vol. 16, no 213, Mar. 1926, pp. 115-116.

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HEADLIGHTS. Automobile Head-Lamp Light-Characteristics and Improved Distribution, W. D. Ryan. Soc. Automotive Engrs.—Jl., vol. 18, no. 4, Apr. 1926, pp. 351-358, 11 figs.

Dipping Headlights. Automobile Engr., vol. 16, no. 213, Mar. 1926, pp. 96-97, 4 figs. Apparatus designed and produced by Sheffield Simplex Co.

Headlighting Situation in the District of Columbia, R. E. Carlson. Soc. Automotive Engrs.—Jl., vol. 18, no. 4, Apr. 1926, pp. 399-401.

WORM-GEAR DRIVE. Worm-Gear Drive Re-entering American Passenger Car Practice, W. L. Carver. Automotive Industries, vol. 54, no. 11, Mar. 18, 1926, pp. 479-482, 2 figs.

AVIATION

AIR-MAIL SERVICE, Air Mail Service, W. I. Glover. Aviation, vol. 20, no. 14, Apr 5, 1926, pp. 488-489, 2 figs. Developments of United States Air Mail Service; specialized planes developed. See also accounts of various air-mail routes as follows: Chicago to Dallas Air Mail Line, pp. 490-491, 2 figs.; Ford Air Transport, p. 492; Los Angeles-Salt Lake City Air Mail Line, H. M. Hanshue, pp. 493-494, 1 fig.; Los Angeles-San Diego Airline, pp. 495-496, 2 figs.; Washington, Oregon, Idaho Air Mail, pp. 496-497, 1 fig.; Boston-New York Air Mail Line, pp. 498-499, 1 fig.; Chicago-St. Louis Air Mail Line, p. 499; Chicago-St. Paul-Minneapolis Air Mail, pp. 500-501, 2 figs.; Seattle-San Francisco Air Mail Line, p. 501.

AIRWAY LIGHTING. The Lighting of the London Continental Airway, C. H. Biddlecombe. Aviation, vol. 20, no. 15, Apr. 12, 1926, pp. 550-552, 2 figs. Night-flying system employed on Imperial Airways Route from London to Continent.

FLYING-FIELD EQUIPMENT. Flying-Field Equipment for Air Transport, A. Black. Aviation, vol. 20, no. 15, Apr. 12, 1926, pp. 553-554, 4 figs. Elements affecting equipment; type of hangar buildings; internal equipment; gasoline storage and equipment.

TRANSPORT ECONOMY. Aircraft Transport Economy, W. L. Cowley. Roy. Aeronautical Soc.—Jl., vol. 30, no. 183, Mar. 1926, pp. 160-228, 26 figs.

B

BALANCING MACHINES

MARTIN. Martin Balancing Machine. Machy. (Lond.), vol. 27, no. 704, Mar. 25, 1926, pp. 842-843, 2 figs. Machine affords quick, inexpensive and accurate method of balancing rotary bodies such as armatures, rotors, gear wheels, propellers, fans, disks, crankshafts, etc.

BEARINGS, ROLLER

TAPERED. The Tapered Roller Bearing in Industry, A. P. Strong. Belting, vol. 28, no. 2, Feb. 1926, pp. 32 and 34. Fulfils all requirements of anti-friction bearing for machine tools; machinery applications requiring low speeds, high speeds and shock loads.

BOILER FEEDWATER

CONDITIONING. Boiler-Water Conditioning with Special Reference to High Operating Pressure and Corrosion, R. E. Hall. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 317-325 and (discussion) 325-327, 17 figs. Prevention of scale formation on evaporating surfaces; relation between chemical used and operating pressure; prevention of corrosion of surface in contact with boiler water; control of non-condensable gases in steam by boiler-water conditioning.

BEAMS

CONTINUOUS. Moments in Restrained and Continuous Beams by the Method of Conjugate Points. Am. Soc. Civ. Engrs.—Proc., vol. 52, nos. 1 and 2, 3, 4, Jan., Feb., Mar. and Apr. 1926, pp. 122-134, 329-333, 473-517 and 645-715, 57 figs. Discussion on paper by L. H. Nishkian and D. B. Steinman.

HEATING AND DEAERATING. Feed Water Heating, Deaerating and Pumping Plant. Eng. & Boiler House Rev., vol. 39, no. 9, Mar. 1926, pp. 411-426, 18 figs. Deals with handling of feedwater, that is, pumping into boiler circuit, deaerating or degassing to get rid of dissolved air in apparatus forming part of this circuit as distinct from ordinary softening plant and feed heating by means of exhaust steam that may be available.

TREATMENT. Preparation of Feed Water in Modern Power Houses, Von Le Juge. Eng. Progress, vol. 7, no. 3, Mar. 1926, pp. 64-67, 5 figs. Recent design of evaporating plants; deals with supplementing and degassing feedwater.

BOILER FURNACES

AIR PREHEATERS. The Perry Air Heater for Boiler Furnaces. Engineering, vol. 121, no. 3144, Apr. 2, 1926, pp. 445-447, 5 figs. Simple and effective form of air heater, which, although primarily intended for preheating air delivered to boiler furnaces, can also be used for obtaining supply of hot air for drying and other industrial processes; designed by H. H. Perry.

COMBUSTION CHAMBERS. Combustion Chambers for Pulverized Coal Firing, L. C. Harvey. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926, pp. 104-106, 4 figs. Forecast of future developments in combustion chamber designs for burning of cheaper grades of fuel in pulverized form under industrial boilers and in smaller types of metallurgical or process furnaces.

GRATE BARS. Recent Tests with Grate Bars (Neuere Versuche mit Roststäben), Schulz Brenstoff- u. Wärmewirtschaft, vol. 8, no. 2, Jan. 2, 1926, pp. 22-25, 7 figs.

MECHANICAL FIRING. The Mechanical Firing of Solid Fuel, A. W. Bennis. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926, pp. 67-73, 4 figs. Describes most efficient and economical method in use.

BOILER OPERATION

DRAFT. Theory of Induced Draft and Suction Draft Apparatus (Théorie des appareils à tirage induit et à tirage aspiré total), F. Frothais. Chaleur et Industrie, vol. 6, nos. 68 and 70, Dec. 1925, and Feb. 1926, pp. 555-561 and 91-96, 4 figs. Discusses forced draft and induced draft, determination of fans and their operation and efficiency. Theory of suction-draft apparatus, comparison of both systems.

BOILERMAKING

BRITISH PRACTICE. British Boiler Firm Fabricates Variety of Plate Products, J. G. Kirkland. Boiler Maker, vol. 26, no. 4, Apr. 1926, pp. 98-101, 12 figs. Welding plays important part in production of tanks, pipe works, stills and boilers; samples of work turned out.

BOILERS

DESIGN. Boilers and Furnaces, A. Grounds. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926, pp. 62-66, 3 figs. Construction and operation of most efficient types of boilers and furnaces used in modern power plants.

DEVELOPMENTS. Increased Efficiency and Progress in Boiler Construction (Leistungssteigerung und Fortschritte im Dampfkesselbau), C. Rühl. Wärme u. Kälte-Technik, vol. 28, nos. 2 and 3, Jan. 15 and Feb. 1, 1926, pp. 9-14 and 23-28, 22 figs.

ELECTRIC. The Generation of Explosive Gases in Electric Water Heaters and Boilers. Elec. News, vol. 35, no. 4, Feb. 15, 1926, pp. 27-30 and 51, 1 fig. Operating on alternating current with submerged electrodes, introduces danger factor; interesting experiments in Winnipeg.

GAS-FIRED. Town's Gas for Steam Generation, J. N. Williams. Gas World, vol. 84, no. 2173, Mar. 13, 1926, pp. 247-251, 4 figs. (Abstract.) Paper read before Midlands District Salesman's Circle.

INSPECTION. Inspecting Boilers in England, A. Wrench. Boiler Maker, vol. 26, no. 4, Apr. 1926, pp. 107-108. Advisability of adopting definite procedure when inspecting boilers of different types; suggested procedure to follow.

INTERNAL-COMBUSTION. The Internal Combustion Boiler, O. Brunler. Inst. Mar. Engrs.—Trans., Feb. 1926, pp. 625-640 and (discussions) 640-663, 5 figs. Considers possibilities of reducing heat losses in boiler; idea in working of internal-combustion boiler, principle of which is to maintain flame burning in water in order to produce steam for power or heating purposes; discusses flame temperature, what becomes of gases produced during combustion; compressor question, condensation, etc.; practical example demonstrating what can be gained with Brunler boiler, showing how it is possible to reduce steam power.

LOCOMOTIVES. *See Locomotive Boilers.*

LOW-PRESSURE. Low-Pressure Boiler Plants (Beobachtungen an Niederdruckkressel-Analgen), M. Klein. Zeit. Bayerischen Revisions-Vereins, vol. 30, no. 4, Feb. 28, 1926, pp. 37-42, 7 figs.

OIL-FIRED. Oil-Fired Yarrow Land-Type Boiler. Engineer, vol. 141, no. 3662, Mar. 5, 1926, pp. 274-275, 1 fig. Boilers of single gas-flow type equipped for oil burning.

RIVETED JOINTS. British Boiler Shop Practice, F. J. Drover. Boiler Maker, vol. 26, no. 4, Apr. 1926, pp. 111-113, 9 figs. Board of Trade requirements for riveted joints and calculation of their efficiencies.

SCALE REMOVAL. Boiler-Scale Prevention by Means of Kespurit (Kesselsteinverhütung mittels Kespurit), E. Awe. Archiv für Wärmewirtschaft, vol. 7, no. 3, Mar. 1926, pp. 85-87.

SPHEROIDAL STATE. The Spheroidal State in Steam Boilers (La Caléfaction et la limite de production des générateurs de vapeur), E. Emanaud. Revue Industrielle, vol. 56, no. 2199, Feb. 1926, pp. 68-74, 5 figs. See also brief translated abstract in Power Engr., Mar. 1926, p. 113.

VERTICAL. New Tests with Sectional Vertical Tube Boilers of Mass Type (Neue Versuche am Sektional-Steilrohrkessel Bauart Maas), F. Kaiser. Zeit des Bayerischen Revisions-Vereins, vol. 30, nos. 1 and 2, Jan. 15 and 31, 1926, pp. 1-6 and 17-20, 2 figs.

BOILERS, WATER-TUBE

HEAT LOSSES. Radiation and Conduction Losses of Water-Tube Boilers in State of Resistance, during Feeding and Stops (Strahlungs- und Leitungsverluste and Wasserrohrkesseln im Beharrungszustande, während des Einlaufens und in den Betriebspausen), E. Praetorious. Archiv für Wärmewirtschaft, vol. 6, no. 11, Nov. 1925, pp. 285-288, and vol. 7, nos. 1 and 3, Jan. and Mar. 1926, pp. 18-23 and 71-80, 14 figs.

HIGH-PRESSURE. High-Pressure Water-Tube Boilers for Marine Purposes, H. E. Yarrow. Engineering, vol. 121, no. 3144, Apr. 2, 1926, pp. 443-445, 6 figs. partly on p. 434. Investigates practical application of high pressure and temperatures on board ship with special reference to definite step which has been taken in introducing high-pressure boilers in passenger steamer under construction. Paper read before Instn. Nav. Architects.

MAINTENANCE AND OPERATION. The Maintenance and Operation of High-Pressure Water Tube Boilers, F. J. Drover. Indus. Mgmt. (Lond.), vol. 13, no. 3, Mar. 1926, pp. 146-148. Notes on firing and regulation of draft plates; feeding; care of boilers after use; industrial management.

BRAKES

AIR. Some Fundamentals of the Air Brake, J. C. McCune. Ry. Mech. Engr., vol. 100, no. 4, Apr. 1926, pp. 223-226. Braking problems of modern freight and passenger-train operation. (Abstract.) Paper read before Eastern New York Section of Am. Soc. Mech. Engrs.

BRASS

HIGH-STRENGTH. High-Strength Brasses. Metallurgist (Supp. to Engineer, vol. 141, no. 3661), Feb. 26, 1926, pp. 20-21. Discusses ternary systems containing copper and zinc with aluminum, iron, nickel and manganese respectively; deals solely with castings; complex alloys.

BRIDGE STRENGTHENING

REINFORCED CONCRETE, USE OF. The Strengthening of Bridges, C.C. Mitchell and C. S. Chettoe. Concrete & Constr. Eng., vol. 21, no. 2, Mar. 1926, pp. 247-250, 11 figs. Deals with strengthening of existing bridges by use of reinforced concrete. (Abstract). Paper read before Instn. Mun. & County Engrs.

BRIDGES, CONCRETE

MINNESOTA. Minnesota Bridge Construction, W. H. Wheeler. Minn. Techno-Log, vol. 6, no. 5, Feb. 1926, pp. 142-145 and 160, 21 figs. Progress of bridge building in Minnesota, present-day reinforced-concrete design supersedes timber, wire suspension, wood and iron truss structures of past.

BRIDGES, LIFT

VANCOUVER. The Second Narrows Bridge, Vancouver. Engineer, vol. 141, no. 3667, Apr. 9, 1926, p. 409, 2 figs. Bridge was designed of standard railway construction known as Cooper's E 50 loading plus 100 lb. per sq. ft. for roadway allowance; subsequently increased to 15-ton truck gross loadings; total length is 1¼ miles; structure comprises one fixed span of 300 ft.; three fixed spans of 150 ft., and bascule lifting span of 185 ft. in length.

BRIDGES, RAILWAY

RAISING. Lift Span Complicated Bridge Raising Project, G. H. Wilsey. Ry. Eng. & Maintenance, vol. 22, no. 4, Apr. 1926, pp. 134-136, 6 figs. Methods employed in raising Chicago Great Western bridge to meet new grade of depot tracks; how difficulty of settlement of pier was overcome.

REINFORCING. Reinforcing Columbia River Bridge of Great Northern Ry., H. S. Loeffler. Eng. News-Rec., vol. 96, no. 14, Apr. 8, 1926, pp. 558-561, 7 figs. Strength of large steel railway bridge increased 100 per cent.; cantilever erection of 416½-ft. span; anchor spans re-used; erection controlled by strain gages.

BRONZES

GENELITE. Characteristics of Genelite. Am. Mach., vol. 64, no. 16, Apr. 22, 1926 pp. 647. Genelite is spongy bronze having approximately 40 per cent by volume of graphite mechanically mixed with it; use for bearing metal and for valve facings. Reference-book sheet.

BUILDING CONSTRUCTION

ARCHITECTURAL FORMS. Traditional Architectural Forms and Their Structural Efficiency, W. Harvey. Engineer, vol. 141, no. 3666, Apr. 2, 1926, pp. 374-375, 9 figs. Points out evil effect of traditional architectural form; patient analytical surveys are needed if effects of time and efforts of curve-loving architects are to be differentiated from one another in case of any particular monument.

BUILDING MATERIALS

BLOCKS. New Product Combines Concrete and Fiber Construction. Concrete Products, vol. 30, no. 2, Feb. 1926, pp. 39-40, 3 figs. Details of building block, made of vegetable fiber which acts as its own mold for interior columns of reinforced concrete; its fundamental element is palmetto fiber or saw grass fiber, chemically treated and condensed into hard block.

C

CABLES, ELECTRIC

CURRENT-CARRYING CAPACITY. Calculation of Current-Carrying Capacity of Type H Cable, D. M. Simons. Elec. Jl., vol. 23, no. 2, Feb. 1926, pp. 59-63, 3 figs. Explains peculiarity in thermal resistance of type H cable; this element on thermal resistance when combined with ordinary equation of belted form can be used to calculate allowable current for cable, and to compare its carrying Capacity with that of belted form.

PAPER-INSULATED. Ionization Studies in Paper-Insulated Cables, C. L. Dawes and P. L. Hoover. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 4, Apr. 1926, pp. 337-347, 17 figs. Preliminary results of research investigation being carried out at Harvard Eng. School; tentative conclusions suggested by data and method developed for making measurements.

RUBBER INSULATED. Rubber Insulated Cables. Elecn., vol. 96, no. 2492, Feb. 19, 1926, pp. 197-199, 4 figs. Describes various processes of manufacture of Helsby Works of British Inuslated Cables, Ltd.

STANDARDS. Wires and Cables. A.I.E.E. Standards, no. 30, Oct. 1925, pp. 5-12. Standards apply to bare wires and cables, rubber insulated wires and cables, impregnated paper insulated wires and cables, varnished cambric insulated wires and cables, and dry core paper insulated cables.

CABLES, HOISTING

CALCULATION. Loading of Stranded Cable (Die Beanspruchung der Litzenseile), P. Stephan. Fördertechnik u. Frachtverkehr, vol. 19, no. 2, Jan. 22, 1926, pp. 14-17, 1 fig.

CALORIMETERS

OXYGEN-BOMB DETERMINATION. Theoretical and Recorded Pressures in Oxygen-Bomb Determinations, M. J. Bradley, C. Z. Rosecrans and R. M. Corbin. Indus. & Eng. Chem., vol. 18, no. 3, Mar. 1926, pp. 307-309, 3 figs. Measurement and photographic records of pressures with oxygen bomb during combustion of different weights of crude petroleum, coals, benzene, kerosene and benzoic acid.

CANALS

WELLAND SHIP, ONTARIO. The Welland Ship Canal. Engineering, vol. 121, no. 3145, Apr. 9, 1926, pp. 451-454, 19 figs. (partly on pp. 466 and sup. plates). Reconstruction of canal which crosses Niagara Peninsula which juts out between Lake Erie and Lake Ontario.

CARBURETORS

ADJUSTING. Correct Carburetor Adjustment and Improper Adjustment Effects, O. H. Ensign. Soc. Automotive Engrs.—Jl., vol. 18, no. 4, Apr. 1926, pp. 389-391. After discussing conditions that control power output, general method of adjustment that can be applied with certainty to any installation is presented.

CAST IRON

MELTING WITH ALKALI FLUX. Refine Iron with Alkali Flux, G. S. Evans. Foundry, vol. 54, no. 5, Mar. 1, 1926, pp. 180-183 and 187, 6 figs. Details of operation and results obtained in using alkali flux in melting foundry iron. (Abstract.) Paper read before Detroit Foundrymen's Assn.

SHRINKAGE. Shrinkage and Stresses in Cast Iron (Schwindung und Spannung im Gusseisen), E. Bauer. Giesserei-Zeitung, vol. 23, nos. 3, 4 and 5, Feb. 1, 15 and Mar. 1, 1926, pp. 61-73, 95-102 and 121-128, 77 figs.

CASE-HARDENING

COPPER MIGRATION IN. Copper "Migration" in Carburizing, E. H. Stilwell. Am. Soc. Steel Treating—Trans., vol. 9, no. 2, Feb. 1926, pp. 323-325.

NITRATION HARDENING. The Krupp Process of Nitration Hardening (Das Nitrierhärtungsverfahren der Fried. Krupp Aktiengesellschaft), A. Fry. Kruppsche Monatshefte, vol. 7, Feb. 1926, pp. 17-24, 16 figs. See also Maschinenbau, vol. 5, no. 4, Feb. 18, 1926, pp. 161-165, 12 figs.

SOLID CEMENTS. Carburization by Solid Cements, W. E. Day, Jr., Am. Soc. Steel Treating—Trans., vol. 9, no. 2, Feb. 1926, pp. 240-257 and (discussion) 257-258, 16 figs. Deals with carburizing process when using solid compounds; production of carburizing gases from cement and their reaction on steel; study is made of mechanism through which carbon is conveyed from surface inward; photomicrographs and curves.

CEMENT

LUMNITE. Tests of Lumnite Cement and Concrete, H. H. Scoffeld and C. A. Wright. Cornell Civ. Engr., vol. 34, no. 5, Feb. 1926, pp. 111-113 and 124, 4 figs. Method of test for shrinkage and temperature change; temperature change and shrinkage during setting.

CENTRAL STATIONS

AUSTRALIA. Electrical Equipment of the Yallourn Power Station. Elec. Engr. of Australia & New Zealand, vol. 2, no. 10, Jan. 15, 1926, pp. 383-388, 6 figs. Has installed capacity of 62,500 kw. in 5 generating units; there are 12 John Thompson boilers of 70,000-lb.-per hr. evaporative capacity each, burning brown coal exclusively; turbines are of impulse (Rateau) type; main generators are of 12,500-kw. capacity each and generate at 11,000 volts, 3 phase, 50 cycles.

CLEVELAND, OHIO. Construction Work Progresses at Avon Station. Power Plant Eng., vol. 30, no. 6, Mar. 15, 1926, pp. 380-381, 4 figs. New plant of Cleveland Electric Illuminating Co., designed for 300,000-kw. ultimate capacity, to have pulverized-fuel-fired boilers.

COLUMBIA PARK, OHIO. The New Columbia Power Station. Elec. Light & Power, vol. 4, no. 1, Jan. 1926, pp. 23-24 and 125-126, 4 figs.

DES MOINES, IOWA. New Des Moines Power Station. Power, vol. 63, no. 16, Apr. 20, 1926, pp. 590-595, 8 figs.

ENGLAND. Extensions at St. Helens. Elec. Times, vol. 69, no. 1798, Apr. 1, 1926, pp. 417-418, 3 figs. See also description in Elecn., vol. 96, no. 2498, Apr. 2, 1926, pp. 382 and 386.

GERMANY. The Goldenberg Central Station (Das Goldenberg-Werk und das Versorgungsgebiet des RWE), W. Kraska. Elektrotechnische Zeit., vol. 47, nos. 3 and 4, Jan. 21 and 28, 1926, pp. 65-70 and 104-108, 14 figs.

MIDDLETOWN, PA. Design and Test of Susquehanna Station, E. M. Gilbert. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 362-368, 11 figs. Details of preliminary studies made in design of Metropolitan Power Co.'s 30,000-kw. pulverized-coal-burning power plant at Middletown, Pa., together with data on performance obtained in tests.

WINNIPEG, MANITOBA. Winnipeg's Steam Plant, G. Mossman. Elec. News, vol. 35, no. 7, Apr. 1, 1926, pp. 29-37, 9 figs. Used at same time as emergency standby and for heating purposes; much of equipment is of English manufacture.

CHROMIUM STEEL

ASCOLOY. Characteristics of Ascoloy. Am. Mach., vol. 64, no. 15, Apr. 15, 1926, p. 609. Characteristics of ductile and malleable chromium-steel alloy made in electric furnace. Reference-book sheet.

ELECTRIC MELTING. Melt High Chromium Alloys in Acid Furnace, R. S. Kerns. Iron Trade Rev., vol. 78, no. 12, Mar. 25, 1926, pp. 812-814; also Foundry, vol. 54, no. 6, Mar. 15, 1926, pp. 229-231. Gives uses of high-chromium alloy steel and relates experience in melting alloy in acid electric furnace; although high losses of chromium were expected, reverse was true.

CIRCUIT BREAKERS

OIL-IMMERSED. English Electric Co.'s. Oil Immersed Current Breakers. Elec. Ry. & Tramway Jl., vol. 54, no. 1331, Feb. 12, 1926, pp. 69-71, 8 figs. Details of breakers of class O.K.B., sizes IV and V.

OIL-TIGHT. Oil-Tight Multi-Pole Circuit Breakers with Single Tanks, H. M. Wilcox. Eng. World, vol. 28, no. 3, Mar. 1926, pp. 171-173, 2 figs. Doming of breaker frame permits change in arrangements with number of advantages accruing.

CITY PLANNING

REGIONAL AND. Regional Planning in Relation to Public Administration, T. Adams. Nat. Mun. Rev., vol. 15, no. 1, Jan. 1926, pp. 35-42. Recommends co-operation between local governmental authorities in regional planning, such authorities should be assisted by advisory agencies established by various states.

COAL

COKING. Low Temperature Process Produces Hard Coke, A. Thau. Chem. and Met. Eng., vol. 33, no. 4, Apr. 1926, pp. 227-228, 3 figs. Process developed by Dobblestein at Essen, Germany; provides for continuous operation without disturbing coal during carbonization.

LIQUEFACTION. The Liquefaction of Coal (Die Verflüssigung der Kohle), F. Berguis. Glückauf, vol. 61, nos. 42 and 43, Oct. 17 and 24, 1925, pp. 1317-1326 and 1353-1358, 16 figs.; also in Montanistische Rundschau, vol. 18, no. 6, Mar. 16, 1926, pp. 184-199, 16 figs.

COAL HANDLING

POWER PLANTS. Methods of Handling Fuel and Waste in the Power House, G. F. Zimmer. Indus. Mgmt. (Lond.) (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926, pp. 96-102, 6 figs. Deals with propositions arising from varying topographical conditions of power-house site, giving practical solutions in each case for dealing with handling of coal.

COAL MINES

ELECTRIFICATION. Power Applications in Coal Mines. Elec. World, vol. 87, no. 13, Mar. 27, 1926, pp. 655-657, 5 figs. Brief résumé of practices followed in 200 mines out of 338 operated in state of Illinois showing trend of electrified mines using purchased power.

COILS

PETERSEN. Operating Performance of a Petersen Earth Coil, J. M. Oliver and W. W. Eberhardt. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 227-230, 3 figs. Results of operating experience show that over-voltage disturbances can be eliminated by doing all line switching operations with Petersen coil out of service; that is, with system neutral solidly grounded; it is believed that same results can also be obtained by under-tuning coil; it appears that application of these coils is limited to comparatively low voltage lines of moderate length with single source of power supply.

COKE OVENS

HEATING. Heating of Modern Coke Ovens, H. Kuhn. Chem. and Met. Engr., vol. 33, no. 4, Apr. 1926, pp. 231-234, 4 figs. Variations of temperature in vertical flues and heat required per pound of dry coal with special reference to the Carl Still oven.

COLD STORAGE

AIR COOLING IN ROOMS. Air Cooling in Cold Storage Rooms. Sulzer Tech. Rev., no. 1, 1926, pp. 9-15, 11 figs. Describes various systems of air coolers, advantages and disadvantages, with particular attention to various types constructed by Sulzer Bros.

COLUMNS

REINFORCED-CONCRETE. Stresses in Helically Reinforced Concrete Columns, A. W. Zesiger and E. J. Affeldt. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 1, Jan. 1926, pp. 3-40, 4 figs. Analyses effect of helical reinforcement on concrete core of helically reinforced-concrete column and develops formulas for stresses which obtain in steel and concrete with varying percentages of reinforcement. See also discussion in no. 4, Apr. 1926, pp. 733-736.

COMPRESSED AIR

PROPERTIES AND USES. Compressed Air and Air Compressors, C. H. Sonntag. Fit & Quarry, vol. 11, nos. 10 and 11, Feb. 15 and Mar. 1, 1926, pp. 59-63 and 95-100.

TUBES. Condensing Equipment. Jl. Electricity, vol. 56, no. 7, Apr. 1, 1926, pp. 259-261, 2 figs. Serial report of Prime Movers Committee, P.C.E.A.; efforts of committee have been confined to trying to find causes and remedies for tube failures in condensers such as are used for condensing steam from prime movers in power plants.

CONCRETE

CALCIUM CHLORIDE, EFFECT OF. Some Effects of "Cal" on Cement and Concrete, M. N. Clair. Boston Soc. Civil Engrs.—Jl., vol. 13, no. 2, Feb. 1926, pp. 33-50, 7 figs. Investigations to determine effect of calcium chloride on time of set of cement, strength of neat cement in tension, cement mortar in tension, and of concrete in compression; elastic properties of concrete.

CAST IRON. Tests on Hooped Cast-Iron Concrete, R. N. Stroyer. Concrete & Constr. Eng., vol. 21, no. 2, Feb. 1926, pp. 170-176, 6 figs. In connection with building of reinforced-concrete bridge of 215-ft. span, in Austria, in which compressive reinforcement consisted of cast-iron, tests on compression members of this description were carried out recently, showing conclusively superiority of hooped cast-iron as compressive reinforcement.

CORROSION. Corrosion of Concrete, J. R. Baylis. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 4, Apr. 1926, pp. 549-579, 11 figs. Points out that porosity is very important factor in determining life of concrete exposed to water or to weather; method of measuring voids in concrete; indicating that voids one day old should not exceed 28 per cent. mortar volume when concrete is to be exposed to water or freezing weather; for concrete more than one day old, voids probably should not exceed 22 per cent.; problem of how to take care of existing structures.

LIME, EFFECT OF. Effect of Lime on Concrete Products, P. C. Cunnick. Concrete, vol. 28, no. 3, Mar. 1926, pp. 43-44, 6 figs. Result of investigations carried out at Rock Island Arsenal during 1925, involving 1,500 test operations.

MOISTURE, EFFECT OF. The Effect of Moisture on Concrete. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 1, Jan. 1926, pp. 164-168, 2 figs. Discussion of paper by W. K. Hatt, continued from Aug. 1925 Proceedings.

CONCRETE CONSTRUCTION, REINFORCED

SPECIFICATIONS. Standard Specification for Reinforced Concrete. Concrete & Constr. Eng., vol. 20, no. 12, Dec. 1925, pp. 689-698, and vol. 21, no. 3, Mar 1926, pp. 266-267 and 270-272. Abstract of recommended specifications reported by affiliated committee of A.S.C.E., A.S.T.M., A.R.E.A., A.P.C.A., etc., Mar. 1926; Reinforced concrete columns; footing; retaining walls; summary of working stresses.

CONVERTERS

SYNCHRONOUS. Synchronous Converter Copper Loss, R. Lee and H. L. Hildenbrand. Elec. Jl., vol. 23, no. 3, Mar. 1926, pp. 110-112, 12 figs. Brings out fact that it is important to keep converter operating at unity power factor, and importance of this becomes greater as number of phases increase.

CORE OVENS

DESIGN. Oven Design Shows Advance, C. A. Barnett. Foundry, vol. 54, no. 6, Mar. 15, 1926, pp. 240-241, 4 figs. Deals with Shelf, drawer-type, portable rack-type, car-type and conveyor ovens.

CORROSION

OXYGEN REMOVAL FROM WATER. Removing Dissolved Oxygen From Water, W. J. Risley, Jr. Chem. & Met. Eng., vol. 33, no. 3, Mar. 1926, pp. 163-164, 3 figs. Equipment used for preventing corrosion occurring due to heated water containing this gas when in contact with iron or steel.

SODIUM SILICATE AS PREVENTIVE. Sodium Silicate as a Corrosion Preventive, R. P. Russell. Mass. Inst. Technology—Publications, vol. 61, no. 69, Feb. 1926, 4 pp., 4 figs. Deals with use of sodium silicate (water glass) as means of decreasing corrosion in water heaters and pipe lines.

CRANES

HYDRAULIC CARGO. Hydraulic Cargo Cranes on the Motor Liner Asturias. Engineer, vol. 141, no. 3665, Mar. 26, 1926, p. 364, 3 figs. Equipment comprises two sets of motor-driven hydraulic pumps, with Ward-Leonard electrically controlled motor-generator, air-lined hydraulic accumulator, and 12 hydraulic cranes which serve 6 cargo hatches.

JIB. New Jib Cranes for Harbor Work (Neue Einziehkrane für den Seehafenumschlag), C. Overbeck. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 3, Jan. 16, 1926, pp. 73-77, 13 figs.

SHIPBUILDING. The Crane Equipment of Shipbuilding Berths, E. Smith. Engineering, vol. 121, no. 3145, Apr. 9, 1926, pp. 480-482, 7 figs. Considers from point of view of mechanical efficiency, different types of cranes. Paper read before Instn. Nav. Architects.

TRAVELING. Traveler Erects Heavy Trusses for Theatre Roof. Eng. News-Rec., vol. 96, no. 11, Mar. 18, 1926, pp. 454-455, 5 figs. Steel traveler of remarkable size used in erecting columns and trusses for auditorium of Paramount Theatre Building in New York; trusses weighing up to 150 tons lifted 130 ft. and set on columns 120 ft. high by traveler carrying two 75-ton derricks.

CRANKSHAFTS

TORSIONAL VIBRATION. Torsional Vibrations in Automobile Engines (Drehschwingungen des Automobilmotors), J. Plünzke. Motorwagen, vol. 29, no. 6, Feb. 27, 1926, pp. 115-128, 27 figs.

CUPOLAS

COKE BEDS. Judging the Coke Bed in the Cupola, R. A. Knight. Foundry, vol. 54, no. 5, Mar. 1, 1926, pp. 177-179, 3 figs. Discusses difficulties encountered by foundryman in judging coke bed when melting in cupola; describes easy correction measure and quick run.

MELTING LOSSES. Losses in Melting, from Cupola to Finished Casting, R. Coulthurst. Mech. World, vol. 79, no. 2044, Mar. 5, 1926, p. 184. Causes determining losses are: (1) insufficient fuel; (2) too much air admitted, thus increasing amount of iron that is oxidized; (3) insufficient supply of limestone to flux away silica.

OPERATION. The Cupola Furnace, J. E. Hurst. Foundry Trade Jl., vol. 33, nos. 498 and 499, Mar. 4, and Mar. 11, 1926, pp. 170-172 and 199-200, 3 figs. Notes on combustion of coke; thermal balance sheet; cupola melting zone; escaping-gas analysis; improved cupolas. Mar. 11: Factors in cupola design; tuyere area; number and shape of tuyeres.

CUTTING METALS

CUTTING ACTION AND TOOLS. Cutting, W. R. Ward. Am. Soc. Steel Treating—Trans., vol. 9, no. 3, Mar. 1926, pp. 482-486, 3 figs.

CUTTING TESTS OF TOOLS. Cutting Tests of Tool Steels, J. Strauss. Am. Soc. Steel Treating—Trans., vol. 9, no. 4, Apr. 1926, pp. 571-584, and 648, 9 figs. Deals with cutting ability of tools and tool steels and cutting resistance of metals; sets forth 3 classes of tools for cutting metals and describes various experimental tests made in determining failure of tools; general precautions necessary to be taken in various methods of testing. Bibliography.

D

DAMS

ORADELL. The Oradell Dam of the Hackensack Water Company. Am. Soc. Civ. Engrs.—Proc., vol. 52, nos. 1 and 2, Jan. and Feb. 1926, pp. 118-121 and 325-328, 3 figs. Discussion of paper by N. S. Hill, Jr. published in Oct. 1925 Proceedings.

ARCH. Stresses in Thick Arches of Dams, B. F. Jakobsen. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 2, Feb. 1926, pp. 206-251 and (discussion), 252-277, 36 figs. Investigates influence of temperature, variations, swelling and shrinkage; presents formulas which make it possible to assume different conditions for up-stream and down-stream faces; shows that radial sections cannot remain plane and that correct stresses cannot be found unless deformations of abutments are taken into account; influence of variation of modulus of elasticity on stress distribution; theory of secondary arch.

DRY-FILL. Reconstructing the Calaveras Dam by Dry Fill, G. A. Elliott. Eng. News-Rec., vol. 96, no. 13, Apr. 1, 1926, pp. 514-517, 4 figs. Dry-fill substituted for hydraulic fill in dam of Spring Valley Water Co., San Francisco, after slip of 1918; dam is now 220 ft. high with provision for ultimate height of 255 ft.

EXPERIMENTAL. Building a Dam Marked for Destruction, F. A. Noetzli. Modern Irrigation, vol. 2, no. 2, Feb. 1926, pp. 16-17, 2 figs. Full-size test arch dam to be built near Fresno, Calif., for experimental purposes.

MULTIPLE ARCH. Multiple-Arch Dam at Gem Lake on Rush Creek, California. Am. Soc. Civil Engrs.—Proc., vol. 52, nos. 1, 2 and 3, Jan. and Feb. and Mar. 1926, pp. 90-101, 293-302, and 457-469. Discussion of paper by F. O. Dolson and W. L. Huber, continued from Dec. 1925 Proceedings.

SPILLWAYS. Side Channel Spillways: Hydraulic Theory, Economic Factors, and Experimental Determination of Losses. Am. Soc. Civ. Engrs.—Proc., vol. 52, nos. 1 and 2, Jan. and Feb. 1926, pp. 107-110 and 319-324, 1 fig. Discussion of paper by J. Hinds, continued from Dec. 1925 Proceedings.

DIE CASTING

ALUMINUM ALLOYS. The Die-Casting of Aluminum Alloys. Machy. (Lond.), vol. 27, no. 703, Mar. 18, 1926, pp. 812-814. Discussion of paper by G. Mortimer presented before Inst. of Metals. Crystallization shrinkage; nomenclature.

DIELECTRICS

SOLID ABSORPTION IN. Theory of Absorption in Solid Dielectrics, V. Karapetoff. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 236-243, 5 figs. Investigation to establish certain general properties of function which expresses increase in initial electric displacement with time; assumption is made that law of relaxation of electric displacement in individual particles of dielectric is simple exponential function of time, but that exponent varies from particle to particle; ultimate aim of theory is to make it possible to correlate and to mutually check vast amount of experimental data on absorption and on dielectric loss.

DIESEL ENGINES

AIRLESS-INJECTION. West Coast System of Airless Injection. Motorship (N.Y.), vol. 11, no. 4, Apr. 1926, pp. 289-292, 21 figs. Design, construction and operation of Pacific Coast types of airless-injection Diesel engines.

COMPRESSORLESS. Improvement in Diesel Engine Design (Neue Wege im Dieselmaschinenbau), Parey. Dinglers polytechnisches Jl., vol. 341, no. 3, Feb. 1926, pp. 26-28. Discusses injection of fuel in compressorless Diesel engines by antechamber; eddy and pressure method and their characteristics.

CRANKLESS. Crankless Diesel Engine. Times Trade & Eng. Supp., vol. 17, no. 396, Feb. 6, 1926, p. 514, 2 figs.

MUNICIPAL POWER PLANTS. A study of Diesel Engines for Municipal Power-Plants, A. L. Mullergren. Am. City, vol. 34, no. 3, Mar. 1926, pp. 240-243, 2 figs. Economics of Diesel vs. steam plant selections of type of plant; adaptation of different types; direct-connected pumps.

SMALL POWER PLANTS. Diesel Engines Raise Small Plant Efficiency, R. C. Demary. Power Plant Eng., vol. 30, no. 6, Mar. 15, 1926, pp. 369-370. Comparison of costs taken from records of steam plant for ten months with corresponding period after Diesel engines were installed, showing savings effected by Diesel-engine installation.

SPEED CONTROL. Novel Speed Control for Diesel Engines, E. J. Kates. Power, vol. 63, no. 16, Apr. 20, 1926, pp. 596-598, 5 figs. N.Y. Central Railroad has placed water-pressure regulated speed control on Diesel engines driving pumps in one of its water stations, which solved difficult problem of wide-speed regulation of such oil-engine-driven units.

TEMPERATURE VARIATION. Temperature Variation and Heat Stresses in Diesel Engines, R. Sulzer. Engineering, vol. 121, no. 3144, Apr. 2, 1926, pp. 447-450, 21 figs. Account and results of experimental work; measurement of temperature in walls of two-cycle marine engine. Paper read before Instn. Nav. Architects. See also Engineer, vol. 141, nos. 3666 and 3667, Apr. 2 and 9, 1926, pp. 391-392 and 420-421, 21 figs.

DRAINAGE

FOREST GROWTH, EFFECT ON. Effect of Drainage of Swamps Uopn Forest Growth, R. Zon. Reclamation & Farm Eng., vol. 9, no. 2, Feb. 1926, pp. 33-37 and 42, 4 figs. Lake States, swamp problem; making swamps safe for forestry; what drainage does to timber growths; costs and returns.

DREDGES

DIESEL-ELECTRIC. Diesel-Electric Drive on Dredge, J. H. Polhemus. Elec. World, vol. 87, no. 14, Apr. 3, 1926, pp. 703-705, 3 figs. Port of Portland has largest and most powerful dredge using this system; electric drive proves most flexible and economical; Diesel engines used as prime movers.

DRILLING MACHINES

AUTOMATIC. Automatic Drilling Machine. Brit. Machine Tool Eng., vol. 3, no. 37, Jan.-Feb., 1926, pp. 361-362, 2 figs. Built by J. Archdale & Co., Birmingham, Eng., for drilling small holes in tubes of special form.

SIX-SPINDLE. Six Spindle Drilling Machine. Brit. Machine Tool Eng., vol. 3, no. 37, Jan.-Feb., 1926, pp. 363-364, 2 figs. Heavy-duty machine, built by Wm. Asquith, Ltd., for drilling holes in special types of gas burners.

DRILLS

STEEL, SHARPENING. Sharpening and Handling Drill Steels at Franklin, C. M. Haight. Am. Inst. Min. & Met. Engrs.—Trans., no. 1556-A, Feb. 1926, 14 pp., 12 figs. Shop procedure; heat-treating machine; cycle of operations; output of heat-treating machine and output per shift.

DROP FORGING

NON-FERROUS ALLOYS. The Drop Forging of Non-Ferrous Alloys. Metal Industry (Lond.), vol. 28, nos. 7 and 9, Feb. 12 and 26, 1926, pp. 149-152 and 197-199, 1 fig. Feb. 12: Practical problems in drop-forging of aluminum alloys. Feb. 26: Practical problems in making of drop-forgings from copper and chief hot-working brasses.

DRYDOCKS

SUNDERLAND, ENGLAND. Messrs. T. W. Greenwell and Co.'s Dry Dock, Sunderland. Engineering, vol. 121, nos. 3135, 3138 and 3140, Jan. 29, Feb. 19 and Mar. 5, 1926, pp. 134-136, 225-228 and 312-313, 89 figs. partly on supp. plate. General features of dock; plan and sections of main structure; details of pump house, fitting-out quay, repairing yards, keel blocks, excavations, dock gates, crane track, pumping plant, etc.

DYNAMOMETERS

ELECTRIC-TOOL TESTING. Electric Dynamometer for Testing Electric Tools (Ueber die Konstruktion von Bremsvorrichtungen zur Prüfung elektrischer Handwerkzeugmaschinen), J. Dalchau. Elektrotechnische Zeit., vol. 47, no. 2. Jan. 14, 1926, pp. 36-38, 4 figs.

E

EDUCATION, ENGINEERING

EUROPE. The Engineering Scene, W. E. Wickenden. Eng. Education—Jl., vol. 16, no. 6, Feb. 1926, pp. 433-449. Critical glance at technical education in Europe and how we may profit by it.

MECHANICAL-LABORATORY COURSES. The Mechanical Laboratory Courses in the Sibley School of Mechanical Engineering, H. Diederichs. Sibley Jl., vol. 40, no. 2, Feb. 1926, pp. 29-30. Historical review of development being partly outlined of work done at present time and of its aims.

ELASTICITY

DYNAMIC MEASUREMENT ON TORSION MACHINE. Dynamic-Elastic Measurements in Torsion, G. Welter. Metallurgist (Supp. to Engineer, vol. 141, no. 3665), Mar. 26, 1926, p. 37, 3 figs. Measurements of elastic properties of specimens when subjected to impact torsional loads. Abstract translated from Zeit. für Metallkunde, vol. 17, Dec. 1925. (See reference to original articles in Eng. Index 1925, p. 239.)

ELECTRIC CIRCUITS

MECHANICAL FORCE BETWEEN. Mechanical Force Between Electric Circuits, R. E. Doherty and R. H. Park. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 231-235, 5 figs. Develops general equation for mechanical force exerted by system of n electric circuits, upon any part of that system; electric circuits are assumed to contain resistances, and reluctance of several magnetic circuits is assumed to be function of both currents and relative positions of circuits; equation is applicable to circuits involving saturated iron.

ELECTRIC CONDUCTORS

EDDY-CURRENT LOSSES. No-Load Copper Eddy-Current Losses, T. Spooner. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 264-271, 11 figs. Attempt to remove calculation of no-load copper eddy-losses from field of empiricism and to place it on firm theoretical foundation; test results show that theoretical formulas which have been developed are correct.

TEMPERATURE MEASUREMENTS. A New Method of Measuring Cable Conductor Temperatures, W. Phillips. Sci. Instruments—Jl., vol. 3, no. 5, Feb. 1926, pp. 135-140, 6 figs. New method of measuring temperature of conductor of live cable; curves showing performance of apparatus.

ELECTRIC DISTRIBUTION SYSTEMS

EXPANSION THEOREM. Heaviside's Proof of His Expansion Theorem, M. S. Vallarta. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 4, Apr. 1926, pp. 383-387. Heaviside's proof of his expansion theorem is reconstructed; it is based upon his so-called conjugate theorem which establishes relation between any two normal modes of oscillation of dynamical system; Heaviside's argument applies to systems having finite number of degrees of freedom and no reported or null roots of detrimenta equation of system.

INTERCONNECTED, STATISTICS KEEPING. Statistics Pertaining to Modern Interconnected Systems, G. S. Jackson. N.E.L.A. Bul. vol. 13, no. 2, Feb. 1926, pp 119-123, 5 figs. Deals with actual working of statistics keeping methods employed in interconnected system operated by Consumers Power Co.

PITTSBURGH, PA. Novel Distribution Scheme, C. G. Watson. Elecn., vol. 96, no. 2494, Mar. 5, 1926, pp. 294 and 297, 3 figs. As illustration of extent to which American engineers will go to ensure continuity of electricity supply, author describes distribution system now being installed by Duquesne Light Co. in Pittsburgh; use of duplicated services.

ELECTRIC DRIVE

FACTORIES. Electricity for the Factory, E. Ingham. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926, pp. 73-78, 3 figs. Methods employed in production, transmission and utilization of electrical power in small factory or works.

SECTIONAL. The Development of the Sectional Paper Machine Drive, H. W. Rodgers. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 4, Apr. 1926, pp. 323-329, 9 figs. History and development of several types of sectional drive and relative merits of each particular type; sets forth advantages of sectional drive and shows that its field of applications should increase with fuller understanding of its advantages as to increased production, improved product and lower operating cost.

UNIT-DRIVE SYSTEM. Advantages of Unit-Drive System Shown in Reorganized Factory. Jl. Electricity, vol. 56, no. 5, Mar. 1, 1926, pp. 179-182, 9 figs. Details of installation in Oakland factory of Fageol Motors Co.

ELECTRIC FURNACES

ANNEALING. An Electric Annealing Furnace. Elec. News., vol. 35, no. 4, Feb. 15, 1926, pp. 41-43, 3 figs. Furnace installed in Davenport Works of Can. Gen. Elec. Co. is of tunnel or box type with steel framework and moveable ends or doors.

Electric Annealing Furnaces. Metallurgist (Supp. to Engineer, vol. 141, no. 3661), Feb. 26, 1926, pp. 19-20. Review of types described in recent issues of Forging—Stamping—Heat Treating. Stahl u. Eisen and Zeit. des Vereines deutscher Ingenieure; advantages of electric furnace for commercial annealing.

ARC. Large Arc Furnace (Le four de 100,000 ampères de Saint-Julien de Maurienne), P. Bergeron. Société Française des Electriciens—Bul.. vol. 6, no. 53, Jan. 1926, pp. 75-80, 2 figs.

HEATING ELEMENTS. Rating of Heating Elements for Electric Furnaces, A. D. Keene and G. E. Luke. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 222-226, 6 figs. Study of practical considerations involved in assigning kilowatt ratings to radiant heating elements in furnace chambers; constants for radiation and absorption are given; consideration of shape and spacing of elements witb respect to shielding due to adjacent elements; method of determining equivalent unshielded element is worked out to provide basis for comparing dissimilar shapes of heaters.

ELECTRIC GENERATORS, A.C.

LOW POWER FACTOR. Effects of Low Power Factor on Alternator's Voltage, C. O. Mills. Power, vol. 63, no. 16, Apr. 20, 1926, pp. 599-601, 12 figs. Explains how when power factor is lagging armature current tends to weaken main poles and when leading, armature current strengthens main poles of machine.

TEMPERATURE MEASUREMENT. Hot-Spot Measurement, S. L. Henderson. Elec. Jl., vol. 23, no. 3, Mar. 1926, pp. 95-99, 10 figs. Discusses 3 main methods of temperature measurement; by thermometer, by increase in resistance of windings, and by embedded temperature detectors.

ELECTRIC LOCOMOTIVES

CLASSIFICATION. Electric Locomotive Classification, D. C. Hershberger. Ry. Elec. Engr., vol. 17, no. 3, Mar. 1926, pp. 81-82, 1 fig. New system proposed which is simple and does not have limitations of Whyte System.

ELECTRIC POWER

GREAT LAKES. Great Lakes Power Survey. Elec. World, vol. 87, no. 14, Apr. 3, 1926, pp. 706-708, 2 figs. Committee of geographic division of Nat. Elec. Light Assn. issues report of its studies on present and future use of electrical energy in Great Lakes territory.

ELECTRIC METERS

THREE-PHASE METERING METHODS. Comparative Accuracy of Three-Phase, Four-Wire Metering Methods, D. T. Canfield. Purdue Univ.—Bul., vol. 9, no. 9, Dec. 1925, 15 pp., 7 fig. Investigation of 3-, 2-, 4-wire and 2-element polyphase wattmeter methods; theory of each of these methods and reasons for and against their use; conclusions from tests concerning relative accuracy of each method.

ELECTRIC MOTORS, A.C.

INDUCTION. Induction Motors and Induction Machines in General. A.I.E.E. Standards, no. 9, Jan. 1926, pp. 5-13. Standards applying to induction motors larger than fractional horsepower motor and induction generators; they are applicable also to induction machines in general.

ELECTRIC MOTORS, D.C.

COMMUTATION. Commutation Troubles in D.C. Motors, E. B. Stavely. Forging—Stamping—Heat Treating, vol. 12, no. 3, Mar. 1926, pp. 91-94 and 107, 7 figs. Causes and remedies of different kinds of commutation troubles in motors and generators.

OPERATION. How a Direct-Current Motor Operates, A. A. Fredericks. Power, vol. 63, no. 12, Mar. 23, 1926, pp. 452-454, 7 figs. Simple explanation of what takes place in direct-current motor to make armature revolve and how current is regulated to meet demands of load changes.

ELECTRIC TRANSMISSION LINES

OVERHEAD-CATENARY, MAINTENANCE. Maintaining an Electrical Contact System, H. W. Schuler. Ry. Elec. Engr., vol. 17, no. 3, Mar. 1926, pp. 86-89, 7 figs. Swiss Federal railroads have well developed organization for maintenance of overhead catenary.

STABILITY. Steady-State Stability in Transmission Systems, E. Clarke. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 4, Apr. 1926, pp. 365-373, 17 figs. Calculation by means of equivalent circuits or circle diagrams.

STABILITY. Studies of Transmission Stability, R. D. Evans and C. F. Wagner. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 4, Apr. 1926, pp. 374-383, 8 figs. Deals with principal elements entering into stability problem such as action of generators and exciters during disturbances, effect of dissymmetry produced by single-phase circuits, simplification of load and network and methods for combining these various factors in determination if electromechanical oscillations of system following major disturbances; various methods of improving stability discussed.

ELECTRIC WELDING

OIL TANKS. Welding as a Means of Fabricating Tanks, Vessels and Pipes, W. Schenstrom. Am. Welding Soc.—Jl., vol. 5, no. 2, Feb. 1926, pp. 11-15. Electrically welded construction, welding on large tanks, vacuum tanks and pipe.

PROCESSES. Electric Welding (La soudure electrique), J. Maurice. Annales de l'Energie, vol. 9 no. 19, Jan. 25, 1926, pp. 3-7. Discusses pressure welding; autogenous and arc welding; resistance or Thomson process, carbon-electrode or Bernados process; preparation of welds; uses of electric welding.

STRUCTURAL WORK. Electric Welding in the Design and Fabrication of Plant and Structures, J. N. Reeson. Engineering, vol. 121, no. 3145, Apr. 9, 1926, pp. 473-474.

ELECTRIC WELDING, ARC

CRANE RUNWAYS. Crane Runway Built By Welding. Iron Age, vol. 117 no. 16, Apr. 22, 1926, pp. 1132-1133, 6 figs. Electric arc employed in fabrication of 14 girders and 16 "A" frames wbich support them; joints given severe tests.

Welded Construction for Runways. Welding Engr., vol. 11, no. 2, Feb. 1926, pp. 28-30, 10 figs. Crane runway fabricated from structural steel, in which arc welding replaced all rivets.

HYDROGEN. Arc Welding in Hydrogen and Other Cases, P. Alexander. Gen. Elec. Rev., vol. 29, no. 3, Mar. 1926, pp. 169-174, 8 figs. Author shows that usefulness of hydrogen in arc welding is not limited entirely to its atomic properties; results obtained through use of this gas mainly as shield around arc; shows that some other gases also have serviceable properties in this respect.

Atomic Hydrogen Arc Welding, R. A. Weimnan & I. Langmuir. Gen. Elec. Rev., vol. 29, no. 3, Mar. 1926, pp. 160-168, 21 figs. Describes apparatus and distinctive character of results obtained.

The Hyde Hydrogen Process of Welding (Nouveau procédé de soudre). Chimie & Industrie, vol. 15, no. 2, Feb. 1926, p. 229.

PRACTICE. Metallic Arc Welding, P. L. Roberts, Mech. World, vols. 78 and 79, nos. 2025, 2027, 2032, 2037, 2042 and 2047, Oct. 23, Nov. 6 and Dec. 11, 1925, pp 325-326, 364-366 and 465-466, and Jan. 15, Feb. 19 and Mar. 26, 1926, pp. 46-47, 148, 150 and 242-243, 24 figs. Oct. 23: Principles of metallic arc welding. Nov. 6: Process. Dec. 11: Welding plant; reverse-compound-wound generators. Jan. 15, 1926: Welding of cast iron. Feb. 19: Applications to manufacture, Mar. 26: Application to repairs.

ELECTRIC WELDING, RESISTANCE

SEAM. Resistance Seam Welding, W. H. Gibb. Welding Engr., vol. 11, no. 3, Mar. 1926, pp. 27-29, 3 figs. Progress made in construction of machines promises to improve many products now assembled by riveting method.

ELECTRICAL APPARATUS

ROTATING, INSULATION OF. A High-Frequency Voltage Test for Insulation of Rotating Electrical Apparatus, J. L. Rylander. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 217-221, 8 figs. Method of making thorough and practical test between various parts of coil or winding; as shop method for checking defects in material or poor workmanship, high-frequency test method has been found very effective; method used for detecting short circuits on principle of radio receiving set is described.

ELECTRICAL MACHINERY

ECONOMIC CHOICE. The Variation of Efficiency with Size, and the Economic Choice of Electrical Machinery, D. J. Bolton, Instn. Elec. Engrs.—Jl., vol. 64, no. 351, Mar. 1926, pp. 337-348, 2 figs. Examination of efficiency on electrical machinery of varying sizes, and application of results to problem of economic choice; results suggest that where hours of service are long or energy is expensive far larger or more efficient machine is justified than would normally be employed.

HYDROGEN AS COOLING MEDIUM. Hydrogen as a Cooling Medium for Electrical Machinery. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 281-284, 1 fig. Discussion of paper by Knowlton, Rice & Freiburghouse, published in July, 1925, issue of journal.

ELECTRICITY SUPPLY

RATES. Rates from the Customer's Viewpoint. Elec. World, vol. 87, no. 16, April 17, 1926, pp. 806-808. Tendency toward rate forms which encourage use of service; psychological effect on customers; need and justification of rates for eveloping new loads.

ELEVATORS

LOCATING FAULTS. Locating Faults in Electric Elevators—Alternating-Current Controllers, C. A. Armstrong. Power, vol. 63, no. 13, Mar. 30, 1926, pp. 483-487, 9 figs. Different types of a.c. elevator-motor controllers, and how to locate troubles in such equipment.

EMPLOYEES

PHYSICAL EXAMINATIONS. Physical Examinations in Industrial Plants, E. W. Locher. Safety Eng., vol. 51, no. 3, Mar. 1926, pp. 170-177. Points out importance of such examinations, their effect upon employer and employee.

EMPLOYEES, TRAINING OF

TEACHING ECONOMICS. Teaching Economics to Industrial Employees, J. R. Barbor. Indus. Mgmt. (N.Y.), vol. 71, no. 4, Apr. 1926, pp. 224-225. Points out advantages of study of economics for industrial employees.

ENAMELLING

RESEARCH. Researches in Enamelling and Glazing. Chem. & Met. Eng., vol. 33, no. 3, Mar. 1926, pp. 167-168, 3 figs. Studies at Bureau of Standards include abrasive hardness test for glazes warpage of sheet metal and development of wet process for cast iron.

ENGINEERING

ETHICS. Ethics and Engineering, C. F. Taeusch, Prof. Engr., vol. 10, no. 3, Mar. 1926, pp. 12-13 and 29. Presentation and review of leadership and accomplishments of Am. Assn. of Engrs. Practice Committee in field of professional ethics.

SCIENCE AND. Science and Engineering, W. F. Durand. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 337-340. Visualization of material elements of civilization as complex products of manifold studies, fundamental and applied, that interlock and trace back to broad, basic concepts through which attempt is made to interpret phenomena of nature.

ENGINEERS

COMPENSATION. Compensation of Engineers, C. S. Shaughnessy. Prof. Engr., vol. 10, no. 2, Feb. 1926, pp. 6-10, 2 figs. Significant movements for financial improvement; factors entering into compensation; address delivered before Philadelphia chapter of Am. Assn. Engrs.

SALESMENSHIP, VALUE TO. Should the Engineer Be a Trained Salesman? J. B. Mannion, Prof. Engr., vol. 10, no. 3, Mar. 1926, pp. 5-7 and 28, 2 figs. Shows briefly how study of salesmanship will save time, effort and money in professional engineer; increase opportunities and earnings; enable him to be a leader and increase power of his personality; show him how to be tactful and resourceful; and speed his progress toward success.

EVAPORATION

RECLAMATION PROJECTS. Evaporation on United States Reclamation Projects, I. E. Houk. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 1, Jan. 1926, pp. 41-61, 5 figs. Summarizes evaporation Investigations of Reclamation Bureau to date; it is roughly estimated that on Federal irrigation projects alone, 1,000,000 acre-ft. of water is lost each year by evaporation from reservoirs, much of this loss is unavoidable, but in some instances substantial economies can be effected if nature and extent of losses are thoroughly studied. See also discussion in no. 4, Apr. 1926, pp. 737-751, 1 fig.

EXCAVATORS

DRAGLINE. An Oil-Engine-Driven Dragline Excavator. Engineer, vol. 141, no. 3667, Apr. 9, 1926, pp. 419, 2 figs. Self-propelling dragline excavator by Ruston and Hornsby, Ltd., Lincoln.

F

FACTORIES

SMALL. Capitalizing the Advantages of the Small Factory, D. S. Cole. Indus. Mgmt. (N.Y.), vol. 71, no. 4, Apr. 1926, pp. 235-240. Looking for new products to make; weeding good from bad; intensive combing of possible fields; narrowing list of possibilities.

FANS

CASINGS AND INLETS. Experiments on Fan-Casings and Fan-Inlets, H. Briggs and J. N. Williamson. Instn. Min. Engrs.—Trans., vol. 70, Jan. 1926, pp. 241-258, 16 figs. Experiments carried out in Heriot-Watt College to determine (1) velocity of flow in air space between fan runner and casing; (2) effect of varying clearance between fan runner and "beak" on commencement of volute; (3 improvement to be effected by substituting casing of profile following definite mathematical relationship; (4) effect of altering width of volute whose curve has definite relationship; (5) changes brought about by using fan inlet of various forms.

FELDSPAR

USES. Feldspar—Commonest of World Minerals, R. C. Rowe. Can. Machy., vol. 35, no. 10, Mar. 11, 1926, pp. 13-17, 7 figs. While main use of feldspar lies in ceramic industry, mineral of which Canada has inexhaustible supply, is used in manufacture of abrasive wheels, false teeth, scouring soap and roofing papers.

FILTRATION

RAPID-SAND. Important Phases of Rapid Sand Filtration, J. O. Meadows. Contract Rec., vol. 40, no. 11, Mar. 17, 1926, pp. 261-262. Proper application of coagulant and types of coagulating basins; design of filter units and underground systems; nature of action that takes place.

FILTRATION PLANTS

ST. CATHARINES, QUEBEC. St. Catharines Filtration Plant, A. Milne. Can. Engr., vol. 50, no. 10, Mar. 9, 1926, pp. 91-94A, 5 figs. With general historical review of city's water works system since its inception half century ago.

FLOTATION

LEAD-ZINC ORES. Selective Flotation at Bauer, Utah, E. H. Robie. Eng. & Min. Jl.-Press, vol. 121, no. 10, Mar. 6, 1926, pp. 405-407, 2 figs. Method of treatment of lead-zinc ores by Combined Metals Reduction Co.

FLOW METERS

SELF-RECORDING. A New Type of Flowmeter, J. H. Powell. Sci. Instruments—Jl., vol. 3, no. 5, Feb. 1926, pp. 144-148, 4 figs. Form of flowmeter in which loosely fitting piston of neutral buoyancy is impelled along glass tube by flow of li uid, against spring control in which restoring force is proportional to square of displacement so as to obtain approximately even velocity scale.

FLUE-GAS ANALYSIS

COMPUTATIONS. Flue-Gas Computations, A. A. Bato. Mech. Eng., vol. 48, no. 4 Apr. 1926, pp. 330-336, 3 figs. Abbreviation methods for checking flue-gas analyses and computing results; heat balance without ultimate analysis of fuel.

FLUMES

VENTURI. The Improved Venturi Flume. Am. Soc. Civ. Engrs.—Proc., vol. 52, nos. 1, 2, 3 and 4, Jan. ,Feb., Mar. and Apr. 1926, pp. 102-106, 303-318, 470-472 and 627-630, 13 figs. Discussion on paper by R. L. Parshall.

FOREMEN

RESPONSIBILITIES. The Foreman's Responsibilities, F. J. Borer. Ry. Mech. Engr., vol. 100, no. 4, Apr. 1926, pp. 219-220. Stopping of leaks of all kinds; constructive suggestions; attitude toward employees; public relations.

FORGING

MACHINES FOR. Modern Forging Machines (Neuere Schmiedemaschinen), A. Georg. Maschinenbau, vol. 5, no. 3, Feb. 4, 1926, pp. 114-116, 4 figs.

FOUNDATIONS

COFFERDAM. Problems of a Deep Caisson-Cofferdam Foundation, New York Federal Reserve Bank, C. S. Proctor. World Power, vol. 5, no. 27, Mar. 1926, pp. 598-604, 7 figs. Great depth required to accommodate five cellar stories; bracing of cofferdam complicated by size of site; 2 types of permanent bracing; wedging methods; stress transfer checked by strain gage.

ROADS AND STRUCTURES. Foundations for Roads and Structures, W. J. Moore. Can. Engr., vol. 50, no. 12, Mar. 23, 1926, pp. 419-420. Failures of bridge piers cited to show need for adequate foundations; subgrade for all types of pavement should be thoroughly consolidated. Paper presented at Annual Conference on Road Construction.

UNDERPINNING. Difficult Underpinning Work in Building Reconstruction, W. P. Parker. Eng. News-Rec., vol. 96, no. 13, Apr. 1, 1926, pp. 530-532, 3 figs. Putting in sub-basement in Philadelphia department store involves unusual difficulties; quick hardening cement used.

FOUNDRIES

AIR FURNACES. Air Furnace Has Underfeed Stoker, B. Finney. Iron Age, vol. 117, no. 16, Apr. 22, 1926, pp. 1119-1123, 8 figs.

CONVEYOR SYSTEMS. Conveyor Systems, F. G. Steinebach. Foundry, vol. 54, no. 7, Apr. 1, 1926, pp. 256-261, 8 figs. Systems employed by Warren Foundry Co.. Warren, Ohio, to transport molds and finished castings, to handle jackets, weights, bottom boards and sand, etc.

Conveyors Nearly Triple Output, F. L. Prentiss. Iron Age, vol. 117, no. 14, Apr. 8, 1926, pp. 977-982, 10 figs. Power-driven conveying systems are feature of improvements in continuous foundry of Saginaw Products Co., Saginaw, Mich.; make 2000 Chevrolet cylinder blocks a day.

COST ACCOUNTING. Foundry Costing, C. Dicken. Foundry Trade Jl., vol. 33, no. 500, Mar. 18, 1926, pp. 215-218. System which can be used in either ferrous or non-ferrous foundries, but chiefly concerned with cost of production in cast-iron foundry from arrival of pattern into foundry to delivery of rough castings to stores.

MATERIALS HANDLING. Handling Foundry Materials Efficiently, R. Micks. Can. Foundryman, vol. 17, no. 3, Mar. 1926, pp. 11-13, 2 figs. Utility of cranes; overhead systems of hoisting and conveying; electric and gasoline truck and truck tractor; conveying system of transportation; transportation in yard.

Lower Handling Costs of Foundry Materials, H. J. Payne. Foundry, vol. 54, no. 7, Apr. 1, 1926, pp. 262-264 and 282, 8 figs. Materials-handling practice of Kuebler Foundries, Easton, Pa., having productive capacity of 80 tons of malleable castings per day; use of electric industrial trucks.

PROBLEMS. Recurring Foundry Problems, D. Wilkinson. Foundry Trade Jl., vol. 33, no. 498, Mar. 4, 1926, pp. 165-169, 3 figs. Deals with troubles arising when actions and reactions occur which are not yet fully under control of founder; typical reactions; troubles from scum inclusions; blowhole defects; importance of magnetic oxide reaction; solidification voids; hot spots; diagnosed by isothermal lines; chills suggested as remedy.

FOUNDRY EQUIPMENT

FLASKS. Moulding Cases. Metal Industry (Lond.), vol. 28, no. 13, Mar. 26, 1926, pp. 301-303, 7 figs. Explains various useful expedients which can be adopted in making molding cases, and gives hints as to advantages and disadvanatges of using foundry floor as part of mold.

FREIGHT HANDLING

EXCEPTIONAL LOADS. Transport of Exceptional Loads, A. R. Polson. Inst. Transport—Jl., vol. 7, no. 5, Mar. 1926, pp. 259-265. Difficulties met with in transporting and delivering heavy packages; outline of services to be provided for and problems to be met by manufacturers exporting abroad.

FUELS

RESEARCH. Significant Progress in Research on Fuels, A. C. Fieldner. Coal, vol. 1, no. 2, Mar. 1926, pp. 88-94. Origin and constitution of coal; research on preparation, storage and utilization of coal; research on combustions and carbonization; by-product coking; gas manufacture; low-temperature carbonization. Paper presented in Annals, Am. Academy of Political & Social Science.

USE AND TREATMENT. The Use and Treatment of Fuel, S. H. North. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926, pp. 51-56, 6 figs. Compares respective calorific values of coal and oil, and gives examples of economies which may be effected where oil is employed for power production. [*See also Coal; Oil Fuel; Pulverized Coal.*]

FURNACES, HEAT-TREATING

SALT BATHS. Design and Operation of Furnaces for Salt Baths, S. Tour. Am. Soc. Steel Treating—Trans., vol. 9, no. 4, Apr. 1926, pp. 553-569 and (discussion) 569-570, 12 figs.

FURNACES, INDUSTRIAL

DESIGN AND OPERATION. Industrial Furnaces. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 356-359. Heat losses, products of combustion, fuels, efficiency and its improvement, automatic control, selection of fuels, etc., as discussed at meeting of Am. Soc. Mech. Engrs.

OIL-BURNING EQUIPMENT. Oil Burning Equipment for Industrial Furnaces, M. H. Mawhinney. Am. Soc. Steel Treating—Trans., vol. 9, no. 1, Jan. 1926, pp. 99-109 and (discussion) 109-110.

G

GALVANIZING

CRAPO PROCESS. Crapo Galvanizing Process. Metal Industry (Lond.), vol. 28, no. 14, Apr. 2, 1926, p. 315, 1 fig. New process developed at research laboratory of Indiana Steel & Wire Co., which solves problem of producing non-peeling, non-cracking zinc coating on iron wire.

GAS ENGINES

POWER PLANTS. The Gas Engine, P. S. Caldwell. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926, pp. 88-95, 19 figs. Its design and application in modern power house; details of most important British types; running costs and results which may be expected from carefully kept installation working either on town, producer, blast-furnace or coke-oven gas.

GAS PRODUCERS

COST. A Few Points on Gas Producer Costs, J. A. Voorhies. Indus. Mgmt. (N.Y.), vol. 71, no. 4, Apr. 1926, pp. 240-241. Gives analysis of cost figures for two raw-gas producer plants of normal size so that relative idea as to comparative costs to other gaseous fuels may be obtained.

STEAM GENERATORS, DIRECT APPLICATION TO. Complete Gasification of Coal for Firing Boilers, C. H. S. Tupholme. Chem. & Met. Eng., vol. 33, no. 3, Mar. 1926, pp. 160-162, 5 figs. Producers directly applied to steam generators, either with or without by-product recovery, have recently received much attention in Great Britain.

GAS TURBINES

5000-KW. Oil and Gas Turbines: A 5000-Kw. Unit Built. Oil Engine Power, vol. 4, no. 4, Apr. 1926, pp. 217-218. Outlines basic conditions, which indicate full consumption is not too high for locomotive work.

GASES

IDEAL, LAWS OF. Aberrations from the Ideal Gas Laws in Systems of One and Two Components, O. Maass and J. H. Mennie. Roy. Soc.—Proc., vol. 110, no. A753, Jan. 1, 1926, pp. 198-232, 7 figs. Research, object of which was measurement of deviations from Dalton's law in gaseous mixtures; density of CO_2 and water vapors; systems water-carbon dioxide and water-ammonia.

GEAR CUTTING

SHAPER CUTTERS. The Design and Application of Gear-Shaper Cutters, H. Walker. Machy. (Lond.), vol. 27, no. 699, Feb. 18, 1926, pp. 671-673, 7 figs. Pressure-angle correction of cutter, application to thread cutting.

SUPER-ACCURATE PRODUCTION. The Super-Accurate Production of Spur Gears on the Gear Shaper, H. Walker. Engineer, vol. 141, no. 3664, Mar. 19, 1926, pp. 316-317, 3 figs. Presents graphical method of correction, reduced to its simplest possible terms.

GEARS

GRINDING. Gear Grinding, H. Darbyshire. Automobile Engr., vol. 16, no. 213, Mar. 1926, pp. 108-110, 3 figs.

GOLD DEPOSITS

NOVA SCOTIA. An Occurrence of Zinc Silicate Ore of Supposed Primary Origin, S. J. Speak. Instn. Min. & Met.—Bul., no. 258, Mar. 1926, pp. 1-13. Facts brought out by analysis of ore; logical conclusion is that Nova Scotia has never properly been tested.

ONTARIO. The Goudreau Gold Area, C. W. Macleod and G. S. Cowie. Can. Inst. Min. & Met.—Bul., no. 167, Mar. 1926, pp. 393-401, 2 figs. Area is roughly 25 miles in length by 6 miles in width; potential gold formation is much more extensive, but little prospecting has been done outside of these limits; actual continuous area of Keewatin formation in which gold has been found is one of largest in Ontario.

ONTARIO. Gold Deposits of Kenora and Rainy River Districts, E. L. Bruce. Ont. Dept. Mines—Annual Report, vol. 34, 1925, pp. 1-42, 23 figs.

ONTARIO. Kamiskotia Gold Area, F. L. Finley. Ont. Dept.Mines—Annual Report, vol. 34, 1925, pp. 43-64, 10 figs.

ONTARIO. Tashota-Onoman Gold Area, T. L. Gledhill. Ont. Dept. Mines—Annual Report, vol. 34, 1925, pp. 65-85, 14 figs.

ONTARIO. Lightning River Gold Area, T. L. Gledhill. Ont. Dept. Mines—Annual Report, vol. 34, 1925, pp. 86-98, 7 figs.

ONTARIO. Red Lake—A Present-Day Klondike Scene, H. P. Prather. Eng. & Min. Jl.-Press, vol. 121, no. 13, Mar. 27, 1926, pp. 523-524, 1 fig. Gold discoveries in isolated region of Northwestern Ontario.

ONTARIO. Gold Deposits of Kenora and Rainy River Districts, Ontario, E. L. Bruce. Can. Min. Jl., vol. 47, nos. 7, 8 and 11, Feb. 12, 19 and Mar. 12, 1926, pp. 159-161, 181-185 and 264-265, 1 fig. Reviews geological occurrence of gold-bearing veins of the various properties; operation at various mines.

GOVERNORS

INERTIA. A New Inertia Governor. Engineer, vol. 141, no. 3667, Apr. 9, 1926, pp. 419-420, 1 fig. Form of governor primarily intended for controlling marine internal-combustion engine made by Ramsay, Jackson and Co.

GRINDING MACHINES

INTERNAL. Automatic Internal Grinding Machine. Engineering, vol. 121, no. 3140, Mar. 5, 1926, pp. 317-319, 7 figs. Latest improvements in machine constructed by Heald Machine Co., Worcester, Mass.

H

HANGARS

INEXPENSIVE TYPE. An Inexpensive Serviceable Hangar. Aviation, vol. 20, no. 11, Mar. 15, 1926, pp. 370-371, 6 figs. Simple building of corrugated galvanized iron rough dressed lumber and garage hardware; built in Kansas for less than $600.

HARDNESS

TESTING MACHINES. Elastic Ring for Verification of Brinell Hardness Testing Machines, S. N. Petrenko. Am. Soc. Steel Treating—Trans., vol. 9, no. 3, Mar. 1926, pp. 420-429, 3 figs.

HEATING, ELECTRIC

APPARATUS. Calculation of Electric Heating Apparatus (Calcul des appareils de chauffage électrique), R. A. Barbes. Electricien, vol. 42, no. 1388, Jan. 15, 1926, pp. 25-30. Discusses laws of heating and cooling, coefficients of profile and of insulation, for developing equations; examples of calculation for various grades of insulation.

HELIUM

PRODUCTION AND PROPERTIES. Helium as a Floating Gas for Airships (Helium als Traggas für Luftschiffe), W. Scherz. Luftfahrt, vol. 30, nos. 3 and 5, Feb. 5 and Mar. 5, 1926, pp. 35-36 and 66-67. Details of properties and production; especially in United States; research; helium from natural gas; use for airships and its advantages.

HIGHWAYS

LOCATING RURAL. Locating Rural Highways, W. W. Crosby. Roads & Streets, vol. 65, no. 3, Mar. 3, 1926, pp. 151-154. General principles, specific example and recommendations. (Abstract) Paper presented before Am. Road Bldrs. Assn.

HOBBING MACHINES

PFAUTER. Pfauter Gear-Hobbing Machine. Machy. (N.Y.), vol. 32, no. 8, Apr. 1926, pp. 666-667, 3 figs. Automatic machine for producing spur, helical and worm gears.

HYDRAULIC PRESSES

ELECTRO-HYDRAULIC. Electro-Hydraulic Forging Press for the Mining and Metallurgical Industry (Elektrische Grossantriebe mit Leonardsteuerung in der Berg- und Hüttenindustrie), E. Riecke. Elektrotechnische Zeit., vol. 47, no. 4, Jan. 28, 1926, pp. 97-99, 5 figs.

PUMP AND ACCUMULATOR CAPACITY. Pump and Accumulator Capacities for Hydraulic Presses. Machy. (Lond.), vol. 27, no. 703, Mar. 18, 1926, p. 807. Method of determining capacity of pump and accumulator to serve specified number of presses to operate at predetermined speed and stroke.

HYDRAULIC TURBINES

MAINTENANCE. Hydraulic Maintenance at Holtwood Plant, T. C. Stabley. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 341-349, 10 figs. Conditions causing deterioration of hydraulic turbines; overcoming effects of corrosion; thrust bearings; maintenance of turbines and governors; pitting of runners; safe practices during turbine repairs; governor-control system; inspection.

TESTING LABORATORY. Turbine Testing Plant of T. Bell & Co. at Kriens (Die Turbinen-Versuchsaniage der A.-G. der Maschinen-fabrik von Theodor Bell & Cie., Kriens), O. Walter. Schweizerische Bauzeitung, vol. 87, nos. 9, 10 and 11, Feb. 27, Mar. 6 and 13; 1926, pp. 111-116, 125-130 and 146-148, 33 figs.

VENTING. Venting Waterwheels for Efficiency, F. Nagler. Elec. World, vol. 87, no. 14, Apr. 3, 1926, pp. 699-703, 6 figs. Among advantages are improvement of speed regulation and runner and draft-tube efficiency, reduction of gate leakage and turbine vibration, provision of vacuum for power-house cleaning, etc.; limitations and precautions, how data to indicate best load apportionment are obtained; venting methods, explanation of effects.

HYDRO-ELECTRIC DEVELOPMENTS

FRANCE. Hydraulic Developments of the Midi Railway in the Ossau Valley. Engineer, vol. 141, no. 3666, Apr. 2, 1926, pp. 376-379, 9 figs.

GEORGIA. Hydro-Electric Development in Georgia. Elec. World, vol. 87, no. 15, Apr. 10, 1926, pp. 750-756, 16 figs.

HYDRO-ELECTRIC PLANTS

AUTOMATIC. Automatic Hydro Plants of the Detroit Edison Co. Power Plant Eng., vol. 30, no. 6, Mar. 15, 1926, pp. 352-358, 10 figs.

BRITISH COLUMBIA. The Stave Falls Development, E. E. Carpenter. Jl. Electricity, vol. 56, no. 5, Mar. 1, 1926, pp. 172-178, 7 figs.

CALIFORNIA. Balch Hydro Plant to Operate at 2740-ft. Head. Power Plant Eng. vol. 30, no. 7, Apr. 1, 1926, pp. 433-434, 4 figs.

CALUMET ISLAND, CANADA. The Ottawa River at Calumet Island. Elec. News, vol. 35, no. 6, Mar. 15, 1926, pp. 31-33, 4 figs.

WASHINGTON. Engineering Features of the Baker River Development, L. N. Robinson, Elec. World, vol. 87, no. 11, Mar. 13, 1926, pp. 547-550, 6 figs.

HYSTERESIS

MAGNETIC. The Magnetic Hysteresis Curve, H. Lippelt. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 4, Apr. 1926, pp. 355-364, 14 figs. Analysis of phenomen a of hysteresis, introducing conception of reactive component and dissipative component of counteracting force, which appears when magnetizable material is subjected to magnetizing force; using this conception, equations and curves are developed for hysteresis curve for various components and for hysteresis loss.

I

IMPACT TESTING

NOTCHED-BAR TESTS. Interpretation of Notched Bar Impact Test Results, P. Heymans. Am. Soc. Steel Treating—Trans., vol. 9, no. 4, Apr. 1926, pp. 604-610, and (discussion) 610-614, 7 figs.

Notes on Impact Testing and the Impact Strength of Copper, Aluminium and Certain Brasses at Different Temperatures, F. Sauerwald and H. Wieland. Metallurgist (Supp. to Engineer, vol. 141, no. 3665), Mar. 26, 1926, pp. 45-47, 1 fig.

INDICATORS

HIGH-SPEED ENGINES. The Gale Indicator for High-Speed Engines. Engineering, vol. 121, no. 3141, Mar. 12, 1926, p. 350, 1 fig.

MEAN-PRESSURE. The M.I.P.-Meter, J. Geiger. Oil Engine Power, vol. 4, no. 4, Apr. 1926, pp. 223-226, 15 figs.

INDUSTRIAL MANAGEMENT

BUDGETING. Foreseeing Volume of Coming Orders, J. H. Barber. Mfg. Industries, vol. 11, no. 4, Apr. 1926, pp. 253-256, 2 figs. Author shows how to construct barometer curve from four groups of Federal Reserve statistics that indicate change in gross profit margins.

ESTIMATES, PREPARATION OF. The Use of Graphs in the Preparation of Estimates, E. G. Fiegehen. Mech. World, vol. 79, no. 2042, Feb. 19, 1926, pp. 146-147. Examples of uses to which estimating graphs may be put.

FINANCIAL AND INDUSTRIAL INVESTIGATIONS. Judging Operating Results, A. Andersen. Mfg. Industries, vol. 11, no. 4, Apr. 1926, pp. 277-280. Analysis of operating statements in financial and industrial investigation; determination of profits; importance of depreciation and appreciation; profit and loss statement; consideration of gross profits and costs.

INVENTORY CONTROL. The Control of Inventory Through the Scientific Determination of Lot Sizes, H. S. Owen. Indus. Mgmt. (N.Y.), vol. 71, no. 4, Apr. 1926, pp. 257-260, 3 figs. Perpetual-inventory stock records.

MATERIALS-COST STANDARDIZATION. Material Costs Can be Standardized, F. H. Figsby. Factory, vol. 36, no. 3, Mar. 1926, pp. 431-432 and 586, 2 figs.

PROJECT ENGINEERS. Functions of a Project Engineering a Techinical Organization, J. F. Hardecker. Am. Mach., vol. 64, no. 16, Apr. 22, 1926, pp. 641-642. Complete analysis made of system whereby one engineer follows through an assignment from preliminary design to finished product.

INDUSTRIAL PLANTS

EFFICIENCY. Plant Efficiency. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 360-361. Problems affecting plant efficiency, including selections of site, plant design, site limitations affecting layout, etc., discussed at meeting of Am. Soc. Mech. Engrs.

POWER-COSTS CONTROL. How Shall a Manager Control His Power Costs? W. H. Larkin, Jr. Factory, vol. 36, no. 3, Mar. 1926, pp. 444-445, 1 fig. Standard, monthly power report, as adopted by wide variety of industries, proves its case for simplicity and effectiveness; it is revolutionizing power costs in many plants

INDUSTRIAL RELATIONS

Improving. Promoting Friendly Relations in Industry, E. M. Herr. Machy. (N.Y.), vol. 32, no. 8, Apr. 1926, pp. 621-622. Method as worked out at Westinghouse plant, East Pittsburgh, Pa.; distinction between owners and management in modern industrial undertakings; responsibilities of management of industrial enterprise.

Maintenance. Maintenance of Proper Relations Between Employer and Employee, E. M. Herr. West. Machy. World, vol. 17, no. 3, Mar. 1926, pp. 99-100 and 135.

INSPECTION

Methods. Inspection Methods. Soc. Automotive Engrs.—Jl., vol. 18, no. 3, Mar. 1926, pp. 323-325. Discussion of paper by C. J. Ross, published in Oct. 1925 issue of same journal.

INSULATING MATERIAL, ELECTRIC

Organic. Organic Insulating Materials, A. C. Hopper. Elecn., vol. 96, no. 2494, Mar. 5, 1926, pp. 258-259. Properties of ideal substance; effect in increasing voltages; impregnation problems; acidity question.

INSULATION, HEAT

High-Temperature. High Temperature Insulation, C. S. Gillette. Am. Soc. Nav. Engrs.—Jl., vol. 38, no. 1, Feb. 1926, pp. 3-16, 3 figs. Advantages of proper heat insulation if piping and machinery on shiboard.

INTERNAL-COMBUSTION ENGINES

Combustion. Control of Carburation in Explosion Engines by Exhaust-Gas Analysis and Carburation Curves (Controle de la carburation dans les moteurs a explosion par l'analyse des gaz d'echappement dans les moteurs explosion par l'analyse des gaz d'echappement et les diagrammes de carburation), B. Jousset. Chaleur et Industrie, vol. 7, no. 71, Mar. 1926, pp. 124-126, 1 fig.

Cylinders. Thermal Stresses in Engine Cylinders, D. Laugharne-Thornton. World Power, vol. 5, no. 27, Mar. 1926, pp. 136-145, 5 figs. Examines principal factors to be considered in determination of stesses which arise in internal-combustion-engine cylinder as result of changes of temperature which such part is subject to during ordinary cycle of engine.

Instruments for. Instruments for Internal-Combustion Engines. Shipbldr., vol. 33, no. 187, Mar. 1926, pp. 150-151, 6 figs. Thermoelectric pyrometers for determining exhaust temperatures; instruments for obtaining accurate indicator diagrams.

Power Plants. The Internal-Combustion-Engine in the Power House, J. Richardson. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926, pp. 81-84, 5 figs. Historical survey of development; chief type of engines at present in use.

(*See also Airplane Engines; Automobile Engines; Diesel Engines; Gas Engines; Oil Engines.*)

IRON ALLOYS

Iron-Chromium. The Nature of the Alloys of Iron and Chromium, E. C. Bain. Am. Soc. Steel Treating—Trans., vol. 9, no. 1, Jan. 1926, pp. 9-32, 18 figs.

Iron-Silicon. Iron and Silicon. Metallurgist (Supp. to Engineer, vol. 141, no. 3665), Mar. 26, 1926, pp. 43-44, 1 fig. Review of work by Wever and Giani on investigation of iron-silicon alloys, account of which is published in Stahl u. Eisen, Jan. 14, 1926.

IRON AND STEEL

Warping. Why Metal Warps and Cracks, J. F. Keller. Am. Soc. Steel Treating—Trans., vol. 9, no. 3, Mar. 1926, pp. 373-400 and (discussion) 400-402, 12 figs.

IRON CASTINGS

Chilled. Making Chilled Castings in Jobbing Foundries, R. Coulthurst. Mech. World, vol. 79, no. 2047, Mar. 26, 1926, pp. 246-247. Discusses difficulties encountered by jobbing foundry, as follows: size of chill, nature of metal to be used, temperature of molten metal entering mold, chief differences in molding as against molds for ordinary castings, and de, th of chill.

Methods and Processes. Comparisons in Foundry Methods and Processes, E. Longden. Foundry Trade Jl., vol. 33, no. 501, Mar. 25, 1926, pp. 227-232, 29 figs. Notes on oil-sand cores, wooden frames, molding tackle, gas-and-oil-engine pistons and liners; cupola design; solid and drop bottoms; special iron.

Notes on the Production of Castings. Foundry Trade Jl., vol. 33, no. 501, Mar. 25, 1926, p. 226. Cupola practice; sand problem; venting and cores; causes of defects. Abstract.

The Manufacture of Iron and Steel, F. T. Sisco. Am. Soc. Steel Treating—Trans., vol. 9, no. 2, Feb. 1926, pp. 305-322, 1 fig. Describes manufacture of iron and steel castings; method of preparing mold; various kinds of molds and their uses; iron for castings is melted in cupola using coke as fuel; various steel-making processes described in so far as they are used for productions of steel for castings and their various advantages and disadvantages; preparing casting for shipment, digging out, cleaning, heat treatment and inspection.

Oxidizing. Oxidizing Cast Iron Castings, W. S. Barrows. Can. Foundryman, vol. 17, no. 3, Mar. 1926, p. 18.

Sand Blasting. Sand Blasting and Other Aids to Fettling, F. W. Neville. Foundry Trade Jl., vol. 33, no. 497, Feb. 25, 1926, pp. 145-150, 8 figs.

IRRIGATION

Exchequer Project, California. The Exchequer Project of the Merced Irrigation District, R. White. Contractors' & Engrs.' Monthly, vol. 12, no. 3, Mar. 1926, pp. 45-52, 7 figs. Primarily an irrigation storage project requiring high masonry dam, work includes relocation of 17 miles of mountain railway, construction of long railway bridge on highest concrete piers ever used for this type of work and installation of 42,000 h.p. hydro-electric plant.

Water-Right Adjudications. Determination of the Duty of Water in Water-Right Adjudications. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 4, Apr. 1926, pp. 580-596. Features of water adjudications of interest to engineers; principles on which duty of water is defined as indicated by court decisions; character of evidence likely to be most useful in assisting adjudicating agencies in such determinations; illustrations of results and practices in existing decrees.

L

LATHES

Tests. Investigation of Small Lathes as to Design, Construction and Efficiency. (Untersuchungen an kleinen Drehbänken hinsichtlich Konstruktion. Ausführung und Leistung), F. Theimer. Zeit, Oesterr, Ingenieur- u. Architekten Vereines, vol. 78, no. 3-4, Jan. 22, 1926, pp. 23-26, 4 figs.

LIFTING MAGNETS

Design. Lifting Magnets. Machy. (Lond.), vol. 27, no. 704, Mar. 25, 1926, pp. 833-835, 5 figs. Theory underlying design; weight of coil; cooling surface; points in construction of modern lifting magnets; control equipment.

LIGHTING

Highways. Comparison Between Lighted and Unlighted Highways, F. C. Taylor. Elec. World, vol. 87, no. 16, Apr. 17, 1926, pp. 816-818, 2 figs. Headlight road illumination not sufficient for timely perception of pedestrians, obstructions, curves and changing road conditions when car is moving at usual highway speed.

Industrial. Lighting of Factories and Workshops (L'Eclairage des Usines et des Ateliers), J. Rumilly. Revue Industrielle, vol. 56, no. 2198, Jan. 1926, pp. 9-16, 11 figs. Advantages of good lighting in industry; relation of lighting to accidents; selection of proper lighting system; coefficient of depreciation; calculation of luminous flux of lamps; details of Luxmetre Mazda for measurement of light.

Street. Cost of Operating Chicago's Street Lights, J. T. Miller. Elec. World, vol. 87, no. 15, Apr. 10, 1926, pp. 759-761, 4 figs. Allowances made by Department of Gas and Electricity for items not charged to street lighting, but really assessable in order to obtain complete operating costs.

LIGNITE

Saskatchewan Development Scheme. An Industrial Development Scheme for the Southern Saskatchewan Lignite Fields, S. R. Parker and W. P. Brattle. Elec. News, vol. 35, nos. 4, 5 and 6, Feb. 15, Mar. 1 and 15, 1926, pp. 43-44, 38-41 and 33-35, 8 figs. Feb. 15: Mining and briquetting; power and gas. Mar. 1: Ultimate layout for province-wide electrification; connected load of 40,000-h.p. awaiting service. Mar. 15: Suggested joint use of poles for telephone and electric power.

LOCOMOTIVE BOILERS

Future Possibilities. Future Possibilities of the Locomotive Boiler. L. A. Rehfuss. Ry. Mech. Engr., vol. 100, no. 4, Apr. 1926, pp. 212-214. Trend towards higher pressures; objections to water-tube boiler; objections to watering type of firebox; question of high steam temperatures.

Pitting. Great Northern Reduces Pitting of Locomotive Boilers. Ry. Age, vol. 80, no. 18, Apr. 3, 1926, pp. 951-958, 7 figs. Changes in water-treating methods yield striking results; mileage doubled and tube life trebled.

LOCOMOTIVES

Compound. High-Speed Compound Locomotives (Locomotive compound à grande vitesse), R. Vallantin. Revue Génèrale des Chemins de Fer, vol. 45, no. 2, Feb. 1926, pp. 89-100, 6 figs.

Diesel-Electric. The Future of the Diesel-Electric Locomotive. Ry. Elec. Engr., vol. 17, no. 3, Mar. 1926, pp. 70-74, 2 figs.

Eight-Coupled. Eight-Coupled Express Locomotives in France. Ry. Engr., vol. 47, no. 555, Apr. 1926, pp. 119 and 122, 2 figs. Comparative tests on 4-8-2 type, having 4-wheel front truck.

Electric. *See Electric Locomotives.*

Garratt. The Garratt Locomotive, R. H. Whitelegg. Engineer, vol. 141, no. 3666, Apr. 2, 1926, p. 392.

Internal-Combustion. Internal-Combustion Locomotives for Railway and Industrial Purposes. Ry. Gaz., vol. 44, no. 10, Mar. 5, 1926, pp. 324-325, 4 figs. Two useful types, manufactured by Crossley Bros., for switching about factory premises and yards.

Oil-Electric. A Survey of Oil-Electric Locomotive Design, E. M. Speakman. Oil Engine Power, vol. 4, no. 4, Apr. 1926, pp. 210-214, 1 fig. Summary of weight and power data of major units built to date is basis of analytical commentary.

Three-Cylinder. The Three-Cylinder Locomotive. Ry. Age, vol. 80, no. 16, Mar. 20, 1926, pp. 849-850, 1 fig. Abstracts of papers read before Chicago Section of Am. Soc. Mech. Engrs., as follows: Construction and Economy Features, J. G. Blunt; Some Test Results, E. L. Woodward.

LUBRICATING OILS

Purification. Oil Purification at Kearny Plant, D. F. Miller and R. H. Osgood. Elec. World, vol. 87, no. 16, Apr. 17, 1926, pp. 801-803, 3 figs. Systems for purifying turbine lubricating oil and transformer and circuit-breaker insulating oils at new generating station of Public Service Electric & Gas Co. at Kearny, N.J

M

MACHINE SHOPS

Foundry. Equip Machines for Large Work, R. A. Fiske. Iron Age, vol. 117, no. 13, Apr. 1, 1926, pp. 899-902, 6 figs. New machine shop of Hubbard Steel Foundry Co., East Chicago, Ind., is located between two foundries; in this shop all castings, with the exception of rolls, are finished.

MACHINE TOOLS

Design Trends. Modern Aims and Tendencies in the Machine-Tool Industry (Neuzeitliche Aufgaben und Ziele des Werkzeugmaschinenbaues), Weil. Zeit, des Vereines deutscher Ingenieure, vol. 70, no. 13, Mar. 27, 1926, pp. 437-439.

German Standards. Standards for German Machine Tools. Am. Mach., vol. 64, no. 16, Apr. 22, 1926, pp. 638, 3 figs.

Modern. Modern Machine Tools. Automobile Engr., vol. 16, no. 213, Mar. 1926 pp. 99-104, 7 figs.

Selection. How to Select Machine-Tools, W. G. Careins. Soc. Automotive Engrs.—Jl., vol. 18, no. 3, Mar. 1926, pp. 275-278 and (discussion) 278-280.

Small, Heavy Work on. Handling Heavy Work on Small Machines, J. H. Rodgers. Machy. (N.Y.), vol. 32, no. 8, Apr. 1926, pp. 632-633, 2 figs. Using rollers to support lathe work; extension plate for die-sinking machine; compensator for milling machine-table overhang.

MACHINE METHODS

Automobile-Cylinders. Stutz Milling and Boring Fixtures, F. H. Colvin. Am. Mach., vol. 64, no. 16, Apr. 22, 1926, pp. 631-634, 14 figs. Methods used in machining new Stutz eight-in-line cylinder block; drilling oil holes 36 in. deep; trunning and indexing fixtures.

MAGNESIUM

Properties. Magnesium and Its Alloys, S. L. Archbutt. Metallurgist (Supp. to Engineer, vol. 141, nos. 3657 and 3661), Jan. 29 and Feb. 26, 1926, pp. 4-6 and 26-30, 10 figs.

MALLEABLE CASTINGS

Contraction. The Contraction of Malleable Castings, R. Stotz and F. Henfling. Metallurgist (Supp. to Engineer), vol. 141, no. 3665), Mar. 26, 1926, pp. 38-40., 2 figs.

MAPPING

Topographical Expression. Expression of Land Forms on Maps, A. C. T. Sheppard. Can. Engr., vol. 50, no. 11, Mar. 16, 1926, pp. 395-397. Meaning of topographical expression; selection of contour interval; physiography as aid to topographical mapping; allowable latitude in topographical mapping. Paper presented at Annual Convention of Dominion Land Surveyors Assn.

MATERIAL HANDLING

OUTSIDE HAULAGE. Undeveloped Possibilities in Outside Haulage. Factory, vol. 36, no. 3, Mar. 1926, pp. 441-443, 510 and 514, 6 figs. Experiences of large steel mill with electric locomotives; of H. C. White Co., with gasoline locomotives; of Wilson Foundry & Machine Co., with tractor-trailers; and of Fedders Mfg. Co., with semi-trailers.

See Also ash Handling; Coal Handling; Foundries; Freight Handling.

MECHANISMS

GENEVA STOP. Inertia Forces in the Geneva Stop and Similar Mechanisms, J. I. Hall. Am. Mach., vol. 64, no. 15, Apr. 15, 1926, pp. 603-605, 5 figs. Derivation of equations for acceleration and inertia forces for general case of crank and slotted-arm mechanism; practical example worked out.

METALS

FATIGUE. On the Concentration of Stress in the Neighbourhood of a Small Spherical Flaw; and on the Propagation of Fatigue Fracture in "Statistically Isotropic" Materials, R. V. Southwell and H. J. Gough, Lond., Edinburgh & Dublin Philosophical Mag. & Jl. of Sci., vol. 1, no. 1, Jan. 1926, pp. 71-97, 12 figs. Concentration produced by small spherical flaw in material subjected to uniform tension; effect of small spherical flow in twisted shaft; origin of fatigue fractures.

What Happens When Metal Fails by Fatigue H. F. Moore. Am. Soc. Steel Treating—Trans., vol. 9, no. 4, Apr. 1926, pp. 539-552, 4 figs. Presents picture of what happens when metal fails by fatigue under repeated stress; also pictures two actions going on in metal under repeated stress; one strengthening and the other destructive action; if destructive overbalances strengthening action, metal will fail.

PLASTIC DEFORMATION. Plastic Formation (Plastische Gestaltung), P. Schweissguth. Maschinenbau, vol. 5, no. 3, Feb. 4, 1926, pp. 105-109, 6 figs.

Processes of Plastic Deformation (Ueber die Vorgange bei der bildsamen Formänderung), H. Hoff and G. Sobbe. Maschinenbau, vol. 5, no. 3, Feb. 4, 1926, pp. 109-112, 16 figs.

The Mechanism of Plastic Deformation, Meyer and Nehl. Metallurgist (Supp. to Engineer, vol. 141, no. 3661), Feb. 26, 1926, pp. 23-25, 3 figs.

POROSITY. The Porosity of Metals. Metallurgist (Supp. to Engineer, vol. 141, no. 3665), Mar. 26, 1926, pp. 41-42. Results of experiments carried out by Tammann and Bredemeyer on such widely varied materials as copper, brass, steel and cast iron, showing that water, applied under pressure, penetrated to very considerable depth. (See reference to original article in Eng. Index 1925, p. 478, under METALS, Hollow Channels.)

STRESS AND STRAIN HARDNESS. The Mechanics of Metals (Vorbilder für die Metall mechanik), F. Rinne. Zeit. für Metallkunde, vol. 18, nos. 2 and 3. Feb. and Mar. 1926, pp. 37-42 and 81-84, 34 figs. Discusses phenomena of stress, plastic deformation, strain hardness and fracture.

MILLING

CAM. Use of Dividing Head and Circular Attachment for Cam Milling. Machy. (Lond.), vol. 27, no. 702, Mar. 11, 1926, pp. 765-766, 2 figs.

MILLING MACHINES

DOUBLE-OVERARM. Double Overarm Milling Machine. Brit. Machine Tool Eng., vol. 3, no. 37, Jan.-Feb., 1926, pp. 369-370, 2 figs. Type of overarm employed on Parkinson machine consists of 2 cylindrical arms carried side by side so that centres of arms and centres of spindle form triangle.

DUPLEX. Full Automatic Table Control a Feature of New Milling Machine. Automotive Industries, vol. 54, no. 12, Mar. 25, 1926, pp. 538-540, 4 figs. Production miller brought out by Brown & Sharpe is of 2-spindle type; adapted for full automatic, part automatic and intermittent table operation; uses variety of fixtures.

High-Production Milling Machine. Iron Age, vol. 117, no. 12, Mar. 25, 1926, pp. 842-843, 3 figs. Full automatic table control is feature of new duplex machine, manufactured by Brown & Sharpe Mfg. Co., Providence; design permits use of wide variety of fixtures and attachments.

MINERALS

CANADIAN PRODUCTION. Mineral Production of Canada, J. A. Robb. Canada Dominion Bur. of Statistics—Report, Feb. 22, 1926, 47 pp., 2 figs. First detailed official figures available for whole of calendar year 1925.

MINES

PNEUMATIC PLACING OF CONCRETE. Pneumatic Placing of Concrete at Ray, D. A. Robotham. Ariz. Min. Jl., vol. 9, no. 20, Mar. 25, 1926, pp. 9-10, 4 figs. Discusses two methods: (1) pneumatic machine is placed at mixing plant conveniently located for delivery of material, and pipe lines for conveying wet mix are laid from plant to forms; (2) machine is located at forms and wet mix is conveyed in cars to machine and then placed in forms by air.

MOULDING MACHINES

DRIVE. Belt or Direct Electric Drive for Moulding Machines. Elec. News, vol. 35, no. 5, Mar. 1, 1926, pp. 49-51, 4 figs. Results of tests show startling reduction of costs with latter, accompanied by increased production.

MOULDING METHODS

LOAM. Describe Loam Moulding Methods, B. Shaw and J. Edgar. Foundry, vol. 54, nos. 5, 6 and 7, Mar. 1, 15, and Aug. 1, 1926, pp. 184-187, 225-228 and 275-279, 44 figs.

MOULDS

FORMED WITH CORES. More Moulds Made with Cores, Caster. Metal Industry (Lond.), vol. 28, no. 10, Mar. 5, 1926, pp. 229-231, 10 figs. Supplement to series or article published in same journal in 1925, giving further interesting examples of construction of molds entirely or mainly from cores.

GASES FROM MOLTEN IRON. Gases Evolved from Heated Iron, B. Hird. Foundry Trade Jl., vol. 33, no. 500, Mar. 18, 1926, pp. 219-221, 13 figs.

PERMANENT. Permanent Molds. Foundry Trade Jl., vol. 33, no. 497, Feb. 25, 1926, p. 153, 1 fig.

Traces Steps in Long Life Mold Advance, H. Schwartz. Foundry, vol. 54, nos. 2, 3, 4 and 5, Jan. 15, Feb. 1, 15 and Mar. 1, 1926, pp. 42-44 and 76, 92-94, 147 and 149-150, and 189-192, 7 figs.

VENTING. Metal Industry (Lond.), vol. 28, no. 9, Feb. 26, 1926, pp. 205-206, 5 figs. Discusses dangers of misuse of vent wire, and points out how use of suitable facing sand and skill of molder will often avoid much artificial venting; describes job illustrating certain difficult problems in venting.

MOTOR BUSES

BRAKES. Brakes for Heavy Vehicles, L. C. Huck. Soc. Automotive Engrs.—Jl., vol. 18, no. 3, Mar. 1926, pp. 288-295 and (discussion) 295-298, 6 figs.

DESIGN CHANGES. Motorcoach Builder's Attitude Toward Changes in Standard Designs, E. W. Templin. Soc. Automotive Engrs.—Jl., vol. 18, no. 4, Apr. 1926, pp. 379-383, 1 fig.

EPICYCLIC GEARS. Magnetically Controlled Epicyclic Gear. Motor Transport (Lond.), vol. 42, no. 1099, Mar. 22, 1926, pp. 349-350, 4 figs. Details of total transmission now being tested on Paris omnibuses as solution of driver problem.

GASOLINE-ELECTRIC. Operating Experience with Gasoline-Electric Motorcoaches. Soc. Automotive Engrs.—Jl., vol. 18, no. 4, Apr. 1926, pp. 373-377. Discussion of paper by R. H. Horton, published in Dec. 1925, issue of journal. See reference to original paper in Eng. Index, 1925, p. 501.

MOTOR-TRUCK TRANSPORTATION

WATER-TERMINAL OPERATION AND. Relation of the Motor Truck to Water Terminal Operation, W. F. Williams. World Ports, vol. 14, no. 5, Mar. 1926, pp. 49-54 and (discussion) 54-75. Discusses relation of motor vehicle to development of water-terminal business as applied in particular to Commonwealth Pier 5 in port of Boston.

MOTOR TRUCKS

LUBRICATION. The Essentials of Industrial Truck and Tractor Lubrication, A. F. Brewer. Indus. Mgmt. (N.Y.), vol. 71, no. 4, Apr. 1926, pp. 247-252, 12 figs. Discusses lubrication requirements of chassis parts and final drives, etc., of various modern types of industrial tractors and trucks.

OPERATING COST. Operating Costs and Economic Life of Motor Vehicles, W. H. Fairbanks. Soc. Automotive Engrs.—Jl., vol. 18, no. 3, Mar. 1926, pp. 285-287. Table summarizing operating costs of large mixed fleet for one year shows how records reveal highly important fundamental facts; relation of mileage to operating costs; determining economic life of truck.

O

OIL ENGINES

DOUBLE-ACTING. Double-Acting Engine of Wide Application. Oil Engine Power, vol. 4, no. 4, Apr. 1926, p. 215, 1 fig. Type now nearing completion at New London is 2-cycle design consisting of massive bedplate with cast-iron columns, guides, slippers, etc., in accordance with modern marine practice.

HIGH-EFFICIENCY. The High Efficiency Oil-Engine, A. E. L. Chorlton. Engineering, vol. 121, no. 3143, Mar. 26, 1926, pp. 409-411, 9 figs.; also Engineer, vol. 141, nos. 3665 and 3666, Mar. 26 and Apr. 2, 1926, pp. 364-366 and 394-395, 9 figs. (Abstract.) Paper read before Instn. Mech. Engrs.

OIL FUEL

COMBUSTION. Experience with the Combustion of Fuel Oil in Power Plant Boilers, J. F. Barkley. U.S. Bur. of Mines—Reports of Investigations, no. 2730, Feb. 1926, 6 pp.-1 fig. Also Oil & Gas Jl., vol. 24, no. 44, Mar. 25, 1926, pp. 90 and 92. Results of studies and tests made of various oil-burning equipments under power-plant boilers.

SPECIFIC GRAVITY AND VISCOSITY. The Graphic Relation of Specific Gravity to Viscosity in the Case of Fuel Oils, G. B. Vroom. Am. Soc. Naval Engrs.—Jl., vol. 38, no. 1, Feb. 1926, pp. 119-129, 5 figs. Shows how, specific gravity and viscosity at known temperatures, being given, its viscosity at any other temperature may be predicted within sufficiently accurate limits for practical working purposes.

OPEN-HEARTH FURNACES

BASIC PROCESS. Elimination of Metalloids in the Basic Open-Hearth Process, J. L. Keats and C. H. Herty. Am. Inst. Min. & Met. Engrs.—Trans., no. 1550-C, Feb. 1926, 28 pp., 18 figs. Wide variations in composition of bath from door to door occur after ore additions; bath is of uniform composition under finishing conditions and test from any door during this period will represent entire bath; one of controlling factors in rate of elimination of metalloids is fluidity of slag.

OPTICAL INSTRUMENTS

GAGING DEVICES. New Projection Device for Testing Fine Bores (Neuartiger Projektionspparat zum Prüfen feiner Bolnungen), O. Lich. Praktischer Maschinen-Konstrukteur, vol. 59, no. 5-6, Feb. 6, 1926, pp. 57-58, 6 figs.

TOOLING WORK. Accurate Angles by Optical Methods, F. C. Hudson. Am. Mach., vol. 64, no. 15, Apr. 15, 1926, pp. 601-602, 4 figs. Simple and very accurate method of setting work at right angles, that can be used on any toolroom job.

ZEISS MEASURING MACHINE. Zeiss Measuring Machine. Machy. (Lond.), vol. 27, no. 703, Mar. 18, 1926, pp. 815-816, 5 figs. Details of design; principle of optical system.

ORDNANCE

ANTI-AIRCRAFT. Anti-aircraft Ordnance—Yesterday, To-day and To-morrow, G. M. Barnes. Coast Artillery Jl., vol. 64, no. 1, Jan. 1926, pp. 17-32, 11 figs. Present and proposed new fire-control equipment; target-practice results; future anti-aircraft material.

OXYACETYLENE WELDING

APPLICATIONS. Oxygen the Wonder Worker, H. L. Rogers. Southern & Southwestern Ry. Club—Proc., vol. 18, no. 7, Jan. 1926, pp. 10, 13, 14, 17, 18, 21, 22 and 25 and (discussion) 25, 26, 29, 30, 33, and 34. Oxyacetylene welding torch and principle; oxyacetylene cutting torch; welders and cutters; application to railway work.

CAST-IRON HEATER SECTIONS. Procedure Control for Oxyacetylene Welding Cast Iron Heater Sections, J. W. Haygood. Am. Welding Soc.—Jl., vol. 5, no. 2, Feb. 1926, pp. 7-11. Selection and inspection of material; design and layout of welded joint; preparation of piece for welding; welding technique; inspection and test.

COPPER. Oxy-Acetylene Welding of Copper, S. W. Miller. Am. Mach., vol. 64, no. 16, Apr. 22, 1926, pp. 639-640, 4 figs. Introduction of silicon as deoxidizer in metal being welded as well as in welding rod results in production of sound welds.

P

PAPER MACHINERY

ELECTRIC DRIVES. Electrification of Paper-Making Machines, S. A. Staege. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 272-281, 12 figs. Outlines trends of development in historical sketch of progress in art up to present time, devoting special attention to unique system of d.c. drive in which section-driving motors through differential electrical field control means, cause several section-driving motors to operate in synchronous relation at any desired relative speed values.

PATTERNMAKING

ECONOMIES. Pattern Economies. Mech. World, vol. 79, nos. 2035, 2038, 2041 and 2043, Jan. 1, 22, Feb. 12 and 26, 1926, pp. 12-13, 67, 124-125 and 168-169, 34 figs. Jan. 1: Solid, or built-up patterns; metal patterns; complete, or skeleton or segmental patterns; boxing up. Jan. 22: Coring intricate interiors. Feb. 12: Sweeping, and segmental work in green sand. Feb. 26: Loam patterns; strickling.

PAVEMENTS, CONCRETE

REINFORCEMENT. A Concrete Pavement Detailed as a Floor is Detailed, W. H. Wheeler. Eng. News-Rec., vol. 96, no. 13, Apr. 1, 1926, pp. 518-520, 2 figs. Slab section and reinforcement varied with changing conditions and location and detail plans provided.

PIPE, CAST-IRON

Bronze Welding. Bronze Welding of Cast Iron Pipe, H. Y. Carson. Acetylene Jl., vol. 27, no. 9, Mar. 1926, pp. 429-435, 9 figs. Results of tests; practical bronze-welding data. Paper presented before Gas Products Assn.

Centrifugally Cast. Centrifugally-Cast Pipes at the Works of the Stanton Iron-works Company, Limited. Iron & Coal Trades Rev., vol. 112, no. 3029, Mar. 19, 1926, pp. 479-482, 13 figs. Methods and equipment of plant installed at Stanton Works near Nottingham, Eng., employing de Lavaud process.

PIPE, WOOD-STAVE

Conduits. Wood-Stave Pipe on Power Project is 16-ft. in Diameter. World Power, vol. 5, no. 27, Mar. 1926, p. 609, 2 figs. Creosoted wood-stave pipe was selected as conduit to connect two concrete-lined tunnels for Copco hydro-electric plant in Northern California.

Corrosion. Factors Other Than Dissolved Oxygen Influencing the Corrosion of Iron Pipes, J. R. Baylis. Indus. & Eng. Chem., vol. 18, no. 4, Apr. 1926, pp. 370-380, 13 figs. Investigation, which has been under way for several years, covering several phases of problem; electrochemical theory of corrosion; solubility of ferrous hydroxide and of ferrous carbonate; compounds formed in corrosion of iron; examination of question as to whether ferrous hydroxide precipitates during corrosion; influence of negative ions; pitting and tuberculation.

Renewals. Plotting a Life Line for Tacoma's Water Supply Conduit, W. A. Kurigk. Eng. News-Rec., vol. 96, no. 14, Apr. 8, 1926, pp. 562-563, 1 fig. Schedule of renewals on 40-mile wood-stave pipe simplied by use of profile on which estimated life is plotted.

PISTONS

Manufacture. Piston Methods, F. H. Colvin. Am. Mach., vol. 64, no. 15, Apr. 15, 1926, pp. 581-583, 14 figs. Methods and sequence of operations and devices used; burnishing ring grooves, grinding relief and facing pistons to length.

PLANERS

Testing Gears. Testing Planer Gears, C. E. Linden. Machy. (N.Y.), vol. 32, no. 8, Apr. 1926, p. 650, 3 figs. Use of special testing fixture may be employed with all large spur, helical, or herringbone gears.

PLATES

Flat Circular, Vibrations in. The Frequencies of Vibration of Flat Circular Plates fixed at the Circumference, H. Carrington. Lond., Edinburgh, & Dublin Philosophical Mag. & Jl. of Sci., vol. 50, no. 300, Dec. 1925, pp. 1261-1264. Gives equations and tables for frequencies of transverse symmetrical vibration of fixed circular plate.

Rectangular, Calculation of. Calculating Flat Rectangular Plates (Calcul des plaques rectangulaires planes), R. Lemaitre. Revue Universelle des Mines, vol. 9, no. 2, Jan. 15, 1926, pp. 58-80, 6 figs. Calculation of plates supported at their circumference and subjected to uniform load per unit.

Ripping up, Machine for. A Large Plate Ripping Machine. Engineer, vol. 141, no. 3664, Mar. 19, 1926, p. 333, 9 figs. partly on pp. 326 and 332. Machine employed for ripping up steel plates required for construction of Sydney Harbor bridge; it can accommodate plates up to 5 ft. in width and 67 ft. in length, and is capable of ripping them from end to end.

POLES

Tests. Tests on Steel and Wood Poles. Jl. Electricity, vol. 56, nos. 4 and 5, Feb. 15 and Mar. 1, 1926, pp. 137-143 and 138-185, 8 figs. Feb. 15: Suggests possible standard requirements for design of steel poles to meet four loadings and furnish two proposed standard designs of steel poles, together with estimates of cost. Mar. 1: Tests to establish as far as possible relative strength of cedar, fir and pine poles, new poles as well as those that have been in service for number of years; study of methods of and materials for preservation of wood poles of all kinds.

POLES, CONCRETE

Armored. Armoured Concrete Posts, T. Rich. Elecn., vol. 96, no. 2496, Mar. 19, 1926, pp. 322-323 and 325, 7 figs. Details of patterns now used in France; their applicability to British conditions.

POWER FACTOR

Correction. The Correction of Power-Factor by the Use of Synchronous Motors, P. C. Jones. Elec. Jl., vol. 23, no. 3, Mar. 1926, pp. 99-101, 3 figs. States that greater part of all losses occasioned by low power factor may be eliminated by installation in each industrial unit of small number of comparatively large synchronous motors, operated principally for corrective purposes; relations between these motors and larger number of low power factor motors in factory.

Low, Causes and Cures. Causes and Suggested Cures for Low Power Factor, E. Douglas. Power, vol. 63, no. 14, Apr. 6, 1926, pp. 528-529. Starting and speed characteristics; disease of individual motors; fallacy of low-speed motors; danger of motor oversizing; bad pulley and belting conditions.

Problems. Power Factor Problems, P. Kemp. Elecn., vol. 96, no. 2485, Jan. 1, 1926, pp. 4-6, 1 fig. Effect of cyclically variable resistance in non-inductive circuit; importance in a.c. measurements.

PRECIPITATION

Cottrell Process. Correction of Radio Interference from Cottrell Precipitators, J. J. Jakosky. Chem. and Met. Eng., vol. 33, no. 4, April 1926, pp. 221-226, 4 figs. In operation of Cottrell precipitator installations and similar apparatus where high potentials are used; electromagnetic radiation sometimes occurs which causes local interference with radio reception; investigation made by Western Precipitation Co. and research corporations develops successful correctors.

PULVERIZED COAL

Gyro Gasification Systems. Installations of a New Pulverized Fuel System, E. K. Scott. Combustion, vol. 14, no. 4, Apr. 1926, pp. 250-253, 3 figs. Firing equipment installed on Gyro gasification system at power stations of West Ham Corp. and Dover Corp.

Limitations and Comparisons. Some Limitations and Comparisons, E. W. L. Nicol. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926, pp. 57-61, 3 figs. Discusses whole question of advantages from an impartial standpoint, and explains systems at present in operation.

Power Generation for. Steam, Oil and Electric Power, E. A. Allcut. Can. Engr., vol. 50, no. 10, Mar. 9, 1926, pp. 54-56. Review of present practice and possible future developments in generation of power for pumping plants.

PUMPS, CENTRIFUGAL

Automatic Control. A Few New Minor Changes Improve Automatic Pumping Service, E. J. Gealy. Coal Age, vol. 29, no. 9, Mar. 4, 1926, pp. 323-324, 3 figs. Details of improvements which have simplified and perfected operation of original automatic features.

Recent Improvements in Automatic Centrifugal Pump Control Simplify Apparatus, R. S. Sage. Coal Age, vol. 29, no. 9, Mar. 4, 1926, pp. 321-322, 1 fig. Time-delay relay takes place of notching type; adjustments are made to suit pumping conditions; in case of trouble pump is locked out of service.

Impellers, Water-Presssure Distribution in. Experimental Research on the Distribution of Water Pressure in a Centrifugal Pump Impeller, S. Uchimaru. Faculty of Eng., Tokyo Imperial Univ.—Jl., vol. 16, no. 6, Sept. 1925, pp. 157-169, 65 figs. partly on supp. plates. Result of experiment to determine variation of water pressure at different points in impeller channel when rotating and delivering water.

R

RADIOTELEPHONY

Interference from Power Circuits. Radio Interference from Power Circuits, P. S. Donnell. Jl. Electricity, vol. 56, no. 6, Mar. 15, 1926, pp. 217-221. Acknowledged sources on interference are static; generative sets; defective connections in receiving sets; equipment and apparatus connected with utility circuits; operating either normally or in some cases defectively for operation of which company is not responsible; machinery, apparatus and circuits for which utilities are directly responsible.

Receiving. Oscillation Without Radiation, W. James. Wireless World, vol. 18, nos. 5 and 6, Feb. 3 and 10, 1926, pp. 154-161 and 231-234, 14 figs. Details of three valve-reflex receiver, first valve acting as high-frequency and low-frequency magnifier, second as reacting detector and third as straight low-frequency magnifier.

RADIATION

Direct. Heat Emission, Heating Effect and Heating Efficiency of Direct Radiation, K. Meier. Am. Soc. of Heat. and Vent. Engrs.—Jl., vol. 32, no. 3, Mar. 1926, pp. 159-163.

RAILWAY ELECTRIFICATION

Chicago. Chicago Terminal Electrification on the Illinois Central, C. J. Brumley. Eng. News-Rec., vol. 96, no. 8, Feb. 25, 1926, pp. 322-326, 3 figs. Terminal and lake front improvements; passenger stations and freight yard; overhead wire system; suburban-train equipment.

Gasoline-Electric. A 73-Foot Gas Electric Car for Boston and Maine. Ry. Elec. Engr., vol. 17, no. 4, Apr. 1926, pp. 109-110, 4 figs. Control circuits and 760-watt lighting load supplied by 215 ampere-hour battery and 2.5-kw. exciter.

Maintenance. Methods of Maintaining Motor Cars. Ry. Rev., vol. 78, no. 11, Mar. 13, 1926, pp. 514-519, 2 figs. Abstract. Report of subcommittee of Committee of Economics of Railway Labor, Am. Ry. Eng. Assn.

Mechanical Transmission. Smalley Rail Car Mechanically Driven Through Herringbone Gears, P. M. Heldt. Automotive Industries, vol. 54, no. 13, Apr. 1, 1926, pp. 566-567, 3 figs. Powered by 2 Climax 4-cylinder engines which develop 76 h.p. at 1,200 r.p.m.; gear changes effected with Campbell sliding-key arrangement; radiator fan driven by spur gears.

RAILWAY OPERATION

A.R.E.A. Report. Report of Committee XXI—Economies of Railway Operation. Am. Ry. Eng. Assn.—Bul., vol. 27, no. 284, Feb. 1926, pp. 733-757, 15 figs. Effect of speed of trains upon cost of transporting freight; method of increasing traffic capacity of railway; effect of installing automatic signals. See also (abstract) in Ry. Age, vol. 80; no. 14, Mar. 12, 1926, pp. 760-764.

Train Control. Train Control Devices Approved. Ry. Age, vol. 80, no. 17, Mar. 27, 1926, pp. 908-910. Interstate Commerce Commission approved 2-speed continuous-induction train-control system of Union Switch & Signal Co., as installed on Wyoming division of Union Pac. and also approved with certain exceptions automatic train-stop system of Nat. Safety Appliance Co. on Central Kansas Division of Missouri Pac.

Train Control Instruction and Inspection. Ry. Elec. Engr., vol. 17, no. 4, Apr. 1926, pp. 122-123, 4 figs. Tracks employed in maintenance program of Richmond, Fredericksburg and Potomac.

RAILWAYS

British. Notes on British Railways by a Continental Engineer. Engineer, vol. 141; nos. 3658, 3659, 3660, 3661, 3662, 3663, 3664 and 3665, Feb. 5, 12, 19, 26, Mar. 5, 12, 19 and 26, 1926, pp. 145-146, 178,179, 204, 205, 236, 238, 264-265, 288-289, 314 and 358-359. Résumé of author's observations and impartial comparison of British railways with those of other countries. Feb. 12: Permanent way, interlocking and signaling. Feb. 19: Terminals and stations; freight stations and running sheds. Feb. 26: Rolling stock, freight cars and trucks. Mar. 5: Locomotives. Mar. 12: Shunting and switching: locomotive running and management. Mar. 19: Electrification; passenger traffic. Mar. 26: Freight and traffic; conclusions.

RECLAMATION

Bombay. Bombay Reclamation Scheme. Times Trade & Eng. Supp., vol. 18, no. 398, Feb. 20, 1926, p. 562, 1 fig. Discusses scheme for reclamation of nearly 1,300 acres from sea at Bombay.

REFRIGERATING MACHINES

Domestic. Efficiency Test of Domestic Refrigerators. Ice & Refrigeration, vol. 70, no. 3, Mar. 1926, pp. 305-310, 12 figs. Results of series of tests conducted at laboratories of Armour Institute of Technology, Chicago, in which 10 refrigerators were used, all identical in shape, size and workmanship with exception of heat-insulating material used in walls.

REFRIGERATING PLANTS

Brine Handling in Coolers. Handling Brine in Coolers and Spray Systems, J. F. Staley. Power Plant Eng., vol. 30, no. 7, Apr. 1, 1926, pp. 440-442, 2 figs. Discusses operation of coolers for both salt and calcium brine, layout of brine spray system and design of brine evaporator.

RESEARCH

Engineering Application. Research and Its Application to Engineering, G. A. Hoadley. Engrs. & Eng., vol. 43, no. 2, Feb. 1926, pp. 45-48. Discusses some of fruit of research, including X-ray and atom; apparatus and training; research vs. industry.

RETAINING WALLS

Reinforced Concrete. Reinforced Concrete Retaining Walls in India. Engineer, vol. 141, no. 3666, Apr. 2, 1926, p. 390, 1 fig. (partly on p. 386). Novel type of retaining wall built at Ahmedabad in India in connection with approach roads to railway overbridge.

RIVERS

Control. River Control at the New St. Louis Water-Works, E. E. Wall. Eng. News-Rec., vol. 96, no. 14, Apr. 8, 1926, pp. 570-572, 5 figs. Expensive works essential to hold river channel to course in front of plant; brush mattresses and pile dikes effect predicted changes and add 300 acres of new land.

Interstate Problems. Interstate Water Problems and Their Solution, M. C. Hinderlider and R. I. Meeker. Am. Soc. Civic Engrs.—Proc., vol. 52, no. 4, Apr. 1926, pp. 597-613. Deals with interstate river problems of Western United States Bibliography.

STEAM REGULATION. Steam Regulation with Reference to Irrigation and Power, J. C. Stevens. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 4, Apr. 1926, pp. 614-626, 10 figs. Inquiry in general terms into varied conditions where power and irrigation uses are of importance and to ascertain possibility of aiding in providing against conflict of interests where new developments are in prospect.

ROAD, CONCRETE

REPAIR METHODS. Repair Methods for Concrete Roads, A. H. Hinkle. Mun. & County Eng., vol. 70, no. 2, Feb. 1926, pp. 109-116, 1 fig. Gives classification of defects found in concrete roads and describes various methods of repairing these defects. Paper read before Miss. Valley Highway Depts.

ROADS

MANAGEMENT AND CLASSIFICATION. Road Management and Classification, J. M. McVicar. Can. Engr., vol. 50, no. 11, Mar. 16, 1926, pp. 399-401. Roads classified according to economic needs of country and traffic; fundamentals of management of township roads; status of superintendent. Paper presented at Ontario Good Roads Assn.

ROADS, BITUMINOUS

DEVELOPMENTS. Recent Developments in Bituminous Paving Practice, H. M. Rex. Good Roads, vol. 69, no. 3, Mar. 1926, pp. 101-103 and 108, 4 figs. Tendency toward leaner mixtures; improved construction methods; asphalt sand pavements; resurfacing old macadam; veneer types; bituminous earth roads.

ROADS, CONCRETE

CONSTRUCTION. Concrete in Modern Road Construction, H. V. Overfield. Surveyor (Lond.), vol. 69, no. 1780, Feb. 26, 1926, pp. 257-260, 6 figs. Factors of importance in making concrete; volume of mixing water; mixing and placing concrete; treatment after placing; design of road slabs; compression tests. Paper presented at meeting of Instn. of Mun. & County Engrs.

CURING AND HARDENING. Curing and Hardening Concrete Roads with Silicate of Soda, R. F. Remler. Good Roads, vol. 69, no. 3, Mar. 1926, pp. 106-108, 3 figs. Method of curing; advantages of chemical curing; effects of silicate of soda on concrete; methods of hardening and dust proofing; tests on surface hardness.

S

SCREW MACHINES

END-KNURLING TOOLS FOR. End-Knurling Tool for Screw Machine, H. Simon. Machy. (N.Y.), vol. 32, no. 8, Apr. 1926, 609-612, 5 figs. Problems involved in designing tool equipment; making knurls; developing knurl-roll holder; preparing work for knurling.

SCREW THREADS

TANGENTIAL CUTTING. Thread Cutting by Means of Tangential Detachment of Chips With Rotating Self-Opening Screwing Chucks (Das Schneiden von Gewinden durch tangentiale Spanabhebung mettels umlaufenden, selbstöffnenden Schneidkopfes), R. Meininger, Maschinenbau, vol. 5, no. 4, Feb. 18, 1926, pp. 167-170, 15 figs.

SEAPLANES

LARGE. Recent Experiments with Large Seaplanes, A. Rohrbach. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 353, Mar. 1926, 33 pp., 15 figs. on supp. plate.

SEWAGE DISPOSAL

ACTIVATED SLUDGE. The Activated Sludge Process of Sewage Treatment, H. T. Calvert. Engineer, vol. 141, no. 3662, Mar. 5, 1926, pp. 267-268. Action of oxygen; variations of method; manurial value of activated sludge; question of cost. (Abstract.) Lecture before Instn. Civ. Engrs.

ACTIVATED SLUDGE. The Activated Sludge Process of Sewage Treatment, H. T. Calvert. Surveyor (Lond.), vol. 69, no. 1781, Mar. 5, 1926, pp. 279-280. Varying nature of sewage; final settling tanks; cost of process; Birmingham (Eng.) experiments; differences in activated sludge; manurial value; dewatering problem; (Abstract) Chadwick Public Lecture.

DEOXYGENATION. Effect of Temperature on Rate of Deoxygenation of Diluted Sewage, R. E. Greenfield and A. L. Elder. Indus. & Eng. Chem., vol. 18, no. 3, Mar. 1926, pp. 291-294, 5 figs. Experiments on rate of deoxygenation of sewage diluted with aerated distilled water and incubated at from 2 deg. to 6 deg. cent.

TANK GASES. Some Observations on Sewage Tank Gases, A. M. Buswell and S. I. Stickhouser. Indus. & Eng. Chem., vol. 18, no. 4, Apr. 1926, pp. 407-409. Gases from foaming Imhoff tanks contain more CO_2, less nitrogen and substantially same amount of methane as compared with gases from non-foaming tanks; amount and heating value of gas available from Imhoff tanks is sufficient to warrant its collection and use for fuel purposes.

SILOS

REINFORCED-CONCRETE. Reinforced Concrete Grain Silos at Alexandra Docks, Liverpool. Concrete & Constr. Eng., vol. 21, no. 3, Mar. 1926, pp. 240-246, 3 figs. Large grain silo with capacity of 12,000 quarters.

SHAFTS

VIBRATIONS. Graphical Method of Determining Torsional Vibrations in Shafts (Zeichnerisches Verfahren zur Bestimmung der Torsions-Eigenschwingungszahlen von Wellen), P. Kohn. Maschinenbau, vol. 5, no. 5, Mar. 4, 1926, pp. 220-221, 3 figs. Method for determining torsional period of vibrations which is comparatively simple.

SOUND

RECORDING AND REPRODUCING. Methods of High Quality Recording, J. P. Maxfield and H. C. Harrison. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 243-253, 13 figs. Analysis of general requirements of recording and reproducing sound with nature of inherent limitations where mechanical records are used; details of solution involving use of electrical equipment for purposes of recording and use of mechanical equipment based on electric transmission methods for reproducing; application of electric transmission theory to mechanical transmission system.

STANDARDIZATION

GERMANY. German Standardization Work (Die deutschen Normungsarbeiten), F. Neuhaus. Technik u. Wirtschaft, vol. 19, no. 1, Jan. 1926, pp. 31-34, 4 figs. Development of German Industrial Standards Committee (N.D.I.) and its work of standardizing and reduction of types; difficulties in adoption of standards; specialization by firms in standard articles, etc.

VARIETY THROUGH. Variety Through Standardization, C. E. Skinner. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 327-329. Nature's use of standards; electrical industry as illustration of value of standardization; work already done in industrial standardization; work of Am. Eng. Standards Committee in national and international standardization; scope of and necessary limitations.

STEAM

HIGH-PRESSURE. High-Pressure Steam in Industrial Plants, A. F. Sheehan. Power, vol. 63, no. 16, Apr. 20, 1926, p. 606. Advantages when process steam is needed; higher installation costs.

STEAM ENGINES

CORLISS. Largest Corliss Engine in Twenty Years. Power, vol. 63, no. 12, Mar. 23, 1926, pp. 441-442, 4 figs. Twin tandem engine capable of developing maximum of 15,000 h.p. at 200-lb. steam pressure is being installed for rope drive at one of large steel mills.

HIGH-PRESSURE. A High-Pressure Quadruple-Expansion Engine. Shipbldg. & Shipg. Rec., vol. 27, no. 11, Mar. 18, 1926, pp. 328 and 335. Details of new set of engines and boilers, intended for propulsion of 11-knot cargo steamer, built by Central Marine Engine Wks.

STEAM POWER PLANTS

COMBINED HEATING AND GENERATING. Combination Power and Heating Plants in North Bohemia, J. H. D. Blanke. Nat. Engr., vol. 30, no. 3, Mar. 1926, pp. 97-101, 4 figs.

COST ANALYSIS. Power Plant Costing, C. H. S. Tupholme. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926 pp. 48-51, 3 figs. How various costs incurred in factory power house should be allocated in works account system.

Production Cost in Private Plant Operation, E. Winholt. Nat. Engr., vol. 30, no. 3, Mar. 1926, pp. 95-96. Practical illustration of cost analysis and factors chargeable to cost of service.

DESIGN. Designing a 500-Horsepower Steam Power Plant, C. L. Hubbard. Southern Power Jl., vol. 44, no. 3, Mar. 1926, pp. 50-55, 8 figs.

OPERATION. The Economical Operation of the Power Plant, W. D. Wylde. Indus. Mgmt. (Lond.), (Cassier's Works Power No.), vol. 13, no. 2, Feb. 1926. pp. 39-48, 15 figs.

PIPING. Industrial Power Plant Piping, T. Maynz. Chem. and Met. Eng., vol. 33, no. 4, Apr. 1926, pp. 229-230. Design and upkeep of pipe lines for water, steam and air with reference to expansion, heat losses and other important factors.

WESTERN ELECTRIC CO., KEARNY, N.J. Western Electric Co.'s Power Plant at New Kearny Works. Power, vol. 14, Apr. 6, 1926, pp. 514-518, 8 figs.

STEAM TURBINES

BLEEDING. Bled Steam Heating, D. T. McHutchison. Mech. World, vol. 79, no. 2044, Mar. 5, 1926, pp. 187-188, 2 figs. Economy resulting from practice is due to fact that steam used for heating has already done considerable amount of useful work in main turbine; this is obviously more efficient than using high-pressure steam, and also more economical than putting in steam-driven auxiliaries in order to obtain supply of exhaust steam for purpose.

DEVELOPMENTS. Modern Development of Steam Turbine Design, E. A. Kraft. Eng. Progress, vol. 7, no. 3, Mar. 1926, pp. 61-63, 5 figs. Examples of recent types.

EXHAUST PRESSURE. Turbine Exhaust Pressure Measurement, W. A. Carter. Power, vol. 63, no. 13, Mar. 30, 1926, p. 488, 3 figs. Results of tests indicate that A.S.M.E. test-code method for measuring exhaust pressure is preferable to either British tip or squarewire gauze tip.

EXTRACTION. Extracted Steam Solves Power Problem. Power, vol. 63, no. 13, Mar. 30, 1926, pp. 474-477, 8 figs. Proximity Mfg. Co., denim cloth manufacturer, makes remarkable power cost reduction by installing extraction turbine and high-pressure boilers; steam at 15 lb. bled to supply dye house; boilers operate at 200 lb. and with 100-deg. superheat.

VAN DEN BOSSCHE. The Van Den Bossche Turbine (La Turbine van den Bossche), J. van den Bossche. Chaleur et Industrie, vol. 7, no. 70, Feb. 1926, pp. 77-79, 4 figs.

STEEL

AIR COOLING. Observations on Temperature Distribution in Steel Bodies Cooled in Air, F. J. Janitzky. Am. Soc. Steel Treating—Trans., vol. 9, no. 3, Mar. 1926, pp. 452-457, 2 figs.

BOILER-FURNACE. Furnace Steels. Eng. & Boiler House Rev., vol. 39, no. 9, Mar. 1926, pp. 430-433, 434, 437 and 438, 3 figs. Results of recent research work carried out by Hadfields, Ltd., Sheffield, England.

CHROMIUM. *See Chromium Steel.*

FAILURES. Facts and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. Steel Treating—Trans., vol. 9, no. 4, Apr. 1926, pp. 615-636, 7 figs.

MARTENSITIC STRUCTURE. On Martensite, H. Hanemann and A. Schrader. Am. Soc. Steel Treating—Trans., vol 9, no. 2, Feb. 1926, pp. 169-233 and (discussion) 233-239 and 364, 72 figs.

PEARLITE INTERVAL. The Effect of Manganese, Silicon and Phosphorus on the Pearlite Interval, B. Kjerrman. Am. Soc. Steel Treating—Trans., vol. 9, no. 3, Mar. 1926, pp. 430-451, 15 figs.

SHEET. Sheet Steel—Specification and Inspection, L. N. Brown. Forging—Stamping—Heat Treating, vol. 12, no. 3, Mar. 1926, pp. 84-90. Improved methods of testing; inspecting "seconds;" finishes for automotive sheets; testing for drawing qualities; ductility tests; gage and size tolerances.

SPECIAL. Some Special Steels. Engineer, vol. 141, no. 3667, Apr. 9, 1926, pp. 407-408, 5 figs. Describes various applications of several new steels which are made at Hecla Works of Hadfields, Ltd.

TOOL. *See Tool Steel.*

STEEL, HEAT TREATMENT OF

AUTOMOBILE PARTS. Reducing Costs in Heat Treating Automobile Parts. Am. Soc. Steel Treating—Trans., vol. 9, no. 3, Mar. 1926, pp. 471-481, 7 figs.

DILATOMETRIC METHOD. Dilatometric Method of Heat Treatment, O. E. Harder and A. C. Forsyth. Am. Soc. Steel Treating—Trans., vol. 9, no. 3, Mar. 1926, pp. 403-412 and (discussion) 412-419 and 520-521, 11 figs. Report of progress in use of dilatometric method of heat treatment and application of that method to study dimensional changes in such materials as gray cast iron; two slightly different pieces of apparatus were used; details of construction and results obtained.

QUENCHING. Initial Temperature and Maas Effects in Quenching, H. J. French and O. Z. Klopsch. Am. Soc. Steel Treating—Trans., vol. 9, no. 1, Jan. 1926, pp. 33-68 and (discussion) 68-74, 12 figs. Results of quenching experiments with high-carbon steels in which speed of cooling was determined at center of spheres, rounds and plates of various dimensions quenched from various temperatures into different coolants. Published by permission of U.S. Bur. of Standards.

STREAM POLLUTION

ACID-MINE DRAINAGE BY. Stream Pollution by Acid Mine Drainage, R. D. Leitch. U.S. Bur. of Mines—Report of Investigations, no. 2725, Jan. 1926, 7 pp. Extent and sources of pollution; present methods of disposal of acid water; cost of purification; concludes that for mine drainage wastes, only solution is neutralization by some means.

STRUCTURAL STEEL

MEMBERS. Utilizable Capacity of Steel Members of Structures. Am. Soc. Civil Engrs.—Proc., vol. 52, no. 2, Feb. 1926, pp. 337-350, 3 figs. Discussion of paper by H. S. Prichard, published in Nov. 1925 Proceedings.

STRUCTURES

VIRTUAL WORK. Virtual Work: A Restatement, H. Cross. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 1, Jan. 1926, pp. 197-205, 4 figs. Restates principle of virtual work, emphasizes that reactions to imaginary external resistance are themselves purely imaginary and in no way necessarily related to supports of structure; illustrates very broad application of principle.

SUBSTATIONS

OUTDOOR. Economies Effected by Standardizing Outdoor Substations. Elec. World, vol. 87, no. 16, April 17, 1926, pp. 803-805, 2 figs. Describes two types of substations employed; class A for 33,000-volt with transformers mounted on ground; class B for trasnformers mounted on elevated platforms in sizes up to three 100-kw. units.

MAINTENANCE RECORDS. Substation Maintenance Records, E. H. Coxe, Jr. Elec. World, vol. 87, no. 14, Apr. 3, 1926, pp. 711-712, 1 fig. Instantly available information on conditions of economical maintenance and operation, together with continuous inventory, of all classes of substation equipment.

T

TELEPHONY

LOADING FOR CIRCUITS. Development and Application of Loading for Telephone Circuits, T. Shaw and W. Fondiller. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 253-263, 18 figs. Review of art of loading telephone circuits as practised in United States; theory of coil loading; describes various improvements of outstanding importance which have been made in loading coils and loading systems during past 15 years to meet new or changing requirements in rapidly advancing communication art, namely: phantom group loading, loading for repeated circuits, incidental cables in open-wire lines, cross-talk, telegraphy over loaded telephone circuits, loading for exchange area cables and submarine cables.

POWER-LINE. Largest System of Power-Line Telephony, C. A. Boddie. Elec. World, vol. 87, no. 11, Mar. 13, 1926, pp. 557-560, 3 figs. Largest and most elaborate system of high-frequency telephony operating over power lines is employed by Central Indiana Power Co.; cause of line noises and remedy.

TELEVISION

RADIO. Broadcasting Photographs. Wireless World, vol. 18, no. 12, Mar. 24, 1926, pp. 437-441, 8 figs. System developed by T. Baker, consists of re-photographing of picture on to piece of copper foil so that copper surface is left clean for those parts of picture representing shadow, whereas high lights are marked by deposit of non-conducting film.

TERMINALS, RAILWAY

DESIGN. Principles of Engine Terminal Design. Ry. Rev., vol. 78, no. 11, Mar. 13, 1926, pp. 521-524, 1 fig. Report of subcommittee of Committee on Shops and Locomotive Terminals, Am. Ry. Eng. Assn.

FREIGHT. Unification of Railway Freight Terminals, E. E. R. Tratman. Eng. News-Rec., vol. 96, no. 9, Mar. 4, 1926, pp. 354-356. Comparisons of multiple-unit system with series of independent parts; examples of experience; interchange service; railway and public interests involved.

TESTING MACHINES

DYNAMOMETER ATTACHMENTS. Dynamometers and Spring Manometers as Power Recorders of Test-Machines (Ueber Messdose und Federmanometer bei Prüfmaschinen), F. Mohr. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 10, Mar. 6, 1926, pp. 317-322, 12 figs.

THERMODYNAMICS

JOULE-THOMSON EFFECT. The Joule-Thomson Effect in Air, J. R. Roebuck. Am Academy Arts & Sci.—Proc., vol. 60, no. 13, Dec. 1925, pp. 537-596, 15 figs. Data covering readily available temperatures above that of room; bath liquid above 300 deg. cent. is serious problem; available and useful pressure range. Bibliography.

THERMOMETERS

RESISTANCE. A Small Resistance Thermometer, G. F. Taylor. Phys. Rev., vol. 26, no. 6, Dec. 1925, pp. 841-850, 3 figs. Construction and performance of instrument developed for field observations in Department of Agriculture; main object sought was to produce resistance theremometer which would be comparable in size to thermocouple and thus combine advantages of both.

Resistance Thermometers (Etude sur les thermomètres à résistance), J. Vassillière-Arlhac. Revue Générale de l'Electricité, vol. 19, no. 9, Feb. 27, 1926, pp. 341-346, 11 figs.

TEST CODE. Test Code on Instruments and Apparatus. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 382-387, 16 figs. Preliminary draft of chapter 3, Temperature Measurement, part 2—Blass Thermometers; general description and classification; expanding fluid; form, glass, immersion; precautions.

TIME STUDY

METHODS. Time Study in Industrial Management, J. S. Gray. Machy. (N.Y.), vol. 32, no. 8, Apr. 1926, pp. 613-615. First step in introducing time studies; general methods in time-study work; using time study for intelligent rate setting; time included in and time required for time studies.

TIRES, RUBBER

PNEUMATIC. Manufacture of Rubber Tires (La fabrication des pneumatiques). Nature (Paris), no. 2704, Jan. 30, 1926, pp. 75-80, 15 figs. Processes and apparatus for manufacture as carried out at Dunlop works at Montluçon, including sheet rubber, coloring and vulcanizing; air tubes, assembling tires, etc.

TOOL STEEL

COMPOSITION AND PROPERTIES. Facts and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. Steel Treating—Trans., vol. 9, no. 1, Jan. 1926, pp. 111-132. Composition, properties and uses of common types of tool steels; explains classification of plain carbon tool steel according to grade and carbon content.

TEMPERING AND AGING. Dimensional Changes Accompanying the Phenomena of Tempering and Aging Tool Steels, H. Scott. Am. Soc. Steel Treating—Trans., vol. 9, no. 2, Feb. 1926, pp. 277-304, 6 figs. Shows that contraction with time is identified with initial contraction on tempering and expansion with expansion on tempering which follows initial contraction; this correlation, together with analysis of associated reactions, permits generalizations regarding control of time changes. Bibliography.

TUNGSTEN. On the Nature of Some Low Tungsten Tool Steels, M. A. Grossman and E. C. Bain. Am. Soc. Steel Treating—Trans., vol. 9, no. 2, Feb. 1926, pp. 259-270 and (discussion) 270-276, 6 figs. Deals with steels containing 3 per cent. tungsten and over 1 per cent. carbon; study of hardness, toughness, shrinkage and microscopic properties.

Tungsten Steels, A. H. Kingsbury. Am. Soc. Steel Treating—Trans., vol. 9, no. 4, Apr. 1926, pp. 597-603. Tungsten steels used for cutting tools; characteristics and application of different steels containing varying percentages of element tungsten; preheating, followed by rapid heating to quenching temperature is good practice.

TRACTORS

ROADLESS TRANSPORT. Roadless Traction, J. Eaglesome. Inst. Transport—Jl., vol. 7, no. 5, Mar. 1926, pp. 230-237 and (discussion) 238-245. Discusses new field open to British manufacture in production of vehicles suitable for primitive practice.

TRANSFORMERS

CALCULATION. Current Transformer Calculations, E. G. Reed. Elec. Jl., vol. 23, no. 2, Feb. 1926, pp. 67-71, 4 figs. Current ratio; secondary winding compensated to correct for ratio error; determination of characteristics of iron in magnetic circuit from ratio and phase-angle curves; burden expressed in terms of volt-amperes and of ohms.

CONSTANT-CURRENT. The Constant Current Transformer and Cooper-Hewitt Mercury Vapor Lamp, H. M. Johnson. Black Hills Engr., vol. 14, no. 1, Jan. 1926, pp. 33-36, 1 fig. Constant current transformer is further development in effort to secure more economic and efficient street lighting; makes possible use of series system of operation whereby one line of wire is used instead of two lines necessary with parallel system; Cooper-Hewitt lamp consists of two parts, glass tube from which light emanates and operating mechanism; most notable special application is in motion-picture industry.

EFFICIENCY CHARTS. Charts for Efficiency of Transformers, A. A. Boelsterli. Sibley Jl., vol. 40, no. 2, Feb. 1926, pp. 22-27, 2 figs. Presents alignment charts for determination of efficiency of transformers and examples of its use.

HIGH-VOLTAGE. Small High-Voltage Transformers, G. W. Lentz, Gen. Elec. Rev., vol. 29, no. 4, Apr. 1926, pp. 257-259, 7 figs. Development of small power distribution transformers suitable for operation on systems up to 110,000 volts.

OIL-FILLED. Experiments on Water Cooling of Oil-Filled Transformers, O. C. Waygood and J. L. Miller. World Power, vol. 5, no. 27, Mar. 1926, pp. 146-152, 9 figs. Experimental work in which heating tests were carried out by keeping watt loss constant at some predetermined value, until temperature rises became steady.

TUNNELLING

HYDROELECTRIC PROJECTS. Tunnelling in Connection with a Hydro-Electric Project. Instn. Min. & Met.—Bul., no. 257, Feb. 1926. pp. 13-26. (Discussion of paper by R. J. D. Richardson.)

MOFFAT TUNNEL, COLO. Soft Rock Operations in Moffat Tunnel, A. E. Anderson. Du Pont Mag., vol. 20, nos. 2-3, Feb.-Mar. 1926, pp. 11, 14-15, 23-24, 11 figs. Construction work at west end was advanced with difficulty until Lewis cantilever girder was designed, made and installed to cope with soft material in bench headings.

SLAKING ROCK, IN. Tunnel Driving and Shaft Sinking in Slaking Rock. Eng. News-Rec., vol. 96, no. 14, Apr. 8, 1926, pp. 573-576, 7 figs. Tunnelling for new Kansas City water works made difficult by sloughing rock and water-bearing gravel; four identical construction plants used.

TUNNELS

PIPE. Pipe Tunnel Under Gowanus Canal, Brooklyn, New York, L. S. Stiles. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 1, Jan. 1926, pp. 62-81, 13 figs. Building of tunnel to carry gas mains from manufacturing plant and connect them to distribution system.

VEHICULAR. The Hudson River Vehicular Tunnel. Contractors' & Engrs.' Monthly, vol. 12, no. 2, Feb. 1926, pp. 47-54, 7 figs. Site and methods of construction; location grades and alignment; ventilation; temporary and permanent clay blankets; materials encountered in tunneling; decompressions; inspection of material; equipment.

TURBO-ALTERNATORS

DESIGN PROBLEMS. Some Problems of the Turbo-Alternator, E. Gallizia. Instn. Elec. Engrs.—Jl., vol. 64, no. 351, Mar. 1926, pp. 372-389, 20 figs. Deals with problems that designer has to face which are seldom dealt with in treatises on design and for this reason have been dealt with in detail; ventilation and liquid cooling; balancing.

HIGH-SPEED. Recent Developments in High-Speed Turbo-Alternators, M. D. Ross. Power, vol. 63, no. 14, Apr. 6, 1926, pp. 519-520, 3 figs. 3600-r.p.m. 12,500-kva. turbine-driven a.c. generator; shows how ventilation problem is solved.

60,000-KVA. Three-Phase, 60,000-Kva. Turbo Alternators for Gennevilliers. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 3, Mar. 1926, pp. 284-290, 3 figs. Discussion of paper by E. Roth, published in Sept. 1925 issue of journal.

VENTILATION. Abridgement of Paper on Concluding Study of Ventilation of Turbo Alternators Multiple Path Radial System, C. J. Fechheimer and G. W. Penney. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 4, Apr. 1926, pp. 347-354, 8 figs. Results of investigation on stationary models; determination of losses.

V

VACUUM

HIGH, PRODUCTION AND MEASUREMENT. The Production and Measurement of High Vacua, G. W. C. Kaye. Engineering, vol. 121, no. 3141, Mar. 12, 1926, pp. 341-342, 17 figs. Reviews development of mercury-vapor diffusion pumps, introduced by Gaede in 1915, stating that they had displaced almost all other methods of producing high vacua; types of vacuum gages. (Abstract.) Third Cantor Lecture.

VENTILATION

STANDARDS. Objectives and Standards of Ventilation, C. E. A. Winslow. Am. Soc. Heat & Vent. Engrs.—Jl., vol. 32, no. 3, Mar. 1926, pp. 113-121 and (discussion) 121-151. Includes discussion on following subjects: Research has determined most desirable air conditions; analysis of ventilation; mechanical ventilation; theater ventilation; control of temperature and drafts; etc.

VIBRATIONS

INSTRUMENTS. The Use of Vibration Instruments on Electrical Machinery, J. Ormondroyd. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 4, Apr. 1926, pp. 330-336, 8 figs. Describes several mechanical vibration instruments and mentions actual problems which these instruments have helped to solve; theory of seismographic instruments is developed to show relation between record or indication and motion being measured.

MEASUREMENTS. Measuring Oscillations by the Vibrometer. Machy. (Lond.), vol. 27, no. 700, Feb. 25, 1926, pp. 715-716, 3 figs. Apparatus designed by C. Schenck of Darmstadt, Germany, in order to determine magnitude of vibrations of any object, either machine, motor, building, structure, railway car or bridge.

RECORDING APPARATUS. A Machine for Recording Movements (Een toeste tot het opteekenen van bewegingen), C. P. B. Van Kempen. Ingenieur, vol. 40, no. 49, Dec. 5, 1925, pp. 1033-1038, 18 figs. Design and application of Guegnon apparatus for studying laws of dynamics and nature and motion of vibrations; periodic, sinusoidal and other motion.

RODS AND SHAFTS. The Vibrations of Rods and Shafts with Tension or End-Thrust, R. C. J. Howland. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. of Sci., vol. 1, no. 3, Mar. 1926, pp. 674-694, 2 figs. Deals with problem of rod or shaft under actual force; uniform shaft without attached masses; shaft carrying concentrated masses.

Engineering Index

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A

ABRASIVE WHEELS

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First-Aid Instruction. The Importance of First-Aid Instruction in Works, E. N. Simons. Mech. World, vol. 79, no. 2048, Apr. 2, 1926, pp. 263-264.

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Pollution. Air Pollution in English Towns and Cities, J. B. C. Kershaw. Engineer, vol. 141, no. 3668, Apr. 16, 1926, pp. 433-434.

AIR COMPRESSORS

Hele Shaw-Beacham. A New Form of Air-Compressor, H. S. Hele-Shaw and T. E. Beacham, Instn. Min. Engrs.—Trans., vol. 70, Apr. 1926, pp. 403-419 and (discussion) 419-431, 19 figs. Compressor which has been delivered to British Admiralty is of rotary type, main structural feature having been employed for several years in pump known as Hele Shaw, essential feature is saturation of incoming air with oil, this oil operating to lubricate both central valves and pistons; two features which are believed to be new are low temperature of delivery of compressed air owing to oil-saturation effect, and high volumetric efficiency at all pressures, due partly to small clearance and to oil filling clearance spaces.

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Humidifying. Air Humidification (Das letzte Wort zur Frage der Luftbefeuchtung), Bürgers and I. Fleischer. Gesundheits-Ingenieur, vol. 49, no. 13, Mar. 27, 1926, pp. 196-200. Discusses hygienic importance of humidification of air; gives results of tests showing that evaporation of water does not materially increase humidity.

Humidification of Air (Ueber Luftbefeuchtung), S. Muntner. Gesundheits-Ingenieur, vol. 49, nos. 13 and 14, Mar. 27 and Apr. 3, 1926, pp. 194-195 and 209-217, 20 figs. Production of humidity in presence of highly hygroscopic material, as in textile and tobacco works; tests carried out with Salinator apparatus and its advantages.

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Albatros. The Albatros L 72A. Flight, vol. 18, no. 15, Apr. 15, 1926, pp. 228-231, 5 figs.

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Wind Tunnels. *See Wind Tunnels.*

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CONTINUOUS CONCRETE. Analysis of Continuous Concrete Arch Systems, C. S. Whitney. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 5, May 1926, pp. 836-878, 22 figs. Presents simple method for analyzing system composed of 2 arch spans with elastic pier; in addition, easily applied approximate method is given for analysis of system of any number of spans which is believed to be accurate enough for majority of cases occurring in practice.

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CRANKCASE-OIL DILUTION. Lubrication Data from Co-operative Fuel Research, S. W. Sparrow and J. O. Eisinger. Indus. & Eng. Chem., vol. 18, no. 5, May 1926, pp. 482-485, 4 figs.

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AIR-MAIL SERVICE. Operation of the Air Mail and Its Possible Application to Commercial Operations, J. E. Whitbeck. Mech. Eng., vol. 48, no. 5, May 1926, pp. 465-467.

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RECORDING, AMPLIMETER FOR. New Type of Recording Amplimeter Is Used on Precision Balancing Machine. Automotive Industries, vol. 54, no. 15, Apr. 15, 1926, p. 649, 2 figs.

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Equipment. A Western Brass Foundry. West. Machy. World, vol. 17, no. 4, Apr. 1926, pp. 163-164, 3 figs.

BRICKMAKING

Electric Hacking Machines. Hacking Brick by Electricity, W. L. Wright. Brick & Clay Rec., vol. 68, no. 8, Apr. 13, 1926, pp. 624-625 and 628-630, 9 figs.

BRIDGE ERECTION

Girder Span. Railroad Bridge Forces Erect Heavy Girder Span. Ry. Eng. & Maintenance, vol. 22, no. 5, May 1926, pp. 177-180, 7 figs. One of longest, if not actually very longest, girder span ever provided with concrete ballast deck was erected by Elgin, Joliet & Eastern in bridge across Desplaines River at Joliet, Ill.

BRIDGES

Reinforcing. Bridge Reinforcing Under Difficulties, H. S. Loeffler. Ry. Rev., vol. 78, no. 18, May 1, 1926, pp. 779-782, 6 figs. Long span of steel bridge over Columbia River, Washington, on Great Northern Railway, has been strengthened by addition of second span, trusses of which are identical in design with original trusses, except for few necessary changes in end panels; timber falsework was used to erect anchor spans; how deck span was reinforced.

BRIDGES, CONCRETE

Rigid-Frame Construction. Rigid Frames in Concrete Bridge Construction. A. G. Hayden. Eng. News-Rec., vol. 96, no. 17, Apr. 29, 1926, pp. 686-689, 11 figs. Frame type of bridge is economical, has great ultimate load capacity, and is freely adaptable to architectural demands; examples of its use in parkway bridges.

BRIDGES, HIGHWAY

Concrete. The Fort Snelling-Mendota Bridge Project, W. H. Wheeler. Minn. Federation Architectural & Eng. Soc.—Bul., vol. 11, no. 4, Apr. 1926, pp. 11-19, 7 figs.

Floor Slabs. Effective Width of Concrete Bridge Slabs Supporting Concentrated Loads, E. F. Kelley. Pub. Roads, vol. 7, no. 1, Mar. 1926, pp. 7-17 and 24, 17 figs.

Hudson River. The New Proposed Hudson River Bridge. Am. City, vol. 34, no. 4, Apr. 1926, pp. 365-366, 2 figs.

Steel. Oregon Steel Arch Bridge Erected by Cableway, C. B. McCullough. Eng. News-Rec., vol. 96, no. 19, May 13, 1926, pp. 760-762, 5 figs.

BRIDGES, RAILWAY

Plate-Girder. Heavy Steelwork in Long Plate-Girder Bridge with Two Twin Lift Spans. Eng. News-Rec., vol. 96, no. 12, Mar. 25, 1926, pp. 474-479, I4 figs. More than 300 main girders required; 288 duplicate 54-ton girders; rocker expansion bearings; lift spans have double sheaves and rope equalization by auxiliary counterweights.

BRIDGES, SUSPENSION

Wire Cables for. Fabricating Steel in World's Largest Suspension Bridge, R. B. Williams. Iron Trade Rev., vol. 78, no. 19, May 13, 1926, pp. 1248-1249 and 1252, 4 figs. Manufacture of steel for new suspension bridge connecting Camden, N.J., and Philadelphia; wire cables have unit strength of 215,000 lbs. per sq. in. and weight of 6,800 tons, each cable is 3,540 ft. long and consists of 61 strands of 306 wires each; details of floor system.

BROACHING MACHINES

Hydrauliic. New Hydraulic Broaching Machine Provides Wide Range of Cutting Speeds. Automotive Industries, vol. 54, no. 16, Apr. 22. 1926, p. 694, 1 fig.

BUILDING CONSTRUCTION

Steel Trusses for. Steel Trusses Carry 22 Storeys in Chicago Hotel. Eng. News-Rec., vol. 96, no. 16, Apr. 22, 1926, pp. 638-641, 7 figs. Unsymmetrical truss with both pin and riveted connections designed to meet special conditions in building of Stevens Hotel; steel castings on truss pins carry columns.

Wall Removal. Alteration Involving a 26-Storey Self-Sustaining Wall, D. C. Coyle. Eng. News-Rec., vol. 96, no. 19, May 13, 1926, pp. 774-776, 2 figs. Three stories of wall removed and load above transferred to steel frame; deflection wedged into framework.

BUILDING MATERIALS

Canada. Structural Materials Produced in Canda. Contract Rec., vol. 40, no. 13, Mar. 31, 1926, pp. 303-305. Statistics covering 1925; production and consumption figures in detail.

BUSBARS

Protection. Bus Protection, P. M. Currier. Gen. Elec. Rev., vol. 29, no. 5, May 1926, pp. 305-310, 4 figs. Sectionalization of bus; primary and secondary failures; isolation of bus phases and equipment; armorclad arrangement; differential and fault-bus protection.

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CABLES, ELECTRIC

High-Tension. Some Recent Developments in High-Tension Cable Practice, G. B. Shanklin. Gen. Elec. Rev., vol. 29, no. 5, May 1926, pp. 311-314. Recent advance in voltage ratings; voids or gas pockets principal problem; new impregnators; liquid rather than solid; four methods in cable practice; 132-kv. cable new feasible.

Single-Cored Armoured. Single-Core Armoured Cables for Alternating Currents, W. Cramp. World Power, vol. 5, no. 26, Feb. 1926, pp. 63-69.

CABLEWAYS

Aerial Tramways. Warden Mine Installs Aerial Tramway to Dump Four Hundred Tons of Refuse Daily. Coal Age, vol. 29, no. 18, May 6, 1926, pp. 629-630, 4 figs. Rock and picking table rejects fall into steel bin and is loaded alternately into one of two 2-ton cars which carry it out on leg of triangular tramways system.

Funicular. Automatic Car Control for Funicular Railways. Brown Boveri Rev., vol. 13, no. 3, Mar. 1926, pp. 67-75, 8 figs.

Ore-Handling. Ore-Handling in Morocco by Mono-Cable Ropeway. Indus. Mgmt. (Lond.), vol. 13, no. 4, Apr. 1926, pp. 161-162, 3 figs.

Slackline. Slack Line Cableways in Finnish and Swedish Cement Plants. Cement Mill & Quarry, vol. 28, no. 6, Mar. 20, 1926, pp. 20 and 22, 3 figs. Details of 1-cu. yd. Sauerman slackline cableway, designed to excavate clay and gravel in Pargas and Finland; and 1½-cu. yd. slackline cableway in Sweden for excavating marl containing many huge boulders.

CAMS

Indexing Motion. The Cam Indexing Motion, B. Sassen. Am. Mach., vol. 64, no. 18, May 6, 1926, pp. 705-707, 6 figs.

CANALS

Chicago Drainage. The Chicago Drainage Canal, J. L. Busfield. Eng. Jl., vol. 9, no. 5, May 1926, pp. 237-257, 8 figs. Review of historical, technical, financial and international features; physical description of drainage canal, pumping stations, treatment plants and water supply system; plans for future works; present and future need for diversion; effect on navigation.

CARS

Dynamometer. Road Tests Influence Locomotive Design, H. A. Campbell. Ry. Rev., vol. 78, no. 17, Apr. 24, 1926, pp. 769-770. Points out that data obtained with dynamometer car are as valuable as those derived from testing plants; results of tests made by Pennsylvania R.R. and by Paris, Lyons and Mediterranean Ry.

CAST IRON

Electric Melting. Cast Iron from Electric Furnaces. Iron Age, vol. 117, no. 11, Mar. 18, 1926, p. 760. Duplexing with cupola in Germany; peculiar properties observed; pig iron unnecessary; high-grade castings from poor scrap. Based on paper delivered by Kerpeley at convention of German foundrymen in Berlin.

Engineering Practice. Cast-Iron and Modern Engineering Practice, J. G. Pearce. Instn. Mech. Engrs.—Proc., no. 6, 1925, pp. 1231-1241. Discusses relationship between engineering and foundry; output of gray iron; character of research on cast iron; co-operative research; standard specifications.

Fire-Resistant. A New Fire-Resistant Casting (Ein neuer feuerbeständiger Guss), E. Schüz. Feuerungstechnik, vol. 14, no. 11, Mar. 1, 1926, pp. 127-128, 5 figs.

Gray. Why Is Gray Iron Porous? H. M. Ramp. Foundry, vol. 54, no. 9, May 1, 1926, pp. 354-355.

Pearlitic. Some Further Notes on Pearlitic Cast Iron, J. E. Hurst. Foundry Trade Jl., vol. 33, nos. 494 and 506, Feb. 4 and Apr. 29, 1926, pp. 95-97 and 333-335, 4 figs. Feb. 4: Properties; Perlit Method; Perlit iron without heating molds; criticism of Diefenthaler's curves. Apr. 29: Concludes that attempt to relate chemical composition, thickness of casting and mold temperatures by series of straight-line curves, as outlined in patent specifications of Perlit process, results in serious anomalies and absurdities; influence of mold temperature on structure of cast iron and relation between mold temperature and composition; except for fact that somewhat lower silicon iron than normally used can be cast in hot mold, it is unlikely that hot mold confers any structure or distribution of structure throughout mass of casting which cannot be duplicated in cold mold.

The Lanz-Perlit Cast-Iron Process. Mar. Engr. & Motorship Bldr., vol. 49, no. 584, Apr. 1926, p. 134.

Testing. Testing Method for Cast Iron (Prüfverfahren von Gusseisen), P. Wolff. Stahl u. Eisen, vol. 46, no. 17, Apr. 29, 1926, pp. 560-564, 6 figs. Relation between tensile strength, compressive strength and hardness; different rapid testing methods; evaluation and comparison of test results.

Titanium, Effect On. Effect of Titanium on Cast Iron, E. Piwowarsky. Iron Age, vol. 117, no. 19, May 13, 1926, pp. 1340-1341, 2 figs. Action similar to silicon but more active; effect on mechanical properties. (Abstract.) Translated from Stahl u. Eisen, vol. 43, 1923, p. 1491.

CASTING

Machines. Pours Work in Casting Machine, W. W. McCarter. Foundry, vol. 54, no. 8, Apr. 15, 1926, pp. 317-319, 12 figs.

CASTINGS

Tolerances. Casting Tolerances, W. J. May. Mech. World, vol. 79, no. 2051, Apr. 23, 1926, p. 326. Points out that with castings made in metal molds there should always be fixed tolerances for excess shrinkage where there is any great variation in melting or rather pouring temperature, because although all grades of some particular metal may not melt and be fit for pouring at one particular heat, rate of expansion and contraction per degree of heat remains practically constant.

CEMENT

Nature and Properties. Cement: Its Real Nature and Properties, E. Godfrey. Can. Engr., vol. 50, no. 16, Apr. 20, 1926, pp. 495-497. Lessons to be learned from knowledge of colloidal character of finely-divided portion; guarding against shrinkage effects; effect of shrinkage upon stability of columns; preventing segregation of colloidal constituents.

Specifications. Cement Specifications Changed by Missouri Highway Commission, F. V. Reagel. Eng. News-Rec., vol. 96, no. 16, Apr. 22, 1926, p. 657, 3 figs.

CEMENT, PORTLAND

Lime-Silica Index. Lime-Silica Index as Measure of Cement Quality, T. Merriman. Eng. News-Rec., vol. 96, no. 16, Apr. 22, 1926, pp. 648-650, 1 fig. Proposal to grade Portland cements in terms of both strength and relative content of cementing constituents; specification for tensile strength and quality proposed.

Manufacture. The Manufacture of Portland Cement—Developments Since the War, P. Hansel. Pit & Quarry, vol. 12, no. 1, Apr. 1, 1926, pp. 75-84.

Mills. Virginia Portland Cement Corporation's New Plant, C. A. Breskin. Rock Products, vol. 29, no. 8, Apr. 17, 1926, pp. 49-63, 48 figs.

CENTRAL STATIONS

Diesel-Engined. Diesel Operated Municipal Plants, R. V. Cook. Power House, vol. 19, no. 7, Apr. 5, 1926, pp. 23-24, 1 fig. Author claims that Diesel engine is making possible success of municipal stations, effecting reduction in expense and saving in labour.

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Narragansett. Enlarged Narragansett Plant Embodies Unusual Engineering Features, H. Couch and R. L. Blanding. Power, vol. 63, no. 18, May 4, 1926, pp. 664-669, 5 figs.

Oil-Engined. Heavy-Oil Engine Installations—Choice of Site and Lay-Out of Plant, G. Porter. Diesel Engine Users' Assn.—Report of Discussion, no. 50, Feb. 19, 1926, 35 pp., 11 figs. Deals with application of heavy-oil engine to electric drive, especially in reference to power stations carrying on business of generating electrical energy for distribution in extensive area.

Operating Performance. Experiences with Modern Stations. Elec. World, vol. 87, no. 19, May 8, 1926, pp. 983-993, 8 figs. Operating performance of some modern plants and their experience with firing method, steam extraction, reheating and air preheating; detailed experiences with powdered fuel; stoker experiences; experience with main unit bleeding.

Philadelphia. Philadelphia Electric Company's Richmond Station. Power, vol. 63, no. 20, May 18, 1926, pp. 740-747, 8 figs.

Richmond Goes on the Line with 100,000 Kilowatts. Power Plant Eng., vol. 30, no. 10, May 15, 1926, pp. 564-573, 11 figs.

Rocky Mount, N.C. Rocky Mount, N.C., Installs Modern Power Plant. Power, vol. 63, no. 15, Apr. 13, 1926, pp. 550-553, 7 figs. New municipal electric light plant at Rocky Mount, N.C., uses high-pressure steam in latest design of turbine; modern equipment employed throughout; total capacity of 7,500 kw. contemplated.

Somerset, Mass. The Somerset Power Station, J. F. Muir. Stone & Webster Jl., vol. 38, no. 4, Apr. 1926, pp. 461-491, 9 figs.

CHIMNEYS

Calculation. Standard Calculations for Chimneys (Berechnungsnormen für Schornsteine), Tonindustrie-Zeitung, vol. 50, no. 13, Feb. 13, 1926, pp. 203-205. Proposed standards for calculating stability of high, self-supporting chimneys, admissible stresses in brickwork and reinforced concrete, foundations, lining and fittings.

Guniting. Guniting Steel Cement Kiln Stacks, J. E. Lind. Can. Engr., vol. 50, no. 16, Apr. 20, 1926, pp. 491-493, 5 figs. Steel kiln stacks at St. Mary's Cement Co.'s plant, St. Mary's, Ont., made self-supporting by application of gunite which will also prolong their life indefinitely; results of tests undertaken in connection with work.

COAL

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Liquefaction. What is the Truth About the Bergius Process? Petroleum Times, vol. 15, no. 380, Apr. 17, 1926, p. 687. Critics of process maintain that, regarded from economic standpoint, process has no claim to be regarded as commercial one; review of reply by Dr. Bergius to criticisms contained in article in Génie Civil.

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Pulverized. *See Pulverized Coal.*

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Central Stations. Coal and Ash Handling at Warrior Reserve Plant, A. T. Hutchins. Elec. Light & Power, vol. 4, no. 5, May 1926, pp. 89-92, 4 figs. Details of coal washer installed to reduce ash content of coal; coal-storage and handling equipment; ash handling, sampling and analyses.

Towers. Coal Towers of Reinforced Concrete (Kohlentürme aus Eisenbeton), H. Butzer. Bauingenieur, vol. 7, no. 10, Mar. 5, 1926, pp. 195-204, 15 figs.

COAL MINES

Drainage Standards. Proposed Coal Mine Drainage Standards. Min. Congress Jl., vol. 12, no. 4, Apr. 1926, pp. 304-313, 5 figs. Pumps for development work; permanent pumping stations; standard practice in priming piston, plunger and centrifugal pumps; semi-remote control, safety precautions and attendants; natural drainage; unwatering abandoned workings.

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Ventilation. Modern Mine Must Have Ventilation System that Suits New Conditions, C. H. Trik. Coal Age, vol. 29, no. 17, Apr. 29, 1926, pp. 595-599, 7 figs. Considers effect of changes on ventilation of mines; dead ends best ventilated by blowers and canvas tubing; characteristic curves of multivane fan.
Winding Costs. Winding Costs, S. Burns. Instn. Min. Engrs.—Trans., vol. 71, Mar. 1926, pp. 141-165 and (discussion) 165-176, 6 figs.

COAL MINING

Conveyors. Installing and Moving Room Conveyors, N. D. Levin. Min. Congress Jl., vol. 12, no. 4, Apr. 1926, pp. 283 and 297-298, 5 figs.
Conveyors. Face Conveyors with Concentrated Mining System, F. S. Follansbee. Min. Congress Jl., vol. 12, no. 4, Apr. 1926, pp. 279-281 and 293-296, 2 figs.
Machine Loading. Mechanical Loading in Coal Mines, E. H. Johnson. Mech. Eng., vol. 48, no. 5, May 1926, pp. 456-458. Points out that choice of proper loader is problem for engineering analysis; mechanical loading means concentration of mine workings; delivery of tonnage from one-quarter to one-half of present developed area, rapid development and recovery in new properties, saving in timber, steel rails, mine ties, trolley wire and bonds; possibility for better supervision and greater safety for men and machinery.
Preparing Coal for Machine Loading, E. H. Johnson. Explosives Engr., vol. 4, no. 4, Apr. 1926, pp. 129-132, 6 figs.
Machine-Mining. Machine-Mining in Bord-and-Pillar Work, J. Brass and J. H. Hesketh. Instn. Min. Engrs.—Trans., vol. 71, Mar. 1926, pp. 88-97 and (discussion) 97-100, 6 figs. Describes how coal-cutting machines have been successfully introduced and are being operated in seam 4 ft. thick in conjunction with bord-and-pillar system.
Stripping. Preliminary Report on Coal Stripping Possibilities in Illinois, H. E. Culver. Ill. State Geol. Survey—Bul., no. 28, 1925, pp. 7-59, 22 figs.
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COAL STORAGE

Power Plants. Coal Storage for Power Plants, C. H. S. Tupholme. World Power, vol. 5, no. 26, Feb. 1926, pp. 90-92. It has been shown that mass of very small, uniform coal particles has no practical effect in retarding diffusion of oxygen through it, and proportion of voids in very fine coal when uniformly sized, is same as in lump coal; mixing different sized pieces in mass tends to reduce proportion of voids; building coal pile so as to reduce or prevent segregation of large and small pieces will lessen proportion of voids in pile, tend to keep down amount of oxygen entering pile by diffusion, and thus reduce oxidation from this source.

COAL WASHING

Flotations. The Application of the Chance Sand Flotation Process to Washing Bituminous Coal, A. Greenwell. Fuel, vol. 4, no. 4, Apr. 1926, pp. 163-166, 2 figs.

COMBUSTION

Temperature. Combustion Temperature and Its Graphic Determination (Die Verbrennungstemperatur und ihre graphische Ermittlung), W. Gunz. Feuerungstechnik, vol. 14, no. 10, Feb. 15, 1926, pp. 109-112, 8 figs.

COMPRESSED AIR

Explosions. Explosions in Compressed-Air Plants (Explosionen in Druckluftanlagen), F. Ritter. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 16, Apr. 17, 1926, pp. 543-544.

CONDENSERS, STEAM

Surface. Regarding Experimental Confirmation of Nusselt Theory on Heat Transmission in Surface Condensers (Intorno alla conferma sperimentale della teoria del Nusselt relativamente alla fase di transmissione vapore-parete nei condensatori a superficie), M. Medici. Industria, vol. 40, no. 3, Feb. 15, 1926, pp. 58-60, 6 figs. Concludes from experiments that values resulting from Nusselt equation are too low, and more so, the higher the velocity of steam.

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British Practice. A British View on Making Concrete, H. V. Overfield. Mun. & County En., vol. 70, no. 3, Mar. 1926, pp. 151-154.
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Water-Cement Ratio. Specifying Concrete by Water-Cement Ratio Alone. Eng. News-Rec., vol. 96, no. 17, Apr. 29, 1926, pp. 698-700, 4 figs. Job procedure in applying strength specification to construction of reinforced-concrete office building in Chicago.

CONCRETE CONSTRUCTION

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CONCRETING

Spillway-Channel Lining. Lining an Earth Spillway-Channel with Concrete, C. E. Blee. Eng. News-Rec., vol. 96, no. 19, May 13, 1926, pp. 777-778, 3 figs. Spillway-channel through clay for Alouette dam exceptionally carefully lined to prevent scour.

CONDUITS

Pressure. Calculating Loss in Pressure Conduits (Calcul de la perte de charge dans les galeries sous pression), J. Calame and D. Gaden. Bul. Technique de la Suisse Romande, vol. 52, no. 7, Mar. 27, 1926, pp. 74-80.
Stresses Due to Temperature in Lined Pressure Tunnels (Gallerie in pressione con rivestimenti tensioni per azioni termiche), U. Puppini. Energia Elettrica, vol. 3, no. 1, Jan. 1926, pp. 1-7. Continuation of previous mathematical study published in same journal (Sept. 1925), devoted to caculation of pressure tunnels when lining of cement, reinforced concrete or sheet iron has different coefficients of elasticity and expansion from those of rock.

CONNECTING RODS

Resistance to Flexure. Calculation of Resistance to Flexure of Connecting Rods for High-Speed Engines (Nota sul calcolo della resistenza alla flessione delle bielle dei motori Velocissimi), A. Capetti. Industria, vol. 11, no. 4, Feb. 28, 1926, pp. 88-90, 2 figs.

CONVERTERS

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CONVEYORS

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COPPER MINING

Methods. Mining Methods Being Used at Ray Mines, R. W. Thomas. Arizona Min. Jl., vol. 9, no. 22, Apr. 15, 1926, pp. 7-9 and 13-14, 5 figs.

CULVERTS

Concrete Pipe. Tentative Standard Specifications for Reinforced Concrete Culvert Pipe. Joint Concrete Culvert Pipe Committee—Report, Feb. 1926, 12 pp., 5 figs.

CORES

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CORROSION

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Protective Media. The Deterioration and Conservation of Materials (Stoffverfall und Stofferhaltung), H. L. Meurer. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 14, Apr. 3, 1926, pp. 461-467, 15 figs. Points out importance of conservation of engineering materials; disadvantages of paint as protection against corrosion; most important galvanizing processes used for rustproofing; physical and chemical adaptability; applications of metal-spray process.
Resisting Finishes. Some Corrosion Resisting Finishes. Foundry Trade Jl., vol. 33, no. 502, Apr. 1. 1926, p. 261.

CRANES

Shipbuilding. The Crane Equipment of Shipbuilding Berths, E. Smith. Shipbldg. & Shipg. Rec., vol. 27, no. 14, Apr. 8, 1926, pp. 407-412, 12 figs.

CULVERTS

Jacking Through Embankment. Culvert Pipe 105-ft. Long is Jacked Through 47-ft. Fill, E. J. Cullen. Ry. Eng. & Maintenance, vol. 22, no. 5, May 1926, pp. 192-194, 6 figs. Because of width of embankment it was necessary to push pipe in from both sides of embankment in culvert installation of Lehigh Valley.

CUPOLAS

Design. Cupola Design, E. A. Roper. Foundry Trade Jl., vol. 33, no. 503, Apr. 8, 1926, p. 272.

CUTTING METALS

Flame-Cutting Speeds. Flame-Cutting Speeds. Mech. World, vol. 79, no. 2051, Apr. 23, 1926, pp. 322-323, 7 figs. Details of Gewe automatic plate-cutting machine, which is motor-driven with adjustable speeds controlled by worm and friction drive and Gewe shaft-cutting appliance; and other cutting and profiling machines.

CYLINDERS

Heads, Machining. Ajax Cylinder-Head Production. Machy (N.Y.), vol. 32, no. 9, May 1926, pp. 707-709, 7 figs.
Cylinder Heads of the New Stutz "Eight," F. H. Colvin. Am. Mach., vol. 64, no. 17, Apr. 29, 1926, pp. 671-673, 7 figs.

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DAMS

Earth. Old Earth Dam on the Pequannock in Northern New Jersey, J. A. Holmes. Eng. News-Rec., vol. 96, no. 19, May 13, 1926, p. 765, 3 figs.
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DIE CASTING

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DIESEL ENGINES

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Diesel Lubrication, P. L. Scott. Indus. & Eng. Chem., vol. 18, no. 5, May 1926, pp. 477-480, 4 figs.

M.A.N. M.A.N. Double-Acting 2-Cycle Engine. Motorship (N.Y.), vol. 11, no. 5, May 1926, pp. 367-370, 6 figs.

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MULTIPLE-SPINDLE. Multiple Spindle Drilling Machines. Brit. Machine Tool Eng., vol. 3, no. 38, Mar.-Apr. 1926, pp. 384-390, 14 figs.

PISTON-PIN HOLES. Machines for Drilling Piston-Pin Holes Introduced in Three Sizes. Automotive Industries, vol. 54, no. 18, May 6, 1926, pp. 776-777, 3 figs.

SINGLE-HEAD. A New Machine for the Locomotive Wheel Shop. Brit. Machine Tool, Eng., vol. 3, no. 38, Mar.-Apr. 1926, pp. 379-381, 2 figs.

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STRUCTURE. An Atomic Picture of Duralumin and Its Crystal Structure, Rob. J. Anderson. Franklin Inst.—Jl., vol. 201, no. 4, Apr. 1926, pp. 465-483, 16 figs. Discusses constitution from atomic point of view with view to presenting true representation of nature of this alloy; summary of conclusions; X-ray data applying to elements in duralumin; effects of cold work and heat treatment on lines in diffraction patterns of duralumin; age-hardening phenomenon.

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AIR-BRAKE. The Heenan-Fell Air Brake Dynamometer. Engineering, vol. 121, no. 3147, Apr. 23, 1926, p. 546.

E

EARTHQUAKES

COAL MINING, EFFECTS ON. Earthquakes, Shocks and Tremors in Relation to Coal Mining, E. O. Sincock. Fuel, vol. 5, no. 4, Apr. 1926, pp. 157-163. Experience and direct observations indicate that earthquakes, shocks and tremors do not materially, if at all, conduce to increase of falls in mines.

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CIVIL ENGINEERING. A Study of Engineering Curricula, W. C. John. Eng. Education—Jl., vol. 16, no. 8, Apr. 1926, pp. 517-549, 3 figs. Deals with subjects of entrance requirements and requirements for graduation in civil engineering.

FRESHMAN COURSE. The Freshman Engineering Problems Course, B. B. Bessesen. Eng. Education—Jl., vol. 16, no. 8, Apr. 1926, pp. 564-572. Describes course which is outgrowth of study and training given to Student Army Training Corps during war, at Oregon Agricultural College.

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ELECTRIC DISTRIBUTION

PRACTICE. Electric Distribution Practice, D. K. Blake. Gen. Elec. Rev., vol. 29, no. 5, May 1926, pp. 330-335.

TRIPLE-PHASE. A Triple-Phase, Five-Wire Distribution System, A. A. Nims. Elec. World, vol. 87, no. 19, May 8, 1926, p. 1001, 1 fig. Suggested scheme for supplying one, two or three-phase services from same distribution system; possible adaptation to existing two-phase systems to secure three-phase advantages.

THREE-PHASE. Three-Phase Four-Wire Metering, G. D. Malcolm. Elec. Rev., vol. 98, no. 2524, Apr. 9, 1926, pp. 572-573, 1 fig.

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THREE-PHASE. Three-Phase Four-Wire Metering, G. D. Malcolm. Elec. Rev., vol. 98, no. 2524, Apr. 9, 1926, pp. 572-573, 1 fig.

ELECTRIC FURNACES

CARBONIZING AND HARDENING. Carbonizing and Hardening Steel. Iron Age, vol. 117, no. 11, Mar. 18, 1926, pp. 764-765, 2 figs. Continuous electric furnaces of pusher type for carbonizing automobile gears and pinions placed in operation by Hudson Motor Car Co., Detroit; represents important forward step in electric heat-treating furnace design as aid to mass production; built by Holcroft & Co., Detroit.

HIGH-FREQUENCY INDUCTION. High-Frequency Induction Furnaces (Der Hochfrequenz-Induktionsofen), F. Wever. Stahl u. Eisen, vol. 46, no. 16, Apr. 22, 1926, pp. 533-536, 6 figs. Describes high-frequency melting installation in Kaiser-Wilhelm-Institut für Eisenforschung; advantages as compared with low-frequency furnaces with annular hearth, from metallurgical and energy-saving standpoint.

ITALY. New Locomotives of the Milan-Varese-Porto Ceresio Line (Nuovi locomotori per la linea Milano-Varese-Porto Ceresio), Rivista Tecnica delle Ferrovie-Italiane, vol. 29, no. 1, Jan. 1, 1926, pp. 1-3, 1 fig.

SWITZERLAND. High-Speed Locomotives of Swiss Federal Railways (Les Locomotives à grande vitesse des chemins de fer féderaux suisses), F. Collin. Vie Technique & Industrielle, vol. 7, no. 76, Dec. 1925, pp. 160-163, and vol. 8, no. 76, Jan. 1926, pp. 235-238, 18 figs.

VIRGINIAN RAILWAY. Mechanical Designs of Virginian Electric Locomotive. Ry. Mech. Engr., vol. 100, no. 5, May 1926, pp. 272-274, 6 figs.

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AIR COOLERS. Application of Surface Air Coolers to Direct-Current Machines, F. S. Bennett. Power, vol. 63, no. 18, May 4, 1926, pp. 671-672, 2 figs. Problems involved in applying closed systems of ventilation to direct-current machines; compares costs of various ways of making installations.

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DINING CARS. First All-Electric Dining Car. Elec. Traction, vol. 22, no. 4, Apr. 1926, pp. 191-192, 3 figs. New diner completed by Interstate Public Service Co. is equipped with electric kitchen and other apparatus.

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AUTOMATIC EQUIPMENT. The Principles of Automatic Switching Equipment, C. Lichtenberg. Gen. Elec. Rev., vol. 29, no. 5, May 1926, pp. 347-355, 5 figs.

ELECTRIC TRANSMISSION LINES

CALCULATION. Simplified Transmission Line Calculations, E. Clarke. Gen. Elec. Rev., vol. 29, no. 5, May 1926, pp. 321-329, 6 figs. Calculations based on hyperbolic functions; operations simplified by charts; voltage and charging current at no load.

CONSTRUCTION. Overhead Line Construction, R. O. Waltham. Elec. Light & Power, vol. 3, no. 12, Dec. 1925, pp. 22-24, 80-82, and vol. 4, nos. 1, 2, 3, 4 and 5, Jan., Feb., Mar., Apr. and May 1926, pp. 27-29, 104, 106, 108 and 110; 31-33, 88, 90, 92, 94, 96, 98 and 100; 23-26 and 88; 182-186; and 26-28, 42 figs. Dec. 2, 1925: Location, stepping, gaining and framing of poles. Jan. 1926: Guying: where required, insulation of; clearances. Feb.: Conductors, climbing and working space, clearance from each other, and clearance from ground. Mar.: Locating apparatus, grounds, cutouts, switches, transformers. Apr.: Conflicts and joint usage of poles, conductor conflicts, line conflicts. May: Graded construction and strength requirements; necessity for and how applied.

ELECTRIC WELDING, ARC

AUTOGENOUS. Autogenous Welding by Means of A.C. Arc (La soudure autogène à l'arc électrique au moyen du courant alternatif), G. Burnand. Bul. Technique de la Suisse Romande, vol. 52, no. 2, Jan. 16, 1926, pp. 16-19, 9 figs. Compares oxyacetylene, d.c. and a.c. welding; types of transformers, tests of welds; gives cost data for comparison.

ELECTRODES, DEPOSIT EFFICIENCY OF. Deposit Efficiency of Electrodes, J. B. Green. Welding Engr., vol. 2, no. 4, Apr. 1926, pp. 21-24, 5 figs. Study of factors affecting percentage of electrode deposited in weld zone by metallic arc.

HYDROGEN. Atomic Hydrogen Arc Welding. Welding Engr., vol. 2, no. 4, Apr. 1926, pp. 31-32, 2 figs. Process developed in Schenectady Research Laboratory employs double tungsten electrode and jet of hydrogen gas.

Welding in an Atmosphere of Hydrogen. Forging—Stamping—Heat Treating, vol. 12, no. 4, Apr. 1926, pp. 136-139, 5 figs. Discusses two methods for producing ductile welds developed by research scientists of General Electric Co.

MILD STEEL. The Metallurgy of an Electric-Arc Weld in Mild Steel, A. G. Bissell. Am. Welding Soc.—Jl., vol. 5, no. 3, Mar. 1926, pp. 8-16, 10 figs. Discusses complicated metallurgical changes that occur in immediate vicinity of arc.

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AGRICULTURE. Electrical Power and Agriculture, C. Turnor. World Power, vol. 5, no. 26, Feb. 1926, pp. 70-71.

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CHROMIUM. Chromium Plating. Iron Age, vol. 117, no. 17, Apr. 29, 1926, pp. 1187-1189, 4 figs.

ELEVATORS

ELECTRIC DRIVE. Electric Drive of Elevators (La commande électrique des monte-charges et ascenseurs), A. Curchod. Revue Générale de l'Electricité, vol. 19, no. 12, Mar. 20, 1926, pp. 453-465, 12 figs.

STARTING AND STOPPING. Rates of Starting and Stopping Elevators and Their Effect on Service, H. B. Cook. Power, vol. 63, no. 19, May 11, 1926, pp. 715-718, 5 figs.

EMPLOYEES' REPRESENTATION

SYSTEM. Building Worker-Management Relations on Full Sharing of Facts, C. F. Dietz. Factory, vol. 36, no. 4, Apr. 1926, pp. 627-630, 4 figs.

EMPLOYMENT MANAGEMENT

PERSONNEL SELECTION. Problems in Personnel, E. Schlesinger. Indus. Mgmt. (N.Y.), vol. 71, no. 5, May 1926, pp. 295-297.

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Cost of Production. Possibilities of Reducing Cost of Energy. Elec. World, vol. 87, no. 17, Apr. 24, 1926, pp. 870-871. 12,000 B.t.u. per kw-hr. seen as immediate limit with present steam cycles, better with combination cycles; capital expenditures and coal-handling costs.

ENGINEERING

Character and Definition. The Character of Engineering (Wesen der Technik), A. Reidler. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 14, Apr. 3, 1926, pp. 457-460. Author gives various definitions of purpose of engineering, its fundamental function being to ensure necessities of human life; it is defined as art of creating values through technical means, art of winning and utilizing energy from natural forces, etc.; cultural value of engineering; its misuse.

ENGINEERS

Registration. Progress of Registration for Engineers, G. E. Taylor. Professional Engr., vol. 10, no. 4, Apr. 1926, pp. 7-8. Reasons for registration; points out that one of weak points in many of existing registration laws for professional engineers is method of enforcement of act; registration in West Virginia; registration by counties, technical societies and by individuals.

Training for Executive Positions. Qualifying Engineers for High Executive Positions, H. A. Guess. Min. & Met., vol. 7, no. 233, May 1926, pp. 213-214. Essentials for new education; points out that recent graduate usually takes job as junior engineer; hence schools should give thorough training in engineering essentials. Review of discussion at joint meeting of New York Sections of four National Societies.

ENTROPY

Absolute-Constant. Absolute-Constant of Entropy and Its Applications (La constante assoluta dell'entropia e le sue applicazioni), F. Rasetti. Nuovo Cimento, vol. 3, no. 1-2, Jan.-Feb. 1926, pp. 67-85.

Definition. A New Statistical Definition of Entropy (Eine neue statistische Definition der Entropie), M. Planck. Zeit. für Physik, vol. 35, no. 3, Dec. 23, 1925, pp. 155-169.

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EXECUTIVES

Relations of Chief to Associates. The Relations of the Chief Executive to His Principal Associate Executives, H. S. Person. Taylor Soc.—Bul., vol. 11, no. 2, Apr. 1926, pp. 47-51. Discusses fundamental and detailed aspects of relationship.

Training for Automobile Industry. The Training of Future Executives, J. Younger. Soc. Automotive Engrs.—Jl., vol. 18, no. 5, May 1926, pp. 479-481.

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FILTRATION PLANTS

Pneumatic-Alum Conveyor. Pneumatic Filter-Alum Conveyor for Minneapolis Water Filters, J. A. Jensen. Eng. News-Rec., vol. 96, no. 19, May 13, 1926, pp. 766-768, 2 figs. Bulk granulated alum moved from freight cars to storage bin and to service hoppers above dry-feed machines.

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Electric Ignition. The Electric Ignition of Firedamp, R. V. Wheeler. Colliery Guardian, vol. 131, no. 3406, Apr. 9, 1926, pp. 850-851, 2 figs.

FLOOD-CONTROL

Paris, France. Flood-Protection Plan Proposed for Paris District. Eng. News-Rec., vol. 96, no. 19, May 13, 1926, p. 773. Latest project would divert almost 1,000,000 cu. m. per hour from Marne at Neuilly to Seine at LaBriche. (Abstract.) Translated from Génie Civil.

FLOORS

Reinforced-Concrete. Design of Floors and Foundations. Concrete & Constr. Eng., vol. 21, no. 4, Apr. 1926, pp. 332-334, 3 figs. New system of reinforced-concrete by which saving of over $500,000 was effected in construction of new Leeds sewage disposal works; it is claimed system has very economical application in case of wide-span floors for factories, warehouses, hospitals and similar structures.

FLOW OF FLUIDS

Measurement. The Measurement of Fluid Flow, P. F. Foster. Mech. World, vol. 79, nos. 2035, 2039, 2043, 2046 and 2049, Jan. 1, 29, Feb. 26, Mar. 19 and Apr. 9, 1926, pp. 10-11, 86-87, 165-166, 227-228 and 282-283, 12 figs. Jan. 1: Measurement of rate of discharge for small flows by orifice method. Jan. 29: Employment of large uncalibrated orifice for flow measurement, etc. Feb. 26: Principle and development of Venturi meter. Mar. 19: Application of Bernoulli's theorem on flow of gas. Apr. 9: Methods of measuring air speeds.

FLOW OF WATER

Conduits. Flow of Water in 54-in. Concrete Conduit, Denver, Colo., F. C. Scobey. Eng. News-Rec., vol. 96, no. 17, Apr. 29, 1926, pp. 678-680, 3 figs.

Open Channels. The Measurement of Large Volumes of Water, F. J. Taylor. Commonwealth Engr., vol. 13, no. 7, Feb. 1, 1926, pp. 225-227, 6 figs.

FLUE-GAS ANALYSIS

CO_2 and CO Recorders. The Mono CO_2 Distant Indicator. Power Engr., vol. 21, no. 241, Apr. 1926, pp. 146-147, 2 figs.

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Intakes for. Intakes for High-Velocity Flumes, C. W. Harris and J. B. Hamilton. Univ. Wash.—Bul., no. 33, Sept. 1, 1925, pp. 5-27, 12 figs. Ideal shape of intake; design; apparatus and methods of conducting tests; selection of type of intake.

FLYWHEELS

Failures. Flywheel Failures. Universal Engr., vol. 43, no. 4, Apr. 1926, pp. 22-23, 1 fig. Discusses common causes of overspeeding or racing.

FORESTRY

Mine-Timber, Supply for. Many Coal Companies Plant Forests to Provide Timbers for Use in Their Mines, N. G. Alford. Coal Age, vol. 29, no. 15, Apr. 15, 1926, pp. 532-535, 7 figs. Protection from fire highly important; natural reseeding adequate with some species; fruit trees thrive on stripped ground; thinning of second growth means of assuring rapid renewal of old forests.

Research Developments. Recent Developments in Forest Products Research in Relation to Forestry, J. D. Rue. Jl. of Forestry, vol. 24, no 3, Mar. 1926, pp. 237-242. Review of outstanding developments which have resulted from investigation of processes of manufacture and application of forest products, considers them especially as they relate to management and reproduction of forests.

Silviculture, Canada. Silviculture in Canada, D. R. Cameron. Jl. Forestry, vol. 24, no. 4, Apr. 1926, pp. 332-346. By Silviculture is understood treatment of forests in such manner as to ensure continuous production of timber and other forest products for uses of trade and industry.

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Machine. Marked Progress in Machine Forging, C. D. Harmon. Forging—Stamping—Heat Treating, vol. 12, no. 4, Apr. 1926, pp. 122-126, 10 figs. Comparison of machine forging and drop forging; points out that quality of machine forgings has been improved to degree not generally appreciated.

FORGING MACHINES

Universal. Universal Forging Machine. Machy. (Lond.), vol. 28, no. 706, Apr. 8, 1926, pp. 37-39, 5 figs.

FORGINGS

Internal Defects. Internal Defects in Forgings, F. W. Rowe. Metal Industry (Lond.), vol. 28, no. 16, Apr. 16, 1926, p. 365, 2 figs. Case of internal defect in forging of 3½ per cent nickel chrome-steel which had been oil hardened and tempered to 55-65 tons after rough machining.

FOUNDATIONS

Roads and Bridges. The Necessity of Adequate Foundations for Roads and Bridges, W. J. Moore. Contract Rec., vol. 40, no. 13, Mar. 31, 1926, pp. 313-314, 1 fig. Discusses failures caused by neglect to observe engineering principles or by poor workmanship; counteracting water; inadequate piling.

Underpinning. Brick Wall Underpinned to Remove Proscenium Arch, A. H. Taylor, Eng. News-Rec., vol. 96, no. 17, Apr. 29, 1926, p. 681, 1 fig.

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Aluminum. Aluminum Foundry Practice, G. Mortimer. Foundry Trade Jl., vol. 33, nos. 503, 504, 505 and 506, Apr. 8, 15, 22 and 29, 1926, pp. 279-281, 293-295, 307-310 and 329-332, 16 figs. Apr. 8: Value of adding copper; disability of zinc; use of manganese; making alloys. Apr. 15: Melting practice and temperature control; plumbago crucibles; iron pots; reverberatory-type furnace; importance of pouring temperature; effect of occluded gases, total shrinkage and slow cooling. Apr. 22: Sand casting. Apr. 29: Fixing height of pouring; use of snap flasks; dressing; soldering; welding; plugging and doping; recovery of waste material.

Artificial Illumination. Artificial Illumination in Foundries. Iron & Steel Engr., vol. 3, no. 4, Apr. 1926, pp. 179-181, 2 figs.

Automobile Plants. Making Cadillac Car Castings. Foundry, vol. 54, no. 10, May 15, 1926, pp. 383-387, 10 figs.

Cost Accounting. Are You Making Wild Guesses or Estimates? A. E. Grover. Foundry, vol. 54, no. 8, Apr. 15, 1926, pp. 304-307 and 325.

Fluxes, Application of. Application of Fluxes, Etc., in the Foundry, W. J. May. Mech. World, vol. 79, no. 2048, Apr. 2, 1926, pp. 266-267.

Materials Handling. Lifting and Shifting Appliances in Foundries, H. H. Moore. Foundry Trade Jl., vol. 33, no. 502, Apr. 1, 1926, pp. 247-253 and (discussion) 253-254, 6 figs.

Research, Application of. Some Applications of Research to Modern Foundry Practice, J. E. Fletcher. Instn. Mech. Engrs.—Proc., no. 6, 1925, pp. 1243-1261 and (discussion) 1261-1273, 8 figs. Author seeks to illustrate example of method of attack used in applying results of research to current foundry practice; skin defects, shrinkage and contraction; trend of future developments in cast iron.

Scientific Control. Scientific Control in a Foundry, B. E. Williams. Rugby Eng. Soc.—Proc., vol. 19, session 1924-5, pp. 35-58, 23 figs.

FREIGHT HANDLING

Mechanical Equipment. Mechanizing Handling of Freight (Die Mechanisierung des Güterumschlags), D. Przygode. Glasers Annalen, vol. 98, nos. 6 and 7, Mar. 15 and Apr. 1, 1926, pp. 87-96 and 112-113, 8 figs.

FRICTION

Aspects. Some Aspects of Friction, W. A. Benton. Engineer, vol. 141, nos. 3667, 3668 and 3669, Apr. 9, 16 and 23, 1926, pp. 403-405, 430-431 and 458-459, 6 figs.

Fuels. *See Coal; Oil Fuel; Pulverized Coal.*

FURNACES, ANNEALING

Tunnel. Unusual Tunnel Annealing Furnace. Iron Age, vol. 117, no. 20, May 20, 1926, pp. 1410-1413, 7 figs.

FURNACES, HEATING

Regenerative. Siemens Regenerative Ingot-Heating Furnace with Blast-Furnace-Gas Firing (Siemens-Regenerative-Stossofen mit Hochfengas-Feuerung und Flammenteilung), A. Sprenger. Stahl u. Eisen, vol. 46, no. 11, Mar. 18, 1926, pp. 361-368, 8 figs. Describes furnace with new type of sliding rails and satisfactory results obtained under prolonged operation; important feature is erection of furnace at considerable distance from rolling mill in a special building; other features are waste-heat utilization, arrangement of sliding rails, etc.

G

GAUGES

Optical Instruments for. *See Optical Instruments.*

GARBAGE DISPOSAL

Trailer System. The Trailer System of Garbage Collection in Milwaukee, J. P. Schwada. Am. City, vol. 34, no. 4, Apr. 1926, pp. 367-372, 17 figs.

GARNET

Abrasive. Abrasive Garnet Production, W. M. Myers and C. O. Anderson. Abrasive Industry, vol. 7, nos, 3, 4 and 5, Mar., Apr. and May 1926, pp. 87 and 89, 112-113 and 153-154. Preliminary report on most important sources, methods by which it is recovered, and manner in which it is utilized. Apr.: Mining and cleaning; deposits in United States and Canada. May: Marketing methods; how garnet is utilized in various industries; future developments.

GAS PRODUCERS

Operation. Operation of Gas Producers, F. S. Bloom. Fuels & Furnaces, vol. 4, no. 4, Apr. 1926, pp. 451-452 and 458, 5 figs. Design and operation of jet blowers and turbo-blowers.

GAS TURBINES

Advantages and Limitations. Gas and Oil Turbines (Turbine à gaz et à pétrole), J. Deschamps. Technique Moderne, vol. 18, nos. 5 and 6, Mar. 1 and 15, 1926, pp. 152-153 and 182-183.

GEARS

Hob-Measuring Machines. Recent Developments at the National Physical Laboratory. Machy. (Lond.), vol. 28, no. 708, Apr. 22, 1926, pp. 111-113, 3 figs. Special machine for hobs; pantograph platform; micrometer for moving pantagraph; simplified design.

Instrument. Die and Assembling Fixture for Instrument Gears, H. M. Groff. Machy. (N.Y.), vol. 32, no. 9, May 1926, pp. 726-729, 6 figs.

Tooth Standardization. Standardization of Gear Teeth (Ueber die Normung der Zahnform), Bauersfeld. Maschinenbau, vol. 5, no. 6, Mar. 18, 1926, pp. 258-262, 3 figs.

GLUES

Polishing for. The Use and Treatment of Glue for Polishing, B. H. Divine. Automotive Mfr., vol. 67, no. 12, Mar. 1926, pp. 22-24.

GOLD DEPOSITS

Ontario and Quebec. Localization of Mineral Deposits of Northern Ontario and Quebec, G. W. Bain. Can. Min. Jl., vol. 47, no. 17, Apr. 23, 1926, pp. 440-443, 3 figs.

GOLD MINES

South African. A Visit to Gold Mines of South Africa, T. F. Sutherland. Can. Min. Jl., vol. 47, no. 15, Apr. 9, 1926, pp. 401-402.

GOVERNORS

Hydro-Electric Units. Governors for Automatic Hydro-Electric Units, J. F. Spease. Gen. Elec. Rev., vol. 29, no. 5, May 1926, pp. 356-359, 2 figs. Automatic operation requires governor accessories; starting solenoid; accelerating oil dashpot; gate-locking device; actions under various service conditions.

GRAPHITE

Lubrication Tests. The Role of Graphite in Lubrication, F. L. Koethen. Indus. & Eng. Chem., vol. 18, no. 5, May 1926, pp. 497-499, 5 figs.

GRINDING

Locomotive Parts. Grinding of Locomotive Parts, K. H. Lansing. Abrasive Industry, vol. 7, no. 5, May 1926, pp. 149-150, 4 figs.

GYPSUM

Manufacture. The Technology of the Manufacture of Gypsum Products. U. S. Bur. Standards—Circular, no. 281, Jan. 22, 1926, 81 pp., 39 figs. Describes mines, quarries and pits from which raw material is obtained, together with methods of working; types of calciners in use and approximate figures concerning efficiency of each; processes through which material passes, with machinery employed.

Production, 1924. Gypsum in 1924, K. W. Cottrell. U. S. Bur. of Mines—Mineral Resources, no. 11:19, Mar. 27, 1926, pp. 231-240.

H

HAMMERS

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NOMENCLATURE. Nomenclature Metallurgist (Supp. to Engineer, vol. 141, no. 2670), Apr. 30, 1926, pp. 50-51. Refers to movement which is taking place in connection with various metallurgical societies in America with regard to question of nomenclature and points out that in designation of alloys and their constituents, matters arise which are of international interest and importance, extending beyond range even of English words; it would seem to be function of some widely international body upon which English and American viewpoints could be adequately represented, as well as those of other nations.

METALLOGRAPHY

MICROSCOPIC EXAMINATION OF METALS. The Optical Examination of Metals, G. Sachs. Metal Industry (Lond.), vol. 28, no. 15, Apr. 9, 1926, pp. 341-343, 6 figs.

MILLING MACHINES

FIXTURES. Milling Machines Handle Wide Range of Product. Am. Mach., vol. 64, no. 17, Apr. 29, 1926, pp. 675-678, 10 figs.
POWER RAPID TRAVERSE. New Large Miller. Iron Age, vol. 117, no. 20, May 20, 1926, pp. 1431-1432, 2 figs.
UNIVERSAL. Universal Milling Machine with Two Overarms. Machy. (Lond.), vol. 28, no. 706, Apr. 8, 1926, p. 45, 1 fig.

MINERAL INDUSTRY

CANADA. Great Progress Made by Canada's Mineral Industry in 1925, S. J. Cook. Can. Min. Jl., vol. 47, no. 13, Mar. 26, 1926, pp. 301-307, 2 figs. Output valued at $224,846,237; building aluminum works; iron, coal, asbestos and gypsum industry; investment in mines; men employed in mining industry.

MINERALS

CANADA. The Influence of Minerals on Canadian History and Development, C. Camsell. Can. Inst. of Min. & Metallurgy—Bul., no. 168, Apr. 1926, pp. 456-465. World's progress in use of minerals; effect of minerals on Canadian history.

MINES

VENTILATION. Standardizing Mine Ventilation, R. D. Madison. Min. Congress Jl., vol. 12, no. 4, Apr. 1926, pp. 254-256 and 286, 3 figs.

MOLDING MACHINES

TURNOVER-TYPE. Turnover-Type Molding Machine with Jarring Device in Turnover Top Table (Wendeplattenformmaschine mit Arbeisttrüttler in der Wendeplatte), A. Schwarze. Zeit. für die gesamte Giessereipraxis, vol. 47, no. 13, Mar. 28, 1926, pp. 142-143, 3 figs. Machine for quantity molding of larger castings, which produces molds by jarring and lifts or lowers these from table by means of rapidly working device, thus avoiding damage to flask in lifting it from table.

MOLDING METHODS

CAR WHEELS. Mechanical Molding of Car Wheels, R. F. Ringle. Can. Foundryman, vol. 17, no. 5, May 1926, pp. 22-23, 5 figs.
MACHINE-PLATE. Machine-Plate Molding Practice, J. Dean. Foundry Trade Jl., vol. 33, no. 506, Apr. 29, 1926, p. 336, 2 figs.

MOLDS

CHILL ROLL. Making a Chill Roll Mould. Foundry Trade Jl., vol. 33, no. 503, Apr. 8, 1926, p. 268, 1 fig.
RAMMING. Modern Foundry Methods, F. A. McLean. Can. Foundryman, vol. 17, no. 4, Apr. 1926, p. 21.
Modern Methods of Ramming Molds, R. Micks. Can. Foundryman, vol. 17, no. 4, Apr. 1926, pp. 11-12. Points out that advent of compressed air in foundry has done much towards increasing production and decreasing labourious work, and air or pneumatic rammer has proved a great boon to both foundryman and molder; making molds on squeezer; most recent method of ramming molds is with sandslinger.

MORTARS

CEMENT-LIME. Cement-Lime Mortars, H. V. Johnson, U. S. Bur. of Standards—Technologic Papers, no. 308, Jan. 29, 1926, pp. 241-274, 14 figs. Tests made on mortars in which percentages of cement, lime and sand were varied considerably; it was found that addition of lime to cement mortars increased water requirement for same consistency, very nearly in proportion to percentage of lime added, that shrinkage is increased by addition of extra water; therefore, where low shrinkage is of prime importance lime should be limited.

MOTION STUDY

ECONOMIC VALUE. Reducing Costs 22% by Motion Study, J. A. Piacitelli. Mfg. Industries, vol. 11, no. 5, May 1926, pp. 347-350, 7 figs. Considers features of cutting and packing of 10-in. strip shingles which is characteristic of majority.

MOTOR BUSES

GASOLINE-ELECTRIC. Mack Departs from Usual Practice in Gas-Electric Design. Automotive Industries, vol. 54, No. 16, Apr. 22, 1926, p. 699, 1 fig. Uses single motor drive and retains standard rear axle and differential gear; two chassis sizes in production; designed for 25- and 29-passenger city-type bodies.

MOTOR TRUCKS

COST DATA. Operating Costs of Motor Trucks (Betriebskosten und Wirtschaftlichkeit von Lastkraftwagen), P. Friedmann. Allgemeine Automobil-Zeitung, vol. 27, no. 11, Mar. 13, 1926, pp. 17-19. Discusses conditions under which motor trucks of various types may be used to greatest advantage, and comparative operating costs of delivery cars; 2-ton and 5-ton trucks; trucks with trailers.

ELECTRIC. The Electric Motor Truck, D. M. Phillips. Elec. World, vol. 87, no. 17, Apr. 24, 1926, pp. 863-866, 3 figs. Characteristics and advantages of electric vehicles; their effect upon revenue of central-station companies; possibilities of development in proper fields of application. (Abstract.) Thesis presented to Univ. of Pennsylvania.

REO. Reo Lowers Body, Improves Steering Gear of 1¼-Ton Truck. Automotive Industries, vol. 54, no. 16, Apr. 22, 1926, pp. 692-693, 1 fig.

SIX-WHEEL. Special Six-Wheel Chassis Is Designed for Moving Vans. Automotive Industries, vol. 54, no. 18, May 6, 1926, p. 761, 2 figs.

N

NON-FERROUS METALS

STANDARDS. German Standards for Non-Ferrous Metals (Die deutschen Werkstoffnormen der Nichteisenmetalle), P. Melchoir. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 16, Apr. 17, 1926, pp. 529-535. Standardization is determined by German Industrial Standards Committee according to nature, properties and designation; chemical and mechanical test standards; standards for nickel, aluminum, tin, zinc, copper, copper alloys, drawn metals, rods, pipe, wires and plates.

O

OHMMETERS

DIRECT-READING. Use of Direct-Reading Ohmmeters, H. N. Faris. Telephony, vol. 90, nos. 12, 13 and 14, Mar. 20, 27 and Apr. 3, 1926, pp. 12-16, 22-23 and 26, and 16-18, 1 fig. Small exchange testing. Mar. 20: Direct-reading ohmmeters are becoming popular and efficient parts of equipment; detail methods for routine tests. Mar. 27: Use of shunted voltmeters for low-resistance measurements. Apr. 3: Voltmeter resistance measurements; how wire chief who has high-class voltmeter can prepare table which will enable him to interpret deflections on his voltmeter into ohms of external resistance.

OIL ENGINES

HEAVY-OIL. A New Gardner Marine Heavy-Oil Engine. Mar. Engr. & Motorship Bldr., vol. 49, no. 584, Apr. 1926, p. 129, 1 fig.

An All-American Two-Stroke Cycle Double-Acting Heavy-Oil Engine. Mar. Engr. & Motorship Bldr., vol. 49, no. 585, May 1926, pp. 188-191, 7 figs.

The Richardsons, Westgarth Heavy-Oil Engine. Mar. Engr. & Motorship Bldr., vol. 49, no. 585, May 1926, pp. 165-170, 19 figs.

PARSONS. An Eight-Cylinder Marine Oil Engine. Engineer, vol. 141, no. 3668, Apr. 16, 1926, p. 447, 1 fig. Designed for output of 56 b.hp. on paraffin fuel and 70 b.hp. when using gasoline, running at normal speed of from 900 to 950 r.p.m.

OIL FUEL

BURNERS. Oil Burner Service. Heat & Vent. Mag., vol. 23, no. 4, Apr. 1926, pp. 80-81.

FUTURE AVAILABILITY. Furnace Oil, Its Future Availability, R. L. Welch. Nat. Petroleum News, vol. 18, no. 15, Apr. 14, 1926, pp. 75-76.

HEAVY OILS. Experimental Investigation of the Physical Properties of Medium and Heavy Oils, Their Vaporization and Use in Explosion Engines, F. Heinlein. Nat. Advisory Committee for Aeronautics, no. 362, May 1926, 25 pp., 2 figs. Defines technically important physical properties of heavy oils, insofar as these properties affect vaporization under pressure and temperature conditions which exist during intake phase of engine; from results, conclusions will be drawn (with mathematical treatment of vaporization process of oils) on state of vaporization, as it takes place under conditions existing in engine. Translated from Motorwagen, Oct. 10, 1925.

MAZOUT FOR DIESEL LOCOMOTIVE. The Burning of Mazout in Diesel Engine of Russian Diesel-Electric Locomotive (Verbrennung von Masut im Dieselmotor der russischen dieselelektrischen Lokomotive), N. Dobrowolski. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 16, Apr. 17, 1926, pp. 527-528.

VAPOUR PRESSURES. The Vapour Pressures of Fuel Mixtures, J. S. Lewis. Instn. Petroleum Technologists—Jl., vol. 12, no. 54, Feb. 1926, pp. 32-44 and (discussion) 44-47, 5 figs. Continuation of previous work, published in same journal (vol. 11, no. 49, 1925). Special attention is paid to influence of alcohol, utilization of which in fuel mixtures is more than theoretical possibility; addition of alcohol to hydrocarbons gives rise to mixtures of maximum vapour pressures or minimum boiling points.

OIL INDUSTRY

ALBERTA. Petroleum and Natural Gas Development in Alberta, C. C. Ross. Can. Inst. of Min. & Metallurgy—Bul., no 168, Apr. 1926, pp. 466-495, 10 figs.

OIL SHALES

MINING AND TREATING COSTS. Estimating Costs of Mining and Treating Oil-Bearing Shale, V. C. Alderson. Salt Lake Min. Rev., vol. 28, no. 2, Apr. 30, 1926, pp. 19-21.

OIL-PRODUCTION COSTS. The Cost of Producing Shale Oil, V. C. Alderson. Can. Min. Jl., vol. 47, no. 18, Apr. 30, 1926, pp. 473-474. Presents analysis from which it is reasonable to infer that oil shale company, adequately financed and operating on open cut plan with 500-ton daily throughput, can manufacture shale oil at a cost approximating $1.25 a barrel.

OIL WELLS

DRILLING. Wildcat Drilling in Wyoming, E. G. Sinclair. Min. & Met., vol. 7, no. 233, May 1926, pp. 210-212, 1 fig.

STEELS FOR BORING EQUIPMENT. The Selection and Properties of Steels Used for Oil-Well Boring Equipment, J. H. S. Dickenson and F. E. Cherry. Instn. Petroleum Technologists—Jl., vol. 12, no. 54, Feb. 1926, pp. 1-24 and (discussion) 24-31.

OPTICAL INSTRUMENTS

TYPES. Measuring by Optical Means. Machy. (N.Y.), vol. 32, no. 9, May 1926, pp. 695-697, 6 figs. Applications of two optical instruments, developed by Bausch & Lomb Optical Co., Rochester, N.Y., intended for use in shop, tool-room and inspection department; one is a direct-reading thickness measure for accurate measurement to 0.0001 in.; other is toolmaker's microscope, applicable in connection with screw threads, gauges, small jigs and other precision parts.

ORE HANDLING

APRON FEEDERS. Apron Feeders at Inspiration, Arizona, G. J. Young. Eng. & Min. Jl.-Press, vol. 121, no. 18, May 1, 1926, pp. 726-728, 8 figs.

UNDERGROUND BINS. Underground Ore-Bin Construction at the United Verde, C. E. Mills. Eng. & Min. Jl.-Press, vol. 121, no. 15, Apr. 17, 1926, pp. 649-650, 3 figs.

OXYACETYLENE WELDING

ALUMINUM. Some Notes on the Welding of Aluminum, E. T. Painton. Mech. World, vol. 79, nos. 2049 and 2052, Apr. 9 and 30, 1926, pp. 290 and 341. Points out advantages of oxyacetylene welding; use of aluminum fluxes.

COPPER. Oxy-Acetylene Welding of Copper, S. W. Miller. Am. Welding Soc.—Jl., vol. 5, no. 3, Mar. 1926, pp. 23-31, 11 figs. Results of series of tests of copper welding rods containing deoxidizers such as silicon, manganese, aluminum, phosphorus and various combinations of them; results show that trouble with copper welding was due to reducing flame of welding blowpipe.

P

PACKING

STANDARDIZATION. How Standardization Helps Export Packing Problems, R. W. Chalmers. Automotive Mfr., vol. 67, no. 12, Mar. 1926, pp. 13-15, 10 figs.

PATTERNMAKING

SHOPS. Pattern Shop Aids to Foundry Production, F. C. Edwards. Foundry Trade Jl., vol. 33, no. 505, Apr. 22, 1926, pp. 311-315, 15 figs.

PAVEMENTS

BLACK-BASE FOUNDATION. Black-Base Foundation for Pavements, V. L. Ostrander. Can. Engr., vol. 50, no. 18, May 4, 1926, pp. 545-547. Methods of construction and qualities of black-base; resilient and flexible features of black-base; comparatively thin foundations have proved successful; paper presented before Mass. Highway Assn. See also Contract Rec., vol. 40, no. 16, Apr. 21, 1926, pp. 378-379.

REPAIR COSTS. Repair Costs of City Pavements, R. H. Simpson. Am. City, vol. 34, no. 4, Apr. 1926, pp. 400-406, 9 figs.

PAVEMENTS, ASPHALT

MIXTURES. New Ideas Concerning the Use of Asphalt Paving Mixtures, P. Hubbard. Contract Rec., vol. 40, no. 16, Apr. 21, 1926, pp. 383-385. Investigation and experience are proving that many customary requirements are unnecessarily restrictive and others not sufficiently so; recommends new rolling procedure; mechanical spreaders are gaining favour.

REPAIR PARTS. Comparison of Brick and Asphalt Pavement Repair Costs, R. H. Simpson. Eng. News-Rec., vol. 96, no. 12, Mar. 25, 1926, pp. 480-482, 7 figs.

PAVEMENTS, BRICK

SALVAGE. The Salvage Value of Brick Pavements, A. S. Mirick. Cornell Civil Engr., vol. 34, no. 6, Mar. 1926, pp. 134-135 and 152, 3 figs.

PAVEMENTS, CONCRETE

CENTER JOINTS. Center Joints Reduce Cracking of Seattle pavements, W. H. Tiedeman. Eng. News-Rec., vol. 96, no. 16, Apr. 22, 1926, pp. 646-647, 3 figs. Experience with center groove has developed design of part depth and through joints which promises advantages.

DEVELOPMENTS. Recent Developments in Concrete Paving Practice, H. E. Surman. Am. City, vol. 34, no. 4, Apr. 1926, pp. 357-360, 3 figs. One of most important developments is improvement in highway alignment; wide earth shoulders, shallower side ditches and stronger cross-section; improving existing pavements; checking specified thickness; use of aluminate cement strength tests of concrete. (Abstract.) Paper read before Am. Road Bldrs.' Assn.

HEXAGONAL SLAB. Cost of Hexagonal Slab Concrete Pavements, L. A. Perry. Roads & Streets, vol. 65, no. 4, Apr. 7, 1926, pp. 207-210, 1 fig.

MIXING AND LAYING. Fundamentals in Mixing and Laying Cement Concrete, C. M. Zeigler. Mun. & County Eng., vol. 70, no. 3, Mar. 1926, pp. 172-177.

PAVEMENTS, WOOD-BLOCK

EXPANSION, EFFECT OF. The Life of Wood Paving as Affected by Expansion, J. Garvie. Surveyor (Lond.), vol. 69, no. 1785, Apr. 2, 1926, pp. 361-365, 8 figs. Method of laying blocks; materials used in expansion joint; pressure generated in wood blocks; effect of using puddle clay in expansion joints; tendency of paving to rise and formation of blisters; failures due to blistering.

PHOTOELASTICITY

STRESS ANALYSES BY. Some Recent Stress Analyses by Means of the Photoelastic Method, P. Heymans. Eng. Jl., vol. 9, no. 4, Apr. 1926, pp. 193-198, 9 figs.

PILES

CONCRETE. Comparative Tests on Concrete Piles in Sea Water. Eng. News-Rec., vol. 96, no. 18, May 6, 1926, pp. 732-736, 3 figs. Los Angeles Harbour Board studies 4 different types; driven piles deflected 6 in.; results show danger attends only cracks above tide level; field and laboratory tests.

Driving. The Vibro Concrete-Piling System. Engineering, vol. 121, no. 3139, Feb. 26, 1926, pp. 251-255, 17 figs. System of forming formations developed by A. Hiley, involving driving into ground of plain steel tube with cast-iron conical shoe, placing suitable reinforcement in tube and filling it with concrete, subsequently withdrawing tube, leaving concrete and shoe behind in ground.

PIPE, CAST-IRON

Centrifugally Cast. Centrifugal Pipe from Sand Molds. Iron Age, vol. 117, no. 15, Apr. 15, 1926, pp. 1055-1060, 12 figs. How sand-spun or mono-cast product is made in new plant of Am. Cast Iron Pipe Co.; details covering molds, sand and finished product; facing sand and handling flasks; photomicographs of cast-iron pipe. See also description in Am. Gas Jl., vol. 124, no. 18, May 1, 1926, pp. 384, 388 and 390-391, 6 figs; also Water Wks. Eng., vol. 79, no. 8, Apr. 15, 1926, pp. 444, 451 and 471, 10 figs.

PISTONS

Machining. Machining Pistons for the Automotive Industry. West. Machy. World, vol. 17, no. 4, Apr. 1926, pp. 145-148, 11 figs.
Pins. Piston-Pin Methods That Are Different, F. H. Colvin. Am. Mach., vol. 64, no. 18, May 6, 1926, pp. 701-702, 5 figs.

PNEUMATIC TOOLS

Mechanisms. Pneumatic Tool Mechanisms, F. Hills. Engineering, vol. 121, nos. 3145 and 3146, Apr. 9 and 16, 1926, pp. 462-463 and 507-508, 19 figs.

POLES

Steel and Concrete. The "Stobie" Steel-and-Concrete Pole. Concrete & Constr. Eng., vol. 21, no. 4, Apr. 1926, pp. 322-325, 6 figs. Details of Australian invention, essential feature of which is used of 2 light standard rolled-steel joists or channel sections, forming main outside tension and compression members; whole triangular space between these sections is then filled with stiff concrete mixture.

POWER

Forecasting Regional Requirements. Predicting Regional Power Requirements, W. Alwyn-Schmidt. Power Plant Eng., vol. 30, no. 10, May 15, 1926, pp. 587-588. To be of aid in predicting.
Generation, Developments in. Latest and Future Developments in Power Generation, L. C. Loewenstein. Franklin Inst.—Jl., vol. 201, no. 4, Apr. 1926, pp. 431-464, 30 figs. Study of problem of power production from engineering point of view; what has been accomplished; lines along which latest developments in power generation are progressing, and along which future endeavours should proceed.
Industry Balance Sheet. An Industry Balance Sheet. Elec. World, vol. 87, no. 19, May 8, 1926, pp. 971-982, 10 figs. Analysis of business situation in light and power industry, based on available data, opinion and general information; data show present business done in each class of service; gross income from each class and total investment in system capacity for each class of service and influence of different class of business on total system characteristics, investments and revenues.
Purchased vs. Generated. Analyzing the Power-Purchase Problem, A. C. Wood. Power, vol. 63, no. 20, May 18, 1926, pp. 777-782, 6 figs. Factors affecting decisions as to purchasing or generating power for industrial plants, particularly those requiring steam for heating and process purposes.

PROSPECTING

Deep-Hole Drilling. Deep-Hole Drilling at the Chief Consolidated, C. A. Dobbel. Ariz. Min. Jl., vol. 9, no. 22, Apr. 15, 1926, pp. 5-6 and 62-63.
Electrical. Electrical Prospecting for Exploring Oil-Fields, N. Gella. Min. Jl., vol. 153, no. 4730, Apr. 17, 1926, p. 324. Results of extensive trials carried out by Elbof Co. of Cassel, Germany, in neighbourhood of oil-bores electric currents were sent into earth, distribution of which was reproduced by induction and recorded on suitably constructed receivers, which also act at great distances from generating plant; in this way complete picture of distribution of electric current in earth was obtained.
Geophysical Methods. Systematic Use of Geophysical Methods in Prospecting, R. A. Gottingen. Can. Min. Jl., vol. 47, no. 16, Apr. 16, 1926, pp. 427-430.
Lundberg Ore Detection Method. The North-Swedish Ore Deposits. Swedish Report, vol. 10, no. 4, Apr. 1926, pp. 43-45.
Sulphide Deposits, Quebec. Exploration of Claims in the Rouyn Area, T. C. Denton. Can. Min. Jl., vol. 47, no. 13, Mar. 26, 1926, pp. 327-328, 1 fig.

PULVERIZED COAL

Ash from. The Ash from Powdered Fuel Installations, J. T. Dunn. Chem. & Industry, vol. 45, no 11, Mar. 12, 1926, pp. 60T-61T.
Problems. Some Problems in the Use of Pulverized Coal, A. G. Christie. Power, vol. 63, no. 20, May 18, 1926, pp. 748-750.
Sampling. Sampling Pulverized Fuel (Richtlinien für die Probenahme von Brennstaub), K. Förderreuther. Glückauf, vol. 62, no. 11, Mar. 13, 1926, pp. 344-345.

PUMPING STATIONS

Electric. New Water Pumping and Filtration Plants, Hannibal, Mo., M. P. Hatcher. Eng. News-Rec.. vol. 96, no. 18, May 6, 1926, pp. 727-728, 3 figs.
Steam. An Efficient Waterworks Pumping Plant, H. R. Lupton. Engineer, vol. 141, no. 3668, Apr. 16, 1926, pp. 438-440, 2 figs. Results obtained in test of pumping plant supplied to Metropolitan Water Board for Lea Bridge pumping station; pumping engine is of triple-expansion inverted vertical type and its specified duty is to pump from 12,000,000 to 14,000,000 gal. of water per day against head of from 180 to 200 ft.; pumps are of outside packed ram type. (Abstract.) Paper read before Instn. Civ. Engrs. See also Engineering, vol. 121, no. 3147, Apr. 23, 1926, p. 528,

Equipment of Provincial Steam Plant of Bay of Friesland (De werktuigen ban het Probinciaal stoomgemaal voor den boezem van Friesland), J. C. Dijxhoorn. Ingenieur, vol. 40, no. 50, Dec. 12, 1925, pp. 1053-1065, 17 figs.

PUMPS

Water Elevators. *See Water Elevators.*

PUMPS, CENTRIFUGAL

Turbine. Greensboro Water-Works Adds Turbine-Driven Pumps. Power, vol. 63, no. 18, May 4. 1926, pp. 681-682, 3 figs. Installation of 4,000,000- and 6,000,000-gal. series centrifugal pump built for 310-ft. head and driven by geared steam turbine.

R

RADIOTELEGRAPHY

Antennas. Space Characteristics of Antennæ, Wm. H. Murphy. Franklin Inst.—Jl., vol. 201, no. 4, Apr. 1926, pp. 411-429, 10 figs. Study of actual radiated fields in space at unit distance made by resolving true fields into three imaginary components, vertical component, horizontal component in directional plane of wave propagation, and horizontal component perpendicular to this plane of propagation; this was done for special cases, such as for vertical and horizontal loops and antennas, from which general formulas for inclined loops and antennas have been evolved.

RADIOTELEPHONY

Short-Wave. Short-Wave Radio Communication, J. K. Clapp. Tech. Eng. News, vol. 7, no. 1, Mar. 1926, pp. 9 and 34, 1 fig.

RAILS

Heat Treatment. Heat Treatment of Rail Steel at the Works of Neuves-Maisons (La question de l'acier à rails et le traitement thèrmique des Usines de Neuves-Maisons), L. Thibaudier and H. Viteaux. Revue de Métallurgie, vol. 23, no. 2, Feb. 1926, pp. 65-81, 8 figs. Part I: Results of study made in collaboration with Alsace-Lorraine Railway show how difficult it is to meet simultaneously the two requirements of elastic limit and resilience in rails of carbon steel; heat treatment of street-railway rails. Part II: Method of heat treating carbon-steel rails at Neuves-Maisons by Compagnie des Forges de Châtillon, consisting essentially in intermittent tempering of head in a quantity of cold water determined in function of weight of bar to be treated; advantages of process and results obtained.

RAILWAY MANAGEMENT

Budgeting. Stabilizing by Budget, C. D. Young. N. Y. Railroad Club—Official Proc., vol. 36, no. 5, Mar. 19, 1926, pp. 7954-7964, 8 figs.

RAILWAY MOTOR CARS

Diesel-Electric. The New Diesel-Electric Motor Coaches on the Swiss Federal Railways. Brown Boveri Rev., vol. 13, no. 4, Apr. 1926, pp. 98-101, 5 figs.

RAILWAY OPERATION

Despatching System. Organization of Central Control Stations on Eastern Railways of France (Particularités de l'organisation des Postes Centraux de Régulation sur le réseau de l'Est), M. Massin. Revue Générale des Chemins de Fer, vol. 45, no. 4, Apr. 1926, pp. 247-259, 18 figs.
Train Control. The Automatic Train Control, C. S. Bushnell. Am. Ry. Assn. (Signal Section)—Proc., vol. 23, no. 4, Apr. 1926, pp. SC211-SC222.
Train Stops. N.Y.C. Installs Miller Train Stop. Ry. Age, vol. 80, no. 23, May 8, 1926, pp. 1257-1259, 7 figs. Intermittent inductive type uses inert track elements, mounted at rail level, with check of wayside circuit. See also description in Ry. Signaling, vol. 19, no. 5, May 1926, pp. 176-80, 16 figs.

RAILWAY REPAIR SHOPS

Electrical. Electrical Repair Shop of the Boston and Maine. Ry. Elec. Engr., vol. 17, no. 4, May 1926, pp. 149-151, 5 figs.
Locomotive. Repairing Locomotives at Pennsylvania Railroad Juniata Shop. Ry. Mech. Engr., vol. 100, nos. 4 and 5, Apr. and May 1926, pp. 237-245 and 291-296, 22 figs. Apr.: Scheduling system, material delivery, inspection methods and standardized repair parts. May: Utilization of semi-finished parts and micrometers; dimension forms; other machine-shop methods.

RAILWAY SHOPS

Locomotive. Iselin Shop Shows Good Design. Ry. Rev., vol. 78, no. 19, May 8, 1926, pp. 820-823, 7 figs. Plant consists of locomotive machine and erecting shop, storehouse and material yard, wheel shop, power house, etc.

RAILWAY SIGNALLING

Automatic Block. A. P. B. versus Straight Automatic Block Signalling, A. R. Fugina, A. H. McKeen and E. E. Worthing. Am. Ry. Assn. (Signal Section)—Proc., vol. 23, no. 4, Apr. 1926, pp. SC223-SC238.

Committee Report on Direct Current Automatic Block Signaling. Am. Ry. Assn. (Signal Section)—Proc., vol. 23, no. 4, Apr. 1926, pp. 663-668. Necessary modifications of d.c. track circuits in detail or in principle, to insure reliable protection of motor buses and cars; preservative treatment of capping and grooved trunking.

Report of Committee on Alternating Current Automatic Block Signaling, Am. Ry. Assn. (Signal Section)—Proc., vol. 23, no. 4, Apr. 1926, pp. 638-663, 2 figs. Protection of low-voltage lines against lightning; inductive interference of a.c. circuits and supply lines for signals and train control with communication circuits; a.c., track-circuit characteristics.
Economics. Report of Committee on Economics of Railway Signaling. Am. Ry. Assn. (Signal-Section)—Proc., vol. 23, no. 4, Apr. 1926, pp. 595-617. Operation of trains by signal indication; problems in economics of railway signaling; estimated savings to be effected on 5 divisions of railway system by replacing manual block system with automatic block system; economy of car retarders at hump and gravity yards; classification yards.
Interlocking. Report of Committee on Mechanical Interlocking. Am. Ry. Assn. (Signal Section)—Proc., vol. 23, no. 4, Apr. 1926, pp. 570-579.
Lamp Standardization. Signal Lamps Standardized, H. H. Handlan. Am. Ry. Assn. (Signal Section)—Proc., vol. 23, no. 4, Apr. 1926, pp. SC250-SC259. Author demonstrates building of lamps from raw sheet of cold-rolled, deep-drawn steel through many exacting operations in stamping and drawing presses and special machinery and tools; function and importance of signal lamp.

RAILWAY SWITCHES

Car Retarders. Car Retarders Cut Down Costs. Ry. Rev., vol. 78, no. 15, Apr. 10, 1926, pp. 674-677, 7 figs.

RAILWAY TRACK

Ballast Requirements. Railway Ballast Requirements, F. J. Stimson. Contract Rec., vol. 40, no. 13, Mar. 31, 1926, p. 315.
Grade Reduction. Comparative Economy of Reduction in Ruling Grade and Length of Line, C. A. Morse. West Soc. Engrs.—Jl., vol. 31, no. 2, Feb. 1926, pp. 4-51 and (discussion) 51-61. Shows that railroads are justified in spending large sums to reduce transportation costs by diminishing heavy grades and sharp curves; each tenth of one per cent of grade eliminated was found to be equivalent to shortening line 4.32 miles.

Snow Melting. Melting Snow on Terminal Tracks of Illinois Central R.R. Eng. News-Rec., vol. 96, no. 12, Mar. 25, 1926, pp. 486-487, 3 figs. Steam pipes laid on ties of exposed tracks and on ballast at switches; snow dumped into steam-heated pits.

Steel-Tie. Steel-Tie Track Laid by New Method, R. Brokaw. Elec. Traction, vol. 22, no. 4, Apr. 1926, pp. 199-200, 7 figs. Peoria division of Illinois Power & Light Corp. constructs over a mile of double track using steel ties with rails supported on concrete frustum pyramids.

RAILWAY YARDS

Switching. Shunting Yards. Int. Ry. Congress Assn.—Bul., vol. 8, no. 3, Mar. 1926, pp. 244-286.

REFRACTORIES

Boiler-Furnace. Boiler-Furnace Combustion Chambers of Modern Design (Die Brennkämmer für Dampfkesselfeuerungen in neuzeitlicher Bauart), Wintermeyer. Wärme, vol. 49, no. 11, Mar. 12, 1926, pp. 189-192, 2 figs. Refractory requirements of a combustion chamber; use of special refractory bricks, such as carborundum, Spinell brick (with 80 per cent magnesium), Zirkol (zirconium oxide with admixtures), etc., for linings.

REFRIGERATING MACHINES

Air Removal. Removing Air from Refrigerating Machines (Die Entlüftung der Kältemaschinen), Steinbach. Zeit. für die gesamte Kälte-Industrie, vol. 33, no. 1, Jan. 9, 1926, pp. 1-7, 8 figs. Discusses behaviour of gas-air mixtures on coaling in connection with air removal and design of air-removal devices, including Friedmann, Hill, Stein, Riegelmann and Linde types.

Troubles. Some Refrigerating Machine Troubles, C. L. Morgan. Power, vol. 63, no. 19, May 11, 1926, pp. 709-710, 2 figs.

ROLLING MILLS

American. American Rolling Mills (Reiseerfahrungen in amerikanischen Walzwerken), G. Bulle. Berichte der Fachausschüsse der Vereins deutscher Eisenhüttenleute (Walzwerksausschuss), no. 41. for Mtg. Mar. 15, 1925, 12 pp. (including discussion), 15 figs. Impression gained by author on visit to American rolling mills. Development and operation of blooming mills, bar, tube and wire mills; output and fuel consumption of rolling-mill furnaces.

Cold-Rolling. The Bliss "Cluster" Mill, L. Jones. Blast Furnace & Steel Plant, vol. 14, no. 4, Apr. 1926, pp. 180 and 201.

Couplings. Mill Type Coupling Design, G. Fast. Iron & Steel Engr., vol. 3, no. 2, Feb. 1926, pp. 100-101, 6 figs.

Electric Drive. Electrical Rolling Mills, D. W. Blakeslee. Iron & Steel Engr., vol. 3, no. 4, Apr. 1926, pp. 163-167, 10 figs.

Medium and Small-Sized Products. Rolling Mills for Medium- and Small-Sized Products, T. W. Hand. Iron & Coal Trades Rev., vol. 112, no. 3033, Apr. 16, 1926, pp. 643-644.

Merchant. Merchant Mills, D. W. Blakeslee. Iron & Steel Engr., vol. 3, no. 2, Feb. 1926, pp. 96-99, 9 figs.

Roll Drives. Main Roll Drives in the United States and Canada. Iron & Steel Engr., vol. 3, no. 1, Jan. 1926, pp. 1-30.

Speed Control. Speed Control in Relation to Modern Rolling Mill Drives, L. Rothera. West of Scotland Iron & Steel Inst.—Jl., vol. 33, Dec. 1925, pp. 24-28 and (discussion) 28-30, 11 figs.

Strip Steel and Mills for Its Production, N. Jones. Iron & Steel Engr., vol. 3, no. 4, Apr. 1926, pp. 155-163, 15 figs. Use of strip steel; metallurgical and physical requirements; hand-operated mills; semi-continuous mills; modified continuous mills; steam engines replaced by motors; method of rolling; heating furnaces and auxiliary apparatus; sizes of rolls and motors; types of cold rolling mills; annealing furnaces.

RETAINING WALLS

Concrete Cribbing. Concrete Cribbing for Railway Retaining Walls. Eng. News-Rec., vol. 96, no. 16, Apr. 22, 1926, pp. 654-656, 5 figs. Open and solid-face walls; beams interlocked or pinned; comparison with monolithic walls.

Types. New Type of Retaining Wall, R. P. Mears. Concrete & Constr. Eng., vol. 21, no. 4, Apr. 1926, pp. 295-299, 11 figs.

ROAD CONSTRUCTION

Embankment. Construction of Hydraulic Fill Road Embankment. Eng. News-Rec., vol. 96, no. 17, Apr. 29, 1926, pp. 692-693, 7 figs.

Materials-Handling Costs. What Should Be the Hauling Cost on Concrete Paving, J. L. Harrison. Eng. News-Rec., vol. 96, no. 19, May 13, 1926, pp. 762-764. Formulas and tables laid down for computing chief cost variable in road paving with concrete.

ROADS, BITUMINOUS

Improvements. Recent Developments in Bituminous Paving Practice, H. M. Rex. Roads & Streets, vol. 65, no. 4, Apr. 7, 1926, pp. 191-196, 7 figs. Improvements in asphaltic mixtures and betterments in construction methods. Paper presented before Am. Road. Bldrs.' Assn.

ROADS, CONCRETE

Curing with Silicate of Soda. Curing Concrete Roads with Silicate of Soda, R. F. Remler. Pub. Wks., vol. 57, no. 3, Apr. 1926, pp. 101-103, 4 figs. Method employed; tests on concrete beams; effect of concrete.

Field Tests. Reports and Field Tests on Concrete Roads, H. C. Badder. Roads & Road Constr., vol. 4, no. 39, Mar. 1, 1926, pp. 77-79. Examination of plans and specifications; locating bench marks and balance points; right of way; grading stakes; full shrinkage; super-elevating curves; eost records; concrete test reports.

Subgrading. Subgrading for Concrete Pavements, C. J. Moritz. Roads & Streets, vol. 65, no. 4, Apr. 7, 1926, pp. 187-190, 1 fig.

ROADS, EARTH

Construction and Maintenance. Earth Road Construction and Maintenance, H. M. Thompson. Can. Engr., vol. 50, no. 15, Apr. 13, 1926, pp. 482-484, 2 figs. Time of construction dependent upon weather and soil conditions; method of operating grader when constructing earth roads through virgin soil; correct shape of blade for grader; cleaning ditches and culverts; regular maintenance essential.

ROOFS

Precast Concrete Slabs. Can. Engr., vol. 50, no. 14, Apr. 6, 1926, pp. 465-466, 4 figs.

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SAND

Filter. Sampling of Filter Sand, W. S. Mahlie. Am. Water Wks. Assn.—Jl., vol. 15, no. 3, Mar. 1926, pp. 256-257. Results of experiments indicate need for something to take place of present effective size and uniformity coefficient methods of judging filter sands used for rapid sand filters.

SAND, MOLDING

Conditioning. Securing Perfectly Conditioned Sand, F. A. Smith. Can. Foundryman, vol. 17, no. 4, Apr. 1926, pp. 13-14, 1 fig. To secure perfectly conditioned sand, portable sand-cutting machine is commonly used; laboratory tests have revealed that mechanically cut and tempered molding sand has much higher strength and permeability than sand cut and tempered by shovel method.

Preparation. Foundry Progress in Sand Preparation, C. D. Hollins. Can. Foundryman, vol. 17, no. 4, Apr. 1926, pp. 20-21.

Sand Supplied Continuously. Foundry, vol. 54, no. 9, May 1, 1926, pp. 346-350 and 372, 7 figs. Details of installation of sand-preparation and mold-conveying units in foundry of Packard Motor Car Co., Detroit.

Reclamation. Can Used Sand Be Reclaimed? P. Dwyer. Foundry, vol. 54, nos. 5, 6, 7, 8, 9 and 10, Mar. 1, 15, Apr. 1, 15, May 1 and 15, 1926, pp. 170-172 and 187, 216-219, 265-267, 311-313, 356-358 and 394-398, 3 figs. Results of questionnaire sent to foundries. Facing-sand formulas; shop test; samples of American molding sands; sand-handling equipment; tests on sand; indefinite variety of natural deposits demand widely different treatments; economy is determining factor in methods adopted. Apr. 1: Wide varition shown in proportion of sand to weight of finished castings. Apr. 15: Mechanical testing and control methods to insure mechanical uniformity. May 1: Relative proportion of foundries in which sand control is exercised and manner in which new sand is added. May 15: Equipment and method for reclaiming sand by addition of clay.

Steel Castings. The Relationship of Sand to Steel Castings. Research Group News, vol. 3, no. 1, Apr. 1926, pp. 69-76, 5 figs.

Testing. Testing Foundry Sand, C. W. H. Holmes. Brass World, vol. 22, no. 4, Apr. 1926, pp. 122-124.

SEMI-DIESEL ENGINES

Peugeot-Tartrais. The Latest Semi-Diesel. Motor Transport (Lond.), vol. 42, no. 1101, Apr. 5, 1926, pp. 433-434, 5 figs. Details of Peugeot-Tartrais heavy-oil engine as developed for commercial production.

SEWAGE DISPOSAL

England. Modern Methods of Sewage Disposal, F. J. Taylor. Can. Engr., vol. 50, no. 14, Apr. 6, 1926, pp. 451-454, 5 figs.

Plant Appurtenances. Sewage Works Appurtenances, C. E. Keefer. Pub. Wks., vol. 57, no. 3, Apr. 1926, pp. 75-77, 2 figs.

Settling Tanks. Improvement of Settling Basins, W. H. Kimball. Am. Water Wks. Assn.—Jl., vol. 15, no. 3, Mar. 1926, pp. 252-255. Improvements in concrete sedimentation basin of Davenport Water Co., including mixing chamber, chemical storage house adjoining division wall in basin and baffle frame, together with valve box or chamber into which water enters after passing baffles.

Sewage Treatment. Some Aspects of Sewage Treatment, A. J. Martin. Can. Engr., vol. 50, no. 17, Apr. 27, 1926, pp. 517-518.

Sludge Digestion. Experience with Sludge Digestion at the Baltimore Sewage Works, C. E. Keefer. Am. City, vol. 34, no. 4, Apr. 1926, pp. 375-379, 4 figs.

Separate Sludge-Digestion System for Small Town Use, J. Donohue. Eng. News-Rec., vol. 96, no. 17, Apr. 29, 1926, pp. 690-691, 2 figs.

Trickling Filters. Limestone for Sewage Trickling Filters, T. C. Schaetzle. Pub. Wks., vol. 57, no. 3, Apr. 1926, pp. 77-78.

SEWER CONSTRUCTION

Methods and Plant. Heavy Sewer Construction Methods and Plant in Brooklyn. Eng. News-Rec., vol. 96, no. 12, Mar. 25, 1926, pp. 488-492, 8 figs. Wide structures, piles in soft bottom, ground water and tide and sewage flow call for intensive use of machine methods.

SEWERS

Intercepting. Toledo Intercepting Sewer System, H. P. Jones. Eng. News-Rec., vol. 96, nos. 13, 15 and 18, Apr. 1, 15 and May 6, 1926, pp. 526-529, 606-608 and 718-721, 10 figs. Apr. 1.: Progressive construction programme laid down after comprehensive investigation; design for ultimate population and area expected in 1960. Apr. 15: Balanced regulators divert storm flow; cast-iron siphons in multiple; tunnel clay excavated with power knives in pilot holes and manholes dug from bottom. May 6: Pumps discharge through submerged concrete outlets; grease removed as elliptical skimmer takes out floating material.

SHAFT SINKING

Artesian-Bore Driving. Artesian-Bore for Water Pressure Relief. Engineering, vol. 121, no. 3147, Apr. 23, 1926, pp. 539, 4 figs. Driving of artesian bore into greensand in connection with shaft-sinking operations for new Betteshanger colliery of Kent coal field.

SHEARS

Knives. Mangan. Steel Shear Knives for Hot Work, E. R. Norris. Blast Furnace & Steel Plant, vol. 14, no. 4, Apr. 1926, pp. 195 and 200.

SILVER METALLURGY

Treatment of Doré. The Parting Plant of the U.S.S. Lead Refinery, Inc., F. F. Colcord. Am. Electro-Chem. Soc.—Advance Paper, no. 17, for mtg. Apr. 26, 1926, pp. 229-238, 3 figs. Describes electrolytic processes for treatment of doré (silver and gold) and new plant embodying many improvements; process consists of electrolysis of doré in electrolyte of silver and copper nitrate, whereby silver is dissolved from doré anodes and deposited in crystalline form as pure silver, while gold and impurities form insoluble residue.

SMOKE

FORMATION AND PREVENTION. Smoke—Its Formation and Prevention, C. F. Wade. Elec. Times, vol. 69, no. 1799, Apr. 8, 1926, p. 451. Discusses causes of loss of heat; points out that black smoke is source of soot deposit on heating surfaces of economizers so that, apart from direct heat losses in gases when this smoke is present, heat-transfer process will be appreciably retarded by deposit of layer of material of very high efficiency as heat insulator.

SNOW REMOVAL

COST ANALYSIS. Cost Analysis of Snow Removal in Michigan, V. R. Burton. Am. City, vol. 34, no. 4, Apr. 1926, pp. 386-393, 3 figs. Effect of topography on cost; effect of wind direction; how study is being used; value of different equipment. (Abstract.) Paper read before Am. Road Bldrs.' Assn.

SPRINGS

HELICAL. Formulas for the Design of Helical Springs of Square or Rectangular Steel, C. T. Edgerton. Mech. Eng., vol. 48, no. 5, May 1926, pp. 484-487 and (discussion) 491.

Phosphor-Bronze Helical Springs from the Standpoint of Precision Instruments, W. G. Brombacher. Mech. Eng., vol. 48, no. 5, May 1926, pp. 488-491 and (discussion) 493 and 494, 5 figs. Results of tests made at Bureau of Standards to obtain knowledge useful in design of springs for precision instruments; sets forth characteristics of spring material, method of construction, apparatus in which springs were tested and procedure followed; results relate to stiffness, maximum fibre-stress, hysteresis, after-effect, drift and buckling.

SHOCK-ABSORBING. Factors of Design of Shock-Absorbing and Recuperating Steel Springs, T. M. Jasper. Mech. Eng., vol. 48, no. 5, May 1926, pp. 487-488 and (discussion) 491-492, 4 figs.

STADIUMS

KENTUCKY UNIVERSITY. Notes on the Construction of the Kentucky University Stadium, D. V. Terrell. Eng. News-Rec., vol. 96, no. 18, May 6, 1926, p. 739, 3 figs.

TORONTO. Toronto Baseball and Athletic Stadium, T. R. Loudon. Can. Engr., vol. 50, no. 17, Apr. 27, 1926, pp. 511-514, 7 figs. New playing field for Toronto's International League team, with covered stand of approximately 20,000 capacity; built in 5 winter months; deck formed mostly by precast slabs; ramp system throughout, on 1 to 6 grade.

STANDARDIZATION

GERMANY. Standardization of Materials and Its Importance for Producers and Consumers (Die Werkstoffnormung end ihre Bedeutung für Erzeuger und Verbraucher), L. Glück. Maschinenbau, vol. 5, no. 6, Mar. 18, 1926, pp. 252-255, 1 fig.

INTERNATIONAL. International Standardization (Internationale Normung), K. Gramenz. Maschinenbau, vol. 5, no. 6, Mar. 18, 1926, pp. 249-251.

RULES. Modifications of Rules in German Industrial Standardization (Gesetzmässigkeiten in der deutschen Industrienormung). Portsmann. Werkstattstechnik, vol. 20, no. 7, Apr. 1, 1926, pp. 217-220. Based on German industrial standards, three laws for standardization are derived and investigated, namely, law of equality, law of similarity, and law of grading.

STANDARDS

AUSTRIAN OE. N.I.G. REPORTS. Report of the Austrian Industrial Standards Committee (Normblattenwürfe), Sparwirtschaft, no. 1, Jan. 1926, pp. N1-N8, 7 figs.

Report of the Austrian Industrial Standards Committee (Normblattenwürfe)), Sparwirtschaft, no. 3, Mar. 1926, pp. N33-N35, 2 figs. Proposed standards for position and movement of operating levers for automobiles; loading of brick and masonry work in building construction.

GERMAN N.D.I. REPORTS. Report of German Industrial Standards Committee (NDI-Mitteilungen), W. Reichardt. Maschinenbau, vol. 5, no. 6, Mar. 18, 1926, pp. 285-290.

Report of German Industrial Standards Committee (NDI-Mitteilungen), W. Reichardt. Maschinenbau, vol. 5, no. 7, Apr. 1, 1926, p. 337.

STEAM

ADIABATIC EXPANSION. Relations between Heat of Expansion and Elasticity and Specific Heat (Su alcune relazioni tra le calorie di dilatazione e di elasticita e i calori specifici), R. Palladino. Rivista marittima, vol. 58, no. 11, Nov. 1925, pp. 409-420 and vol. 59, no. 2, Feb. 1926, pp. 491-504. Develops new formulas for expressing adiabatic expansion of steam, and application to perfect gases and saturated steam.

HIGH-PRESSURE. The Löffler High-Pressure Steam System, C. S. Darling. Power Engr., vol. 21, no. 242, May 1926, pp. 169-170, 1 fig.

NATURAL, FROM GEYSERS. Natural Steam for Developing Electricity, C. W. Geiger. Power Plant Eng., vol. 30, no. 10, May 15, 1926, pp. 607-609, 7 figs.

SUPERHEAT AND REHEAT. Superheat and Reheat, B. N. Broido. Power, vol. 63, no. 20, May 18, 1926, pp. 757-759, 7 figs. Author reviews reasons for using superheat and reheat, discusses design problems showing that superheater must withstand severe operating conditions; describes three schemes for reheating low-pressure steam.

STEAM GENERATION

RAPID AND HIGH-PRESSURE. New Methods of Rapid and High-Pressure Steam Generation (Neue Wege der Schnell- und Hochdruckdampferzeugung), Wintermeyer. Feuerungstechnik, vol. 14, nos. 7 and 8, Jan. 1 and 15, 1926, pp. 74-77 and 86-90, 16 figs. Arguments in favour of further development, and how this may be accomplished with aid of different types of evaporators and with steam generators of superheated water, and circulating steam generators.

STEAM METERS

ELECTROPHYSICAL. Electrophysical Measurement of Steam (Elektrophysikalisches Dampfmesserprinzip), Wittenhaus. Elektrotechnischer Anzeiger, vol. 43, no. 14, Feb. 17, 1926, pp. 163-165, 3 figs.

FLOW MEASUREMENT. Modern Practice in Steam Flow Measurement, M. A. Goetz. Power Plant Eng., vol. 30, no. 9, May 1, 1926, pp. 518-520, 4 figs. Advantages and use of flow indicators.

STEAM PIPE

INSULATION. Value of Insulation for Steam Pipe Lines (Der Wert der Isolation von Dampfleitungen), P. Wiegleb. Wärmne- & Kälte-Technik, vol. 28, no. 6, Mar. 20, 1926, pp. 60-62, 1 fig.

STEAM POWER PLANTS

BLEACHERY MILL. Southern Bleachery Installs Steam Plant in Hydro-Electric District. Power, vol. 63, no. 17, Apr. 27, 1926, pp. 626-629, 7 figs. Combined power and steam-heating plant; installed in new bleachery mill at Taylor, S.C.; horizontal tubular boilers and superheaters are used; steam is extracted from 750-kw. turbine at 40-lb. gauge.

DESIGN. Designing a 500-Horsepower Steam Power Plant, C. L. Hubbard. Southern Power Jl., vol. 44, no. 4, Apr. 1926, pp. 50-55. Steam requirements; type of prime mover; boiler capacity; condensing and furnace equipment; chimney and smoke breeching; feedwater heaters and purifiers; water piping.

STEAM TURBINES

DESIGN TENDENCIES. Tendencies in Steam Turbine Design. Power Plant Eng., vol. 30, no. 9, May 1, 1926, pp. 525-528, 4 figs. Review of situation discloses many interesting developments; use of turbines of special design; possible increased ratings from existing turbines; potential capacities of turbines designed for regenerative cycle; operation of mercury-vapour turbine at Hartford. (Abstract.) Serial report of Prime Movers Committee of Nat. Elec. Light Assn.

EXTRACTION. High Load Factor and Process Steam Demand Enables Extraction Turbine to Save Over $50,000 a Year, H. W. Gochnauer. Power, vol. 63, no. 19, May 11, 1926, pp. 706-708, 2 figs.

RESEARCH. Investigation and Research Relating to the Steam Turbine, G. B. Warren. Wis. Engr., vol. 30, no. 6, Mar. 1926, pp. 187-189, 212 and 216, 2 figs. Résumé of research work carried on during past few years by Gen. Elec. Co. relating to steam elements of large steam-turbine construction.

STEEL

ALLOY. *See Alloy Steels.*

COLD DRAWING. The Cold Drawing of Bar Steel, F. W. Krebs. Mech. Eng., vol. 48, no. 5, May 1926, pp. 448-450, 8 figs. Various steps involved in converting hot-rolled steel into cold-drawn bars; equipment used; factors affecting machining quality of steel; effects of cold drawing upon physical properties.

CORROSION. Corrosion of Steels in the Atmosphere, W. G. Whitman and E. L. Chappell. Ind. Eng. Chem., vol. 18, no. 5, May 1926, pp. 533-535, 3 figs.

FORGEABILITY. Forgeability of Steel Determined by the Brinell Machine, R. E. Kerslake. Am. Soc. Steel Treating—Trans., vol. 9, no. 5, May 1926, pp. 773-776, 5 figs.

SHEET. Sheet Steel—Specification and Inspection, L. N. Brown. Blast Furnace & Steel Plant, vol. 14, no. 5, May 1926, pp. 206-212. Testing for drawing qualities; ductility test; gauge and size tolerances; tabulated data giving results of ductility tests.

TOOL. *See Tool Steel.*

STEEL, HEAT TREATMENT OF

DILATOMETRIC EQUIPMENT. Volcrit Method of Heat Treatment by the Rockwell Dilatometer. West. Machy. World, vol. 17, no. 4, Apr. 1926, pp. 154-155 and 179, 3 figs. Details of Rockwell dilatometer and advantages of its use for heat treatment.

HARDENING, EFFECTS OF. Facts and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. Steel Treating—Trans., vol. 9, no. 5, May 1926, pp. 781-792.

NICKEL STEEL. Heat-Treatment for Nickel Steels. Am. Mach., vol. 64, no. 17, Apr. 29, 1926, p. 683. Reference-book sheet on treatment for annealing or hardening nickel steels.

QUENCHING. Mass Effects in Quenching. Fuels & Furnaces, vol. 4, no. 4, Apr. 29, 1926, pp. 435-438, 3 figs.

REHEATING, EFFECT OF. Effect of Reheating on Cold Drawn Bars, S. C. Spalding. Am. Soc. Steel Treating—Trans., vol. 9, no. 5, May 1926, pp. 685-707 and (discussion) 707-716 and 780, 23 figs.

STEEL MANUFACTURE

ELECTRIC MELTING. Progress in the Electric Melting of Steel (Fortschritte im Elektrostahlschmelzen), G. Mars. Giesserei-Zeitung, vol. 23, nos. 5 and 6, Mar. 1 and 15, 1926, pp. 117-120 and 154-156 and (discussion) 156-159.

INGOTS, LARGE. Chemical Analyses of Large Ingots, J. H. Hruska. Iron Age, vol. 117, no. 15, Apr. 15, 1926, pp. 1049-1050. Facts as to inclosures and gases more vital than strict chemical specifications; melting practice and analysis both important; basic, acid and refined open-hearth ingots; basic and acid electric steel ingots.

TOOL STEEL. Making High Grade Steel, J. A. Coyle. Iron Trade Rev., vol. 78, no. 18, May 6, 1926, pp. 1177-1179, 5 figs.

STELLITE

APPLICATION TO METAL PARTS. Stelliting of Metal Parts. Oxy-Acetylene Tips, vol. 4, no. 10, May 1926, pp. 177-179, 3 figs. New process of applying stellite to metal surfaces which are called upon to withstand heat, abrasion or corrosion. See also description in Machy. (N.Y.), vol. 32, no. 9, May 1926, pp. 687-690, 8 figs.

STOKERS

UNDERFEED. Recent Underfeed Stoker Developments. Power, vol. 63, no. 20, May 18, 1926, pp. 751-753, 6 figs. Outlines losses chargeable to stoker and shows how recent developments serve to reduce these losses.

STORAGE BATTERIES

POWER PLANTS. Use of Storage Batteries in the Power Plant, J. L. Woodbridge. Power Plant Eng., vol. 30, no. 9, May 1, 1926, pp. 533-535, 3 figs.

STROBOSCOPES

ROTOSCOPE. The Ashdown Rotoscope. Mech. World, vol. 79, no. 2051, Apr. 23, 1926, pp. 319-320, 3 figs.

SUBSTATIONS.

AUTOMATIC. Maintenance Experience on Automatic Substations. Elec. World, vol. 87, no. 17, Apr. 24, 1926, pp. 861-863.

AUTOMATIC CONTROL. Automatic Control in Main and Substations. Power Plant Eng., vol. 30, no. 10, May 15, 1926, pp. 602-605, 3 figs. Automatic substations for industrial and mine service; control of multiple transformer banks; automatic control for hydro-electric plants; supervisory systems.

GROUNDING. Grounding Systems for Generating Stations and Substations, W. W. Lewis. Gen. Elec. Rev., vol. 29, no. 5, May 1926, pp. 314-321, 3 figs. Importance of surrounding station with grounding system at absolute earth potential; grounding of various equipment; proper types of connection; determining size of ground leads; pipe vs. plate ground.

110,000-Volt. Standardizing 110,000-Volt Distribution Substations, L. M. Smith. Elec. Light & Power, vol. 4, no. 5, May 1926, pp. 134-136, 7 figs. Points out that, as far as practical, substations should be standardized as to type of equipment, general arrangement and facility for repair and inspection, scheme of protection and switchhouse.

SURVEYING

Great Circle and Rhumb Line. Field Procedure of Adjusting the Great Circle Line to the Rhumb Line, N. B. Sweitzer. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 5, May 1926, pp. 879-885, 1 fig.

SWIMMING POOLS

Indoor. Operation of Indoor Swimming Pools, R. F. Heath. Can. Engr., vol. 50, no. 16, Apr. 20, 1926, pp. 499-502.

SWITCHGEAR

Mining. Modern Mining Switchgear, E. E. Grover. Colliery Guardian, vol. 131, no. 3405, Apr. 1, 1926, pp. 787-788, 3 figs.

T

TAPS

Drill Sizes. The Development of Tap-Drill Sizes, A. C. Danekind. Mech. Eng., vol. 48, no. 5, May 1926, pp. 445-448, 5 figs.

TELEPHONY

Carrier-Current. Carrier-Current Communication, B. R. Cummings. Gen. Elec. Rev., vol. 29, no. 5, May 1926, pp. 365-367, 1 fig. Application to power systems; fundamental requirements for successful installation; tuned coupling around power circuit gaps; freedom from energy radiation; 50 to 150-kc. waveband limits; single-frequency operation; standardization of apparatus.

TEMPERATURE MEASUREMENT

Instruments. Test Code on Instruments and Apparatus. Mech. Eng., vol. 48, no. 5, May 1925, pp. 517-526, 16 figs.

TERMINALS, LOCOMOTIVE

Hampton, Pa. D. L. & W. Engine Terminal at Hampton, M. R. Freeley. Ry. Mech. Engr., vol. 100, no. 5, May 1926, pp. 297-301, 7 figs. Equipped with inspection sheds, ash pit, gravity coal chutes and other mechanical features of improved design.

TESTING MACHINES

Universal. A New Universal Testing Machine. Engineer, vol. 141, no. 3668, Apr. 16, 1926, p. 446, 3 figs. partly on p. 442

TEXTILE MACHINERY

Cotton Spinning. Saco-Lowell Long Draft Systems. Textile World, vol. 69, no. 15, Apr. 10, 1926, pp. 63 and 73, 4 figs.

TEXTILE MILLS

Group Drive. Group Drive Economy in Modern Textile Mills, L. H. Hopkins. Belting, vol. 28, no. 4, Apr. 1926, pp. 11-14. Saving effected by present-day methods; selection and installation; transverse and torsional strain.

THERMOMETERS

Resistance, Installing. Installing Electric Temperature-Measuring Instruments (Ueber den Einbau der elektrischen Temperaturmessgeräte), M. Moeller. Siemens Zeit., vol. 6, no. 2, Feb. 1926, pp. 65-72, 10 figs.

TIME STUDY

Analyst, Functions of. The Functions of the Time Study and Methods Analyst, H. B. Maynard. Am. Mach., vol. 64, no. 18, May 6, 1926, pp. 729-731. Relation of analyst to various departments; his qualifications.

Computation. Computing Relative Speeds of Work to Save Time Study Expense, R. Mawson. Mfg. Industries, vol. 11, no. 5, May 1926, pp. 371-372.

Piece Work. Determining Time for Piece Work (Einige Betrachtungen zur Zeitermittlung bei Akkordarbeit), K. Gottwein. Maschinenbau, vol. 5, no. 7, Apr. 1, 1926, pp. 297-300, 7 figs.

TIN DEPOSITS

Bolivia. Geologic Features of Bolivia's Tin-Bearing Veins, F. R. Koeberlin. Eng. & Min. Jl.-Press, vol. 121, no. 15, Apr. 17, 1926, pp. 636-642, 2 figs.

TIRES, RUBBER

Balloon. Balloon Tires for Motorcoaches, J. M. Linforth. Soc. Automotive Engrs.—Jl., vol. 18, no. 5, May 1926, pp. 477-478.

TOOL STEEL

Types and Classification. Selecting the Proper Steel for Making Shop Tools, J. B. Mudge. Iron Trade Rev., vol. 78, no. 17, Apr. 29, 1926, pp. 1116-1118, 4 figs. Consideration of types of steel to be used in making various tools; presents type of tool and steel classification chart employed by Western Elec. Co. serving to identify various steels.

TRAFFIC

City Streets. Increasing the Efficiency of Passenger Transportation in City Streets, J. A. Miller, Jr. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 5, May 1926, pp. 827-835, 3 figs. Considerations which point to possible solution of street traffic problems by (1) reduction or eliminating of parking; and (2) substitution of buses in many instances in place of extravagant private automobile and taxicab.

TRANSFORMERS

Eddy-Current Losses. Supplementary Eddy-Current Losses in Transformers, H. Bohle. World Power, vol. 5, no. 26, Feb. 1926, pp. 72-77, 8 figs.

High-Voltage. High-Voltage Current Transformers Developed at Niagara, L. C. Nicholson. Elec. World, vol. 87, no. 17, Apr. 24, 1926, pp. 868-869, 3 figs.

Load-Ratio Control. Arrangements for Load-Ratio Control, H. R. Wilson. Gen. Elec. Rev., vol. 29, no. 5, May 1926, pp. 335-338, 8 figs.

Oils. Care of Transformer Oil, F. C. DeWeese. Power, vol. 63, no. 17, Apr. 27, 1926, pp. 630-631, 2 figs.

TRANSMISSION LINES

Reliability. Reliability of Transmission Lines. Elec. World, vol. 87, no. 19, May 8, 1926, pp. 995-1000, 10 figs.

TUNGSTEN

Mining. Mining Tungsten at Pine Creek, California, G. J. Young. Eng. & Min. Jl.-Press, vol. 121, no. 15, Apr. 10, 1926, pp. 605-606, 3 figs.

TUNNELLING

Driving Below Water Surface. Tunnel Taps Mystic Lake Below Water Surface. Eng. News-Rec., vol. 96, no. 16, Apr. 22, 1926, pp. 642-643, 2 figs.

TUNNELS

Concrete Lining. Webb Concrete Gun. Commonwealth Engr., vol. 13, no. 7, Feb. 1, 1926, pp. 258-259, 2 figs.

TURBO-GENERATORS

Foundation. A Spring Supported Turbine Foundation, L. J. Rehberg and J. R. James. Power, vol. 63, no. 17, Apr. 27, 1926, p. 642, 3 figs. Plan worked out at Marysville power plant of Detroit Edison Co. involves supporting turbo-generator of 2000-kw. capacity on spring mattress eliminating building vibrations and gives entirely satisfactory results.

V

VALVES

Hydraulic. New Developments in Hydraulic Valves (Neuerungen an Abschlussorganen von Turbineanlagen), R. Löwy. Elektrotechnik u. Maschinenbau, vol. 43, no. 43, Oct. 25, 1925, pp. 841-846, 13 figs. Discusses problem from viewpoint of hydraulic turbines and their pipe lines; type of valve must be designed in accordance with its function; describes new type, known as spherical slide valve, built by Escher, Wyss & Co., which is combination of cock or rotary slide valve and poppet principles; for control of pressure and for by-passes, piston valves are almost universally used, and several new types are described, some of which are operated automatically and hydraulically for regulating purposes; one, a double-beat valve, made by Loebersdorf Maschinenfabrik, is operated by crank and connecting rod.

Pipe-Line Air-Inlet. Pipe-Line Air-Inlet Valves, J. W. Ledoux. Mech. Eng., vol. 48, no. 5, May 1926, pp. 467-469. Prevention of collapse due to reduced internal pressure; detailed calculation of number of air valves required in pipe line having sections of different gradients and diameters.

VENTILATION

Buildings. Artificial Ventilation of Buildings (Künstliche Regelung der Luftbeschaffenheit in Gebäuderäumen), M. Hirsch. Gesundheits-Ingenieur, vol. 49, no. 13, Mar. 27, 1926, pp. 188-194, 6 figs. Conditions conducive to comfort, and their determination; temperature and humidity; purification, cooling and heating of air; air-conditioning apparatus, etc.

VIBRATIONS

Synchronous. Notes on the Demonstration of Synchronous Vibration and Critical Speed, R. T. Liddicoat. Mich. Technic, vol. 39, no. 3, Mar. 1926, pp. 17-18 and 23, 1 fig. Summary of underlying theory and demonstration.

W

WAGES

Barth Standard Scale. The Barth Standard Wage Scale. Mfg. Industries, vol. 11, no. 5, May 1926, pp. 373-374. Discussion by C. D. Demond and reply by C. G. Barth.

Bonus Systems. *See Bonus Systems.*

WASTE ELIMINATION

Industrial. Orgbnization of a National Committee to Study Practical Methods for the Elimination of Waste. Soc. Indus. Engrs.—Bul., vol. 8, no. 3, Mar. 1926, pp. 2-10. Purpose of committee is to promote interest in elimination of waste in management, manufacturing, distribution, national resources and government.

WATER ELEVATORS

Continuous Machine. Continuous Water-Lifting Machine. Engineering, vol. 121, no. 3139, Feb. 26, 1926, p. 278, 3 figs.

WATER FILTRATION

Reaction Apparatus. Laboratory Reaction Apparatus Helps Operate Filters, C. H. Spalding. Eng. News-Rec., vol. 96, no. 16, Apr. 22, 1926, pp. 644-645, 6 figs. Better application of chemicals gives economical balance between iron and alum; saves $4500 during year.

WATER PIPE

Friction. An Easy Method to Determine Friction Losses in Water Pipe, F. J. Walter. Ry. Eng. & Maintenance, vol. 22, no. 5, May 1926, pp. 181-

WATER POWER

France. Water Power in France. Engineering, vol. 121, no. 3148, Apr. 30, 1926, p. 550. Brief review of developments in 1925; outline of what has been and is being accomplished, based on water-power year book, issued by Revue Générale de l'Electricité.

WATER SUPPLY

Ontario. Discussion on the Water Supply of the Border Cities. Eng. Jl., vol. 9, no. 4, Apr. 1926, p. 212-214. Discussion of paper by W. Gore and J. C. Keith, presented before Eng. Inst. of Canada.

Tastes. Chlorophenol-Like Tastes in Bay City's Filtered Water Supply, L. B. Harrison. Am. Water Wks. Assn.—Jl., vol. 15, no. 3, Mar. 1926, pp. 292-297, 1 fig.

WATER TREATMENT

Chlorination. Chlorination of Water and Sewage, E. B. Phelps. Boston Soc. Civil Engrs.—Jl., vol. 13, no. 4, Apr. 1926, pp. 150-169, 4 figs. Germicidal action of chlorine; rôle of chlorination in water supply practice; reliability of chlorination; what chlorination has accomplished; tastes and odors; chlorination of water for use in swimming pools; chlorination of sewage; bibliography.

Red-Water Prevention. The Causes and Prevention of Red Water, P. C. Laux. Am. Water Wks. Assn.—Jl., vol. 15, no. 3, Mar. 1926, pp. 271-278.

Softening. Zeolite Softening Plant of the Ohio Valley Water Company, F. B. Beech. Am. Water Wks. Assn.—Jl., vol. 15, no. 3, Mar. 1926, pp. 227-233. New plant will remove manganese and crenothrix, making water suitable for laundry and other washing purposes, prevent stains on plumbing fixtures and save large cost which cleaning of mains and replacing of services would require; Zeolite process may be used to reduce hardness of any desired degree down to zero; it requires little space as compared with lime-soda process.

WATERWAYS

Quebec Streams Commission. The Work of the Quebec Streams Commission, O. Lefebvre. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 5, May 1926, pp. 895-910, 4 figs. Deals with stream measurements, meteorological data, power sites, legislation and storage dams.

WATER WORKS

Bay City, Mich. New Bay City (Mich.) Water-Works Displaces Two Old Plants, J. W. Ellms. Eng. News-Rec., vol. 96, no. 17, Apr. 29, 1926, pp. 682-683, 3 figs.

Kansas City, Mo. Additional Water Supply Under Way for Kansas City, Mo. Eng. News-Rec., vol. 96, no. 12, Mar. 25, 1926, pp. 492-494, 2 figs.

Orlando, Florida. The Municipal Water and Light Plant at Orlando, Florida, W. W. Mathews. Am. Water Wks. Assn.—Jl., vol. 15, no. 3, Mar. 1926, pp. 238-251.

WELDING

Electric. *See Electric Welding, Arc.*

Wire Specifications. Welding Wire Specifications, F. E. Burk. Welding Engr., vol. 2, no. 4, Apr. 1926, pp. 33 and 36. Points out that only small number of specifications have so far been accepted as standard, and discusses advisability of providing greater number of standards.

WELLS

Pumping. Wells and Well Pumping, F. J. Garland. Power Engr., vol. 21, no. 241, Apr. 1926, pp. 130-133, 3 figs.

WIND TUNNELS

Turbulence in. Investigation of Turbulence in Wind Tunnels by a Study of the Flow about Cylinders, H. L. Dryden and R. H. Heald. Nat. Advisory Committee for Aeronautics—Report, no. 231, 1926, pp. 3-17, 19 figs.

WINDING ENGINES

Steam. Steam Winding-Engines and Accumulators, H. Pilling. Instn. Min. Engrs.—Trans., vol. 71, Mar. 1926, pp. 63-79 and (discussion) 79-87, 27 figs.

WINDMILLS

Electric-Power-Plant. Electric Wind-Power Stations (Elektrische Windkraft zentralen), Foerster. Elektrotechnischer Anzeiger, vol. 43, no. 25, Mar. 27, 1926, pp. 299-304, 12 figs.

X-RAYS

Metal-Structure Analysis. X-Rays and the Ultimate Structure of Metals, R. H. Aborn. Tech. Eng. News, vol. 7, no. 2, Apr. 1926, pp. 54-55, 76 and 98, 7 figs. Account of recent research in Research Laboratory of Applied Chemistry considering metals as crystalline aggregates, which diffract X-rays in ways characteristic of their properties.

VISCOSMETERS

Air-Bubble. The Air-Bubble Viscometer, G. Barr. Aeronautical Research Committee—Reports and Memoranda, no. 988, Apr. 1925, 10 pp., 5 figs. Investigation to find whether and under what circumstances, rise of large bubble in vertical tube containing liquid could be used as indication of viscosity of liquid.

Unit System. Construction and Use of Unit Wage Key for Determining Rate (Aufbau und Benutzung eines Einheitslohnschlüssels sur Ermittlung des Tariffaktors), A. Scheid. Technik u. Wirtschaft, vol. 19, no. 2, Feb. 1926, pp. 51-56, 6 figs. Method of arriving at amount of wages from minimum to which are added various factors of coefficients representing risk, heavy work, piece rate, artistic work, overtime, etc.

WATER FILTRATION

Colloid Chemistry in. Colloid Chemistry in Filtration, A. V. Delaporte and F. R. Manuel. Can. Engr., vol. 50, no. 10, Mar. 9, 1926, pp. 94A-94C. Explanation of terms used; colloids, suspensoids and emulsoids; mechanism of reaction; recovery of alum.

WATER METERS

Advantages and Tests. Services and Meters, E. V. Buchanan. Can. Engr., vol. 50, no. 10, Mar. 9, 1926, pp. 141-144 and (discussion) 144-146, 3 figs. Sizes of lead pipe; estimates for copper pipe; reasons for metering; meters tested for accuracy; meter-installing methods. Paper read before Can. Section, Am. Water Wks. Assn.

WATER SUPPLIES

Sanitary Conservation. The Sanitary Conservation and Utilization of Water Resources, W. L. Stevenson. Boston Soc. Civil Engrs.—Jl., vol. 13, no. 2, Feb. 1926, pp. 51-61. Magnitude of problems in Pennsylvania; existing anti-stream pollution statutes; functions of sanitary water board; typical results attained in past two years.

WATER SUPPLY

Distribution Systems. Practical Features of Water Distribution, N. R. Wilson. Contract Rec., vol. 40, no. 10, Mar. 10, 1926, pp. 240-243, 3 figs. Types of systems and their layout in relation to present-day needs; pipes and house services; hydrant, valve and meter records.

Mains, Hydrants and Valves, N. M. R. Wilson. Can. Engr., vol. 30, no. 10, Mar. 9, 1926, pp. 113-115 and (discussion) 115-119, 5 figs. Reorganization of old systems; zoning and belting; distribution mains; valves in distribution systems. Paper read before Can. Section, Am. Water Wks. Assn.

Intakes and Storage. Supply, Intakes and Storage, W. Gore. Can. Engr., vol. 50, no. 10, Mar. 9, 1926, pp. 27-29 and (discussion) 30-32, 3 figs. Natural storage of water; study of rainfall statistics; rights of riparian owner; pollution of Great Lakes system; sites for intakes; water from underground sources. Paper read before Can. Section, Am. Water Wks. Assn.

WATER TREATMENT ..

Aluminum Hydrate Sol, Use of. Use of Aluminum Hydrate Sol, E. W. Johnston and F. P. Downey. Can. Engr., vol. 50, no. 10, Mar. 8, 1926, pp. 94C-94D. Preparation of coagulant; apparatus used for experimental purposes; character of water treated.

Problems. Purification and Treatment, J. O. Meadows. Can. Engr., vol. 50, no. 10, Mar. 9, 1926, pp. 87-88 and (discussion) 88-90. Application of chemicals; coagulation; filtration. Paper read before Can. Section, Am. Water Wks. Assn.

Softening. Problems of Hard and Soft Water, R. A. Thuma. Am. Water Wks. Assn.—Jl., vol. 15, no. 2, Feb. 1926, pp. 152-157. Water softening in relation to health; cost of softening water as determined at St. Paul plant; value or return from water softening.

Modern British Practice in Water Softening, D. Brownlie. Indus. Chemist, vol. 2, no. 13, Feb. 1926, pp. 61-64. Advantages and disadvantages of zeolite or base-exchange methods of water softening.

WATERWAYS

Chicago Diversion. Army Engineers Recommend Restricting Chicago Diversion. Eng. News-Rec., vol. 96, no. 14, Apr. 8, 1926, pp. 576-578. Report that navigation requirements of Illinois Canal and Chicago sewage disposal needs can both be cared for with flow of 4167 sec. ft. in Chicago River out of Lake Michigan.

St. Lawrence. The St. Lawrence Waterway to the Sea. Am. Soc. Civ. Engrs.—Proc., vol. 52, nos. 1 and 2, Jan. and Feb. 1926, pp. 86-89 and 282-288. Discussion of paper by F. C. Shenehon continued from Dec. 1925 Proceedings.

WELDING

Electric. *See Electric Welding; Electric Welding, Arc; Electric Welding, Resistance.*

Fusion. Fusion Welded Pressure Vessels, S. W. Miller. Am. Welding Soc.—Jl., vol. 5, no. 2, Feb. 1926, pp. 23-40, 9 figs. Proposed code for fusion-welded pressure vessels; omission of some parts of A.S.M.E. code; specifications for fusion-welded tank in 60 in. in diameter, 20 ft. long, for working pressure of 200 lb. per sq. in.

Oxyacetylene. *See Oxyacetylene Welding.*

WINDMILLS

Tests. Tests and Investigation of Power of Windmills (Forsog og undersogelser vedrorende vindmotorers ydeevne), Tylvad. Ingenioren, vol. 34, no. 51, Dec. 19, 1925, pp. 613-618, 7 figs. Reviews work done in investigating windmills, wind wheels and propeller wheels, and concludes that their efficiency is respectively 23, 17.5 and 43 per cent.

WIRE ROPE

Calculation. A Method of Calculating Wire Rope (Ein Verfahren zur Berechnung von Drahtseilen), K. Kleinn. Praktischer Maschinen-Konstrukteur, vol. 59, no. 1-2, Jan. 9, 1926, pp. 2-7, 5 figs. Calculation of tensile strength, bending load, safety factor, cross section of wire; various examples of calculating wire rope for stated conditions, for winding engines, etc.; also tables for calculations.

WOOD

Industrial Problems. Problems of the Wood Industries. Mech. Eng., vol. 48, no. 4, Apr. 1926, pp. 349-355, 5 figs. Abstracts of following papers at session held under auspices of Wood Industries Division of Am. Soc. Mech. Engrs.; Scientifically Developed Shipping Containers, C. M. Bonnell, Jr.; Electric Molder, A. Jensen, Jr.; Recent Advances in Methods of Glue Evaluation, W. L. Jones; Spark Arresters and Forest Fires, J. S. Mathewson; High-Speed Induction and Frequency Changers, C. Fair.

WOODWORKING MACHINERY

Planers. High-Speed Wood Planing and Matching Machine. Engineer, vol. 141, no. 3663, Mar. 12, 1926, p. 303, 4 figs. Machine built by Thos. Robinson & Son; chief features are chain-driven feed rollers, improved weighing system for tellers, combination of rotary and fixed knives for planing, and complete equipment throughout with ball and roller bearings, whereby working speeds up to 400 ft. per min. are obtainable.

Engineering Index

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A

AERONAUTICAL INSTRUMENTS

Aircraft Bubble Sextant. The Aircraft Bubble Sextant, Type A, R. C. Parker. Am. Soc. Nav. Engrs.—Jl., vol. 38, no. 2, May 1926, pp. 301-317, 4 figs. Constructed to fill requirements of instrument with which altitude of heavenly bodies can be measured without depending on sea horizon.

AIR

Pollution. Exact Methods for the Measurement of Air Pollution, J. B. C. Kershaw. Indus. Chemist, vol. 2, no. 15, Apr. 1926, pp. 153-158, 10 figs.

AIR COMPRESSORS

Portable. Portable Compressors Aid Development of Mineral Properties in Canada, F. A. McLean. Compressed Air Mag., vol. 31, no. 5, May 1926, pp. 1631-1634, 11 figs. Gasoline-driven portable compressors have been found valuable in opening up prospects; examples of application.

Testing. The Heat-Balance Method of Testing Centrifugal Compressors, M. G. Robinson. Refrig. Eng., vol. 12, no. 10, Apr. 1926, pp. 327-335 and (discussion) 335-337, 11 figs. In this method, principle is used that balance exists between mechanical energy supplied by rotation of shaft and heat-energy increase in air which is being compressed, heat-energy increase in cooling water used, and heat loss from casing, bearings and packings.

AIR CONDITIONING

Atmospheres of Low Temperatures. Work Tests Conducted in Atmospheres of Low Temperatures in Still and Moving Air, W. J. McConnell and C. P. Yaglou. Am. Soc. Heat & Vent. Engrs.—Jl., vol. 32, no. 5, May 1926, pp. 375-386, 7 figs. Results of experiments definitely indicate to what extent atmospheric conditions influence human efficiency.

AIRCRAFT CONSTRUCTION MATERIALS

Corrugated Metal. Corrugated Metal Sheet in Aircraft Structures. Aviation, vol. 20, no. 24, June 14, 1926, pp. 909-910, 6 figs. Possibilities of employing corrugated duralumin for large aircraft components in addition to parts of compound structures.

Dopes. Durability of Airplane Doping and Varnishing Systems, H. A. Gardner. Paint Mfrs.' Assn. of U. S., Sci. Section—Circular, no. 274, June 1926, pp. 61-70, 4 figs. Study of cellulose acetate and cellulose nitrate tautening and proofing schemes for fabric surfaces.

AIRPLANE ENGINES

Air vs. Water Cooling. Air-Cooled or Water-Cooled Airplane Engines (Moteurs d'avions à refroidissement par air ou par eau), J. A. Lefranc. Nature (Paris), no. 2716, Apr. 24, 1926, pp. 262-269, 6 figs. Technical advantages and disadvantages of air cooling and water cooling; rivalry between two types in France; balance of evidence is in favour of air cooling.

Fairchild-Caminez. Cam is Used Instead of Crank Train in Radial Airplane Engine, A. F. Denham. Automotive Industries, vol. 54, no. 21, May 27, 1926, pp. 891-893, 3 figs. New 4-cylinder, air-cooled engine constructed for commercial use by Fairchild-Caminez Corp.; large cylinders give output of 150 h.p.

The Fairchild-Caminez Engine. Aviation, vol. 20, no. 21, May 24, 1926, pp. 788-791, 6 figs. Details of four-cylinder air-cooled radial engine fitted into Avro 504K-type machine; design is result of inventor's effort to produce mechanism which would give four strokes per revolutions to coincide with four-strike cycle employed in internal-combustion engines; special features of engine and results of tests.

AIRPLANE PROPELLERS

Strength Determination. Propeller Design, F. E. Weick. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 238, June 1926, 11 pp., 7 figs. Simple method for determining strength of propellers of standard form and sufficient for safe operation; paper also gives approximate method of stress analysis.

AIRPLANES

Airfoils. Pressure Distribution Over Thick Tapered Airfoils, N. A. C. A. 81, U. S. A. 27 C Modified and U. S. A. 35, E. G. Reid. Nat. Advisory Committee for Aeronautics—Report, no. 229, 1926, 18 pp., 25 figs.

Calculation. Elements of a New Method for Aerodynamic Calculation of Airplanes (Elementi per un nuovo metodo di calcolo aerodinamico degli aeroplani), G. Costanzi. Rendiconti Tecnici della Direzione Generale del Genio Aeronautico, vol. 14, no. 1, Mar. 1926, pp. 1-74, 87 figs. Series of experiments with various types of wings, variation of bearing power with velocity and resistance; new method of calculation based on tests with models.

Developments. Airplanes Greatly Improved With Recent Developments in Aerodynamics, L. H. Allen. Automotive Industries, vol. 54, no. 21, May 27, 1926, pp. 898-899, 2 figs. Advantages of tailless plane, Autogiro, and slotted wing and flap are described by A. Klemin before Soc. Automotive Engrs. Metropolitan Section; further radical improvements predicted.

Drag. Notes on Airplane Performance from the Standpoint of the Modern Conception of Drag, J. A. Roche. Air Service Information Circular, vol. 6, no. 560, Mar. 15, 1926, 7 pp., 5 figs. Simple and practical explanation of modern conception of aerodynamic drag, and how it can be used in estimating power consumption of airplanes.

Gliders. Note on the Minimum Speed from Which the Direction of a Gliding Aeroplane Can Be Changed to a Horizontal Path for Landing, F. W. Meredith. Aeronautical Research Committee—Reports and Memoranda, no. 993, June 1925, 5 pp., 1 fig.

Maintenance and Depreciation. Maintenance and Depreciation of Airplanes and Engines, E. W. Dichman. Mech. Eng., vol. 48, no. 6, June 1926, pp. 574-577.

Performance Tests. The Representation of Aircraft Performance Tests, Using Non-Dimensional Variables, With Special Reference to the Prediction of the Effects of Change of Loading on Performance, R. S. Capon. Aeronautical Research Committee—Reports and Memoranda, no. 984, Nov. 1925, 7 pp., 2 figs.

Stalled Flight. Notes on Stalled Flying, C. Howarth. Roy. Aeronautical Soc.—Jl., vol. 30, no. 186, June 1926, pp. 394-402, 5 figs.

The Control of Stalled Aeroplanes, B. M. Jones. Roy. Aeronautical Soc.—Jl., vol. 30, no. 186, June 1926, pp. 345-356 and (discussion) 356-364, 5 figs. Report based on results of researches made by (Brit.) Air Research Committee.

Resistance and Thermoelectromotive Potential. The Specific Resistance and Thermoelectromotive Potential of Some Steels Differing Only in Carbon Content, E. D. Campbell and H. W. Mohr. Iron & Steel Inst.—Advance Paper, no. 4, for mtg. May 1926, 18 pp., 5 figs.

ALLOY STEEL

Properties. Properties of Alloy Steels. Am. Mach., vol. 64, no. 22, June 3, 1926, p. 873. Properties of manganese, nickel, chrome, tungsten, molybdenum and high-speed steels. Reference-book sheet.

Tungsten. The Estimation of Phosphorus in Steels Containing Tungsten, T. E. Rooney and L. M. Clark. Iron & Steel Inst.—Advance Paper, no 12, for mtg. May 1926, 6 pp. Authors carried out estimations on number of tungsten steels of low phosphorus content; in some cases no phosphorus was detected, and in others results were too low.

ALLOYS

Aluminum. *See Aluminum Alloys.*

ALUMINUM ALLOYS

Aging. Aging of Aluminum Alloys, K. L. Meissner. Metal Industry (Lond.), vol. 28, nos. 16, 17 and 19, Apr. 16, 23 and May 7, 1926, pp. 363-364, 391-393 and 439-440, 7 figs. Its effect upon electrical conductivity and chemical resistance. Discusses obscure phenomena of aging and various theories which have been advanced to account for its occurrence; influence of aging and some of other properties of aluminum alloys, and function of magnesium silicide compound, to which age-hardening effects are sometimes ascribed.

Aluminum Bronze. *See Aluminum Bronze.*

Castings. Impact Tests Show Fitness of Cast Aluminum Alloys, J. Strauss. Foundry, vol. 54, no. 11, June 1, 1926, pp. 426-429, 4 figs. Summary of impact resistance of alloys in common use at present time; tabular data on mechanical properties of various aluminum alloys.

Duralumin. *See Duralumin.*

Heat Treatment. Heat Treatment of Aluminum-Copper Alloys (Recherches sur le traitement thermique des alliages aluminium-cuivre), L. Guillet and J. Galibourg. Revue de Métallurgie, vol. 23, no. 3, Mar. 1926, pp. 179-190, 22 figs.; also translated abstract in Metallurgist (Supp. to Engineer, vol. 141, no. 3672), May 28, 1926, pp. 78-79. Investigation of behaviour under heat treatment of alloys of aluminum with copper; study of hardness of alloys; observations on resistivity; measurements of hardness and of dimensions carried out on two pistons made of one alloy containing 13 per cent copper; heat treatments were performed in baths of water, oil or salt; alloys of 5 to 35 per cent copper are harder as cast than cooled in air; tempering at 100 deg. cent. for an hour immediately after quenching decreases hardness below that of alloys in quenched state.

ALUMINUM BRONZE

Acid-Resisting. Acid-Resisting Bronze, W. E. Corse. Iron Age, vol. 117, no. 24, June 17, 1926, p. 1707, 1 fig. Advantage of alcumite in pickling equipment; properties of new aluminum alloy.

AMMONIA COMPRESSORS

Diagrams. Analyzing Ammonia Compressor Diagrams, W. H. Motz. Power, vol. 63, no. 21, May 25, 1926, pp. 812-813, 1 fig. Method developed by author of laying out adiabatic compression curve which will give correct location of points on compression curve to show relation of pressures and volumes of ammonia under actual working conditions, but compressed adiabatically.

AUTOMOBILE ENGINES

Valve Guide, Tooling. Tooling for a Valve Guide, F. H. Colvin. Am. Mach., vol. 64, no. 24, June 17, 1926, pp. 935-936, 6 figs. Fixtures and methods for an unusual design of valve guide used in new Stutz engine; automatic turning and grinding machines used.

AUTOMOBILES

Brakes. A Front Braking Problem, W. G. Aston. Autocar, vol. 56, no. 1596, May 21, 1926, pp. 807-808, 3 figs. How front brakes may lose their efficiency through unequal wear between front and rear brake linings.

AUTOMOTIVE FUELS

Alcohol-Ether Mixture. Making Alcohol-Ether Mixture in Cuba for Motor Fuel, E. Humboldt. Chem. and Met. Eng., vol. 33, no. 6, June 1926, pp. 332-336, 6 figs. How plant was designed and constructed for fermentation of waste molasses in order to take advantage of peculiar economic as well as climatic conditions in tropics.

Anti-Knock. Anti-Knock Motor Fuels Derived from Cracking Shale Oils, J. C. Morrell and G. Egloff. Petroleum Times, vol. 15, no. 383, May 15, 1926, 807-809. Shale oils of American, Australian and French origin have been cracked into yields of gasoline in excess of 50 per cent, based upon charging oil.

Finding an Anti-Knock Material, T. Midgley, Jr. Tech. Eng. News, vol. 7, no. 3, May 1926, pp. 119, 140 and 142. Explanation of cause of knock in internal-combustion engines and story of discovery of its preventive, tetraethyl lead.

Dopes and Detonation. Dopes and Detonation, H. L. Callendar, R. O. King and C. J. Sims. Engineering, vol. 121, nos. 3145, 3146, 3147, 3148 and 3149, Apr. 9, 16, 23, 30 and May 21, 1926, pp. 475-476, 509-511, 542-545, 575-576 and 605-608, 15 figs. Account of investigation made at Air Ministry, Imperial College of Sci. and Technology.

AVIATION

Coast Defense. The Influence of Aviation Upon Coast Defense, W. T. Carpenter. Coast Artillery Jl., vol. 64, no. 5, May 1926, pp. 464-475. It is concluded that net effect of aviation upon coast defense has been to advantage of defense, since aviation has increased power of shore armament over that of naval armament; that fixed primary armament, anti-aircraft artillery and submarine mines are most dependable means for defense of important harbours against naval attack; that observations aircraft and balloons should be permanently assigned to defenses of most important harbours.

Future of. The Future of Air Transport. Engineering, vol. 121, no. 3149, May 21, 1926, pp. 598-599. Review of lecture by W. S. Brancker, presenting survey of British position; figures are given illustrating present position. See also Engineer, vol. 141, no. 3671, May 21, 1926, p. 518.

AXLES

Taper Fits for. Taper Fits for Railway Axles, D. A. Hampson. Machy. (N.Y.), vol. 32, no. 10, June 1926, pp. 804-805, 3 figs. Gauges and work-holding chucks; locating and gauging taper on axle; boring and facing wheels.

B

BEAMS

Bending Moment. Problems in the Theory of Construction, E. S. Andrews. Concrete & Constr. Eng., vol. 21, no. 5, May 1926, pp. 353-358, 4 figs. Deals with problem to find bending moment and shear diagrams for beam which is simply supported at one end and fixed at other end, load being distributed and increasing uniformly in intensity from zero value at simply-supported end to maximum value at other end.

Stress Distribution. Observed Stress Distribution in Web of I-Beam, O. H. Basquin. Eng. News-Rec., vol. 96, no. 22, June 3, 1926, pp. 892-894, 2 figs. One-inch gauge used in three-directional strain measurements; cross stresses found important.

BEARINGS

Anti-Friction. Anti-Friction Bearings on Steel Mill Motors, A. G. Place. Indus. Engr., vol. 84, no. 6, June 1926, pp. 260-262, 5 figs. Operating results obtained by use of anti-friction bearings and factors considered in applying them to all bearings on 32 travelling cranes.

Overhead-Camshaft. Fixtures for Overhead-Camshaft Bearings, F. H. Colvin. Am. Mach., vol. 64, no. 23, June 10, 1926, pp. 905-906, 6 figs. Bronze self-contained bearing, that requires careful work and is made in special fixtures; bearing surface is ground automatically.

BELT DRIVE

Calculation. Safety Factor in Belt Transmission (Le coefficient de sécurité dans la transmission par courroie), G. Balachowsky. Electricité & Mécanique, no. 10, Jan.-Feb. 1926, pp. 1-8, 24 figs. Discusses present method of calculating belting and shows that it may lead to erroneous results so far as safety factor is concerned.

Crossed-Belt. Operating Characteristics of Crossed-Belt Drives, R. F. Jones. Indus. Engr., vol. 84, no. 6, June 1926, pp. 267-271, 6 figs. As determined by series of tests, with particular reference to minimum centre distances which can be used in laying out such drives.

BENZOL

Manufacture. Manufacture of Motor Benzol, E. L. Hall. Chem. & Met. Eng., vol. 33, no. 5, May 1926, pp. 288-292, 5 figs.

BOILER FEEDWATER

Locomotive Boilers. Experiments in Preheating Locomotive Feedwater (Esperimenti con preriscaldatori d'acqua per locomotive), G. Corbellini. Rivista Tecnica Ferrovie Italiane, vol. 29, no. 4, Apr. 15, 1926, pp. 140-150, 5 figs. Experiments carried out by Italian State Railways with apparatus for preheating feedwater with exhaust steam; heat balance and how affected by locomotive operation; economics and efficiency; limitations of preheaters.

BOILER FURNACES

Air Preheaters. Comparative Performance of Air Preheaters, N. E. Funk. Mech. Eng., vol. 48, no. 6, June 1926, pp. 562-566, 11 figs. Results of tests on number of boiler units equipped with air preheaters and one unit using unheated air; curves presented show comparative performances of units, relation between coal fed and flue-gas temperature, relation between gas-temperature drop and air-temperature rise and percentage of rating, and relation between percentage of combustible in ash and coal fed.

Combined Oil- and Gas-Burning. Combined Oil- and Gas-Burning Furnaces for Power-Plant Use, J. G. Rollow. Mech. Eng. (Supp.), vol. 48, no. 6, June 1926, pp. 683-685, 7 figs. Deals with combinations of equipment for best meeting required conditions.

Combustion in. Combustion of Volatiles in Furnaces with Travelling Grate (De la combustion des matières volatiles dans les foyers à grille mécanique), V. Kammerer. Société Industrielle de Mulhouse—Bul., vol. 92, no. 2, Feb. 1926, pp. 111-133, 7 figs. Results of tests carried out in various types of furnaces; concludes that by means of secondary air greater part of unburned gases from coal with high volatile content will disappear, reducing smoke, etc.

Oil-Burning. Practical Handling of Fuel Oil Burning Equipment, A. F. Brewer. Combustion, vol. 14, no. 5, May 1926, pp. 308-312, 5 figs. Deals with furnaces for burning oil fuel; details of construction; checkerwork design; oil-burner location; lining and setting requirements; furnace volume.

Pulverized-Coal. Evolution of Combustion Volumes in Design of Boiler Furnaces for Pulverized Fuel, H. W. Brooks. Engrs.' Soc. West. Pa.—Proc., vol. 42, no. 1, Feb. 1926, pp. 18-45 and (discussion) 46-59, 11 figs. Combustion volumes for stoker furnaces; furnace combustion volumes with pulverized fuel; fundamentals of pulverized-fuel combustion; past and present methods of pulverized-fuel firing.

BOILER PLANTS

Automatic Regulation. Automatic Regulation of a Small Boiler Plant, E. Therkelsen. Power, vol. 63, no. 22, June 1, 1926, pp. 846-847, 3 figs. How one plant solved problem of automatic regulation and achieved increased average economy from 5½ to 6½ lb. equivalent evaporation per pound of coal fired, and gave fireman time to keep plant clean and in perfect repair and make him ready for any emergency.

BOILER PLATE

Embrittlement. The Cause and Prevention of Embrittlement of Boiler Plate, S. W. Parr and F. G. Straub. Am. Soc. Testing Matls.—Preprint, no. 26, for mtg. June 21, 1926, 28 pp. 13 figs. Three types of cracks are recognized; those due to direct corrosion of metal, those due to fatigue, and those caused by caustic solutions; includes photomicrographs of both natural and artificially produced cracks which furnish method of identification and illustrate their special characteristics.

BOILER TUBES

Corrosion. The Influence of Segregation on the Corrosion of Boiler Tubes and Superheaters, G. R. Woodvine and A. L. Roberts. Iron & Steel Inst.—Advance Paper, no. 16, for mtg. May 1926, 4 pp., 6 figs. Results of experiments made in order to determine extent to which pitting and general corrosion in tubes could be ascribed to segregated ingot material. See abstract in Engineering, vol. 121, no. 3150, May 28, 1926, pp. 646-647, 3 figs; also Iron & Coal Trades Rev., vol. 112, no. 3039, May 28, 1926, pp. 841-842.

Stoker-Fired. Another Stoker-Fired Boiler Shows High Efficiency, D. J. Mosshart. Power, vol. 63, no. 24, June 15, 1926, p. 325, 1 fig. Efficiency ranging from 78 to 84 per cent for boiler without economizer or air preheater is shown by series of tests recently conducted by High Bridge Station at St. Paul, Minn.

Waste-Heat. Gas-Fired and Waste-Heat Boilers. Colliery Eng., vol. 3, nos. 25 and 26, Mar. and Apr. 1926, pp. 122-124, and 166-167 and 182, 12 figs. Leading features of various types.

BOILERS, WATER-TUBE

Single- and Multi-Pass. Design and Construction Details of Single- and Multi-Pass Boilers, A. A. Fette. Nat. Engr., vol. 30, nos. 5 and 6, May and June 1926, pp. 201-204 and 245-249, 19 figs. Consideration of all passes produced by baffle walls and water-tube boilers; particulars of Edge Moor and Bigelow-Hornsby boilers, which are prominent examples of this type. (Abstract.) Paper presented before Nat. Assn. Stationary Engrs.

BRAKES

Air. Investigation Made of Brake Pipe Leakage. Ry. Rev., vol. 78, no. 23, June 5, 1926, pp. 999-1003, 3 figs. Report of committee of Air Brake Assn. contains exhaustive study of entire subject; standing tests with brake-system leakage-testing device.

Lining. Coefficient of Friction of Brake Linings (Coefficient de frottement des garnitures de frein), M. Albadie. Industrie des Ferrées et des Transports Automobiles, vol. 20, no. 230, Feb. 1926, pp. 81-86, 4 figs. Results of tests to determine coefficient of friction and resistance to wear of various materials used as brake linings for buses and street cars.

Magnetic. Magnetic Brakes as Developed by West Penn Railway Company, D. Durie. Aera, vol. 15, no. 4, May 1926, pp. 623-625, 3 figs. Twenty-three years' experience with this type of brake on cars operating on steep grades satisfies management that it is reliable under severe conditions.

BRIDGE PIERS

Concreting. How They Concreted 19 Piers, P. L. Pratley. Concrete, vol. 28, no. 5, May 1926, pp. 26-28, 6 figs. Floating mixing plant and industrial railway on trestle permitted mixing and placing of good concrete in first piers for new Montreal-South Shore bridge, now being constructed over St. Lawrence River; use of inundator proved of value.

BRIDGES, HIGHWAY

Concrete. Provincial Highway Bridge, Freeport, A. B. Crealock. Can. Engr., vol. 50, no. 3, Mar. 30, 1926, pp. 431-434, 10 figs. New bridge over Grand River, Ont., has seven reinforced-concrete truss spans, each 69 ft. 8 in.; abutments and piers of mass concrete construction; cold-weather concrete pouring.

Beam and Slab Concrete Highway Bridges, O. Williams. Concrete & Constr. Eng., vol. 21, no. 5, May 1926, pp. 359-363, 7 figs. Deals with question of design of highway bridges to carry Ministry of Transport loading; when to use beams and slabs as against solid slab construction, what centres to put beams if beams are used, are economic questions which arise in design of small-span concrete bridges.

Design and Construction. Designing and Building an Ontario Highway Bridge, A. B. Crealock. Concrete, vol. 28, no. 6, June 1926, pp. 26-30, 13 figs. Situation affecting requirements of design of Freeport bridge; parabolic arch ribs; general features of construction; winter protection of concrete; bridge is composed of seven spans.

Developments. Recent Developments in Highway Bridge Engineering, J. R. Burkey. Mun. & County Eng., vol. 70, no. 4, Apr. 1926, pp. 233-2377.

BUILDING CONSTRUCTION

Fire-Test Specification. Specifications for Fire Tests of Building Construction and Materials. Nat. Fire Protection Assn.—advance paper for mtg. May 10-13, 1926, 12 pp., 1 fig.

BUILDINGS

Wind Bracing. Wind Bracing in Industrial and Many-Storied Buildings, R. Fleming. Boston Soc. Civ. Engrs.—Jl., vol. 13, no. 5, May 1926, pp. 199-215, 12 figs. Relation between wind velocity and pressure; typical mill building bent with kneebraces; wind bracing for modern high buildings; working stresses.

C

CABLES, ELECTRIC

High-Tension. Tests of Paper-Insulated High-Tension Cable, F. M. Farmer. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 5, May 1926, pp. 454-461, 11 figs.

CABLEWAYS

Coal Mines. Aerial Ropeway at Marine Colliery, Iron & Coal Trades Rev., vol. 112, no. 3038, May 21, 1926, pp. 771-773, 8 figs. Cableway is of bi-cable type, has capacity of 130 tons per hour when rope is running at speed of 110 yd. per min.; it is arranged to discharge both on outgoing and return sides.

PASSENGER. Funicular Lines for Passenger Transport from the Standpoint of Safety (Le funicolari aeree per trasporto di persone dal lato della sicurezza), I. Bertolini. Ingegneria, vol. 5, no. 3, Mar. 1926, pp. 102-109, 23 figs. Discusses bearing and traction cables, their construction and properties; telpherage systems by Bleichert, Ceretti and Cortirra; funicular line of Mont Blanc between Chamonix and Aignille de Midi for cars with 18 passengers.

CAR WHEELS

CHILLED. Chilled Wheel Design Improved, F. K. Vial. Ry. Rev., vol. 78, no. 23, June 5, 1926, pp. 1007-1008, 5 figs. Reinforcing rings and lip-type chillers add to service life of wheels.

CARBON MONOXIDE

RECORDERS. Development and Characteristics of a Carbon Monoxide Recorder, S. H. Katz, D. A. Reynolds, H. W. Frevert and J. J. Bloomfield. Am. Soc. Heat & Vent. Engrs.—Jl., vol. 32, no. 5, May 1926, pp. 349-374, 16 figs. Previous development of principle of indicating presence of combustible gases in air by differential temperature effect induced by gases when in contact with catalyst to promote oxidation; principle of CO recorder, mechanism and structure; laboratory tests of recorder and characteristics; performance of CO recorders during extended use.

CARS

CENTRE OF GRAVITY. The Determination of Height of the Centre of Gravity of Cars and Locomotives, G. L. Fowler. Ry. & Locomotive Eng., vol. 39, no. 5, May 1926, pp. 134-135, 3 figs. Explains simple method used, which is more rapid and accurate than any calculation based upon weights and relative locations of several parts entering into structure can possibly be; principle of method is that of tilting vehicle on one side and determining relation between weight thus imposed on lower wheels and vehicle as a whole.

CASE-HARDENING

GEAR STOCK. Reducing the Cost of Carburizing Transmission Gear Stock, J. B. Nealy. Iron Trade Rev., vol. 78, no. 22, June 3, 1926, pp. 1431-1432, 4 figs. Standardization of all factors involved in carburizing process is necessary for scientific duplication of results desired; describes heat-treating department of well-known automobile plant, where two large oil-fired carbonizing furnaces are installed.

CAST IRON

ANALYSIS. The Rapid Determination of Structural or Constitutional Analysis of Cast Iron. Brit. Cast Iron Research Assn.—Bul., no. 12, Apr. 1926, pp. 14-15. In any consideration of relationship between constitution and mechanical or other properties of gray iron it would be found worth while to consider properties as related to structural analysis, either by weight or volume, instead of to chemical analysis in skeleton form.

DESULPHURIZATION. Desulphurization Experiments on Cast Iron. Foundry Trade Jl., vol. 33, no. 510, May 27, 1926, p. 379, 1 fig. Experiments with cast iron with respect to (1) degree of desulphurization in strongly superheated iron baths high in sulphur content without addition of flux; (2) in just liquid iron (high in silicon); (3) composition of segregates product; (4) degree of desulphurization in cast iron of normal composition; (5) influence of movement of liquor iron upon desulphurization. Translated abstract from article by T. Meierling and W. Dennecke in Giesserei-Zeitung.

MECHANICAL PROPERTIES AND ANALYSIS. The Relation Between the Mechanical Properties and the Analysis of Cast Iron. Brit. Cast Iron Research Assn.—Bul., no. 12, Apr. 1926, pp. 16-20, 5 figs. Presents curves published by Klingenstein which are result of 2,000 routine tests made at Esslingen Iron Foundries in Germany on 1.2-in. diameter test bars. Translated from Giesserei, Feb. 27, 1926.

MECHANITE. New Cast Iron. Iron Age, vol. 117, no. 21, May 27, 1926, pp. 1559-1560, 2 figs. Mechanite, made by adding calcium silicide to iron and brought out by Ross-Meehan Foundries, Chattanooga, Tenn., has average ultimate tensile strength of 50,000 lb. per sq. in., as compared with 20,000 to 25,000 lb. per sq. in. for ordinary gray iron; material preserves its integrity almost up to its high breaking point.

STRUCTURE. The Structure of Cast Iron. Metallurgist (Supp. to Engineer, vol. 141, no. 3672), May 28, 1926, p. 74. Review of lecture by Hanemann before Betriebsverein Deutscher Ingenieure, in which suggestion is made that when gray iron is melted, whole of graphite present does not at once pass into solution, but that minute flakes of graphite remain suspended in liquid, which dissolve only at higher temperatures; photomicrographs show structure of same iron solidified before and after superheating to 1500 deg. cent.

CENTRAL STATIONS

BELGIUM. The Langerbrugge Power Station. Engineer, vol. 141, no. 3673, June 4, 1926, pp. 570-573, 17 figs, partly on supp. plate and p. 582. Station near Ghent, Belgium, contains three boilers, capable of normal aggregate output of 79,200 lb. of steam per hr., working at gauge pressure of 56 kilos per sq. cm., and at temperature of 842 deg. Fahr.; details of equipment; turbo-generator was constructed by Brown, Boveri & Co.

EQUIPMENT. Power Stations and Their Equipment, W. M. Selvey. Instn. Elec. Engrs. Jl., vol. 64, no. 352, Apr. 1926, pp. 485-495. Power-station design; boiler plant, turbines, condensers and alternators, switchgear, etc.

INTERCONNECTED STEAM AND HYDRO. Some Interconnected-System Operating Problems, F. G. Boyce. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 5, May 1926, pp. 462-466, 3 figs. Outlines advantages and disadvantages of interconnected system consisting of steam and hydro-electric stations; investment costs are materially reduced because of less reserve capacity being required to insure continuous service; more efficient operation of generating units is possible and operating costs are reduced.

PULVERIZED-COAL-BURNING. Motors and Control for Pulverized Fuel Plants, M. B. Wyman. Elec. Jl., vol. 23, no. 5, May 1926, pp. 236-243, 6 figs. Operating conditions and service requirements; special features of motors and control in pulverized-fuel plant; special applications of motors for drives of equipment.

SMALL. Outlook Promising for the Small Power Plant, E. Douglas. Power, vol. 63, no. 25, June 22, 1926, pp. 960-961. Trend of central-station business for last five years.

STEAM POWER AND HYDRO SUPPLY. Aspects of Steam Power in Relation to a Hydro Supply, A. H. Markwart. Mech. Eng., vol. 48, no. 6, June 1926, pp. 557-561, 9 figs. In final analysis relative development by utility of hydro and steam-generating capacity is problem of economy; natural resources available, character of load to be carried, rate at which energy must be supplied or load factor, extent to which utilities may depend upon it for stand-by and other related elements furnish criteria for its solution; general tendency seems to be for steam-plant ratio to increase slightly; gives data on central-station construction programme for 11 western states for 3-year period 1924 to 1926.

CHAIN DRIVE

AUTOMATIC IDLER. Holding Chain Drives at Constant Tension, F. W. Curtis Am. Mach., vol. 64, no. 21, May 27, 1926, pp. 823-824, 4 figs. Feature of automatic adjustment is that it not only takes care of any elongation that develops in chain in service, but also insures longer chain life and sustained quiet operation; chain drives with automatic idler can be applied to all styles of metal-working machines in which driving power is between ½ and 25 h.p.

CIRCUIT BREAKERS

RECLOSING EQUIPMENT. Automatic Reclosing Equipment for Alterating-Current Feeders, A. J. A. Peterson and R. F. Frenger. Elec. Jl., vol. 23, no. 4, Apr. 1926, pp. 179-190, 15 figs.

COAL

BLENDING. Coal Blending, D. Brownlie. Iron & Steel Inst.—Advance Paper, no. 2, for mtg. May 1926, 42 pp., 12 figs. Survey of subject of coal blending in connection with carbonization, that is, primarily mixing of swelling bituminous coals with other products such as non-swelling bituminous coals, anthracites and anthracite coals, high-temperature carbonization coke, which may be either metallurgical or household gas coke, low-temperature carbonization fuels, oxidized coals and various constituents of coal. Also abstract in Iron & Coal Trades Rev., vol. 112, no. 3039, May 28, 1926, pp. 837-838.

PULVERIZED. *See Pulverized Coal.*

COAL MINES

SURFACE AND UNDERGROUND SURVEYS. Orientation of Surface and Underground Surveys by Means of Plumb Lines Freely Suspended in Vertical Shafts, G. A. Gilchrist. Iron & Coal Trades Rev., vol. 112, no. 3032, Apr. 9, 1926, p. 608. Tests of various methods for orientation of surface and underground surveys which could be carried out with colliery appliances.

COAL MINING

LUMP-COAL PRODUCTION. Factors Affecting Production of Lump Coal, J. E. Tiffany and B. L. Lubelsky. Carnegie Inst. Technology—Coal-Mining Investigations Bul. 19, 1925, 92 pp., 34 figs.

COKE

COMBUSTIBILITY. Notes on the "Combustibility" of Coke and Direct Reduction in the Blast-Furnace, W. W. Hollings. Iron & Steel Inst.—Advance Paper, no. 8, for mtg. May 1926, 9 pp. Points out that only lines on which it would seem possible to make any considerable saving on side of heat demands of modern blast-furnace would appear to be: (1) considerable enrichment of blast with oxygen; (2) substitution, so far as may be practicable, of pulverized quicklime blown in tuyeres for limestone added at top of furnace.

TESTING. Notes on Coke Testing, W. A. Haven. Am. Iron & Steel Inst.—Advance Paper, for mtg. May 21, 1926, 30 pp., 9 figs.

CONCRETE

MANUFACTURE. Forward Steps in Concrete Making, A. R. Smith. Contract Rec., vol. 40, no. 21, May 26, 1926, pp. 485-488, 4 figs. Water-cement ratio method; proportion of coarse to fine aggregate; selection of materials; colorimetric field test; making watertight concrete; mixing and curing.

CONCRETE CONSTRUCTION

VIBROLITHIC PROCESS. Tests of Vibrolithic Concrete, L. S. Teller and C. E. Proudley. Pub. Roads, vol. 7, no. 2, Apr. 1926, pp. 36-45, 21 figs. Results of 28-day tests on concrete slabs constructed on same materials in accordance with ordinary methods and vibrolithic process patented by American Vibrolithic Corp.; tests were made for purpose of obtaining data on relative strength of specimens equivalent in every particular except method of construction.

CONDENSERS, ELECTRIC

AUTOMATIC CONTROL. Automatic Control for Synchronous Condensers, C. C. Levy. Elec. Jl., vol. 23, no. 4, Apr. 1926, pp. 150-153, 6 figs. Design features of full automatic equipment controlling 10,000-kva. synchronous condenser in Vancouver substation of Northwestern Elec. Co. of Portland, Ore.

CONDENSERS, STEAM

SURFACE. Auxiliary Supercooling in Surface Condensers, A. J. Nicholas. Power, vol. 63, no. 21, May 25, 1926, pp. 804-805, 4 figs. Condensate vs. steam-air temperatures; effect of supercooling on volumetric efficiency of vacuum pump; it is clear that cooling of residual steam-air mixture leaving condenser, before it reaches vacuum pump, is powerful means of either increasing capacity of pump of existing installation or reducing size of pump required for new job.

Present Problem of Surface Condensers (Le problème actuel du condenseur à surface), A. Delas. Revue Industrielle, vol. 56, no. 2201, Apr. 1926, pp. 153-159, 6 figs. Discusses conditions of effective operation, cleanliness of surfaces on both sides; uniform hourly rate of condensation per unit of surface and uniform speed of steam; gives examples with calculations.

CONVERTERS

SYNCHRONOUS. Modern Problems of Synchronous Converters, E. B. Shand. Eng. Jl., vol. 9, no. 6, June 1926, pp. 281-288, 10 figs. Outline of recent developments and means adopted to overcome various problems.

CONVEYORS

TRAMRAIL SYSTEM. Special Carrying Rail, A. F. Anjeskey. Iron Age, vol. 117, no. 23, June 10, 1926, p. 1651, 1 fig. New development in overhead conveying systems reduces wear and increases life; it eliminates entirely troubles encountered with I-beam.

COPPER METALLURGY

POWDERED COPPER IN ANODE MUD. Formation of Powdered Copper in Anode Mud, M. DeKay Thompson. Chem. & Met. Eng., vol. 33, no. 5, May 1926, p. 298. Usual explanation of precipitation of finely-divided metal at anode is shown to be correct.

CRANKSHAFTS

TORSIONAL VIBRATION. Torsional Vibration fo Crankshafts, P. M. Heldt. Automotive Industries, vol. 54, no. 23, June 10, 1926, pp. 957-965, 10 figs. Points out that lower harmonics of gas-pressure curve and not inertia force are principal factor.

CULVERTS

JACKING THROUGH EMBANKMENT. Reducing the Cost of Culvert Placement, A. S. Rosing. Good Roads, vol. 69, no. 5, May 1926, pp. 181-184, 191 and 203, 15 figs. Recommended practice based on actual field experience with jacking method of culvert placement, which differs from other methods in that culvert is forced completely through embankment without constructing open trench.

CUPOLAS

PRACTICE AND METALLURGY. Cupola Practice and Metallurgy. West. Machy. World, vol. 17, no. 5, May 1926, pp. 211-212, 1 fig. Height of coke bed, volume of air and weight of charges of metal and fuel in cupola operations are items that require manipulation, based upon fixed principles; how to figure melting capacity of any size cupolas.

SHAFT FURNACES. Melting Practice in the Iron Foundry, with Special Reference to the Shaft Furnace, J. Mehrtens. Foundry Trade Jl., vol. 33, no. 511, June 3, 1926, p. 399. Effect of melting in shaft furnace on quality of cast iron; author claims old cupola or shaft furnace still maintains its position as being simplest and cheapest melting device in iron foundry; recent improvements in shaft furnace.

CURVES

CATENARY AND PARABOLA. Properties of the Catenary and Parabola, R. Fleming. Can. Engr., vol. 50, no. 21, May 25, 1926, pp. 591-593, 2 figs. Useful mathematical and geometrical relationships for each curve; comparison of curves; error involved in substituting parabolo for catenary; common assumptions of practice; when to approximate; older books valuable in study of curves.

CUTTING METALS

OXY-ILLUMINATING GAS. Metal Cutting with Oxy-Illuminating Gas, F. P. Wilson, Jr. Gen. Elec. Rev., vol. 29, no. 6, June 1926, pp. 443-445, 6 figs. Action of metal-cutting torch; design of new torch; comparison of illuminating gas and other gases; superheating; advantages of new torch.

D

DIESEL ENGINES

APPLICATIONS. Applications, Economics and Operation of Modern Diesel Engines, G. A. Adkins and R. H. Bacon. Nat. Engr., vol. 30, no. 5, May 1926, pp. 189-195, 6 figs. Applications of modern types of various classes of service; factors to be considered in selection of units; fuel consumption, lubrication and operating requirements; operating costs, first costs, fixed charges and total cost of service under various operating conditions. Paper presented during Oil & Gas Power Week.

DOUBLE-ACTING. The North-Eastern Double-Acting Marine Diesel Engine. Engineering, vol. 121, no. 3150, May 28, 1926, pp. 634-635, 3 figs. on supp. plates. Diesel engine working on 4-stroke cycle, capable of developing 5,800 i.h.p. in its 6 cylinders, built for installation in motorship Stentor. See also description in Engineer, vol. 141, no. 3672, May 28, 1926, p. 559, 3 figs. on pp. 554 and 558.

PIPE-LINE PUMP DRIVE. Oil Engines as a Drive for Pipe-Line Pumps, F. Thilenius. Mech. Eng. (Supp.), vol. 48, no. 6, June 1926, pp. 663-670, 11 figs. Survey of use of Diesel engines for this purpose, covering facts pertaining to pipe-line systems leading out of Mid-Continent area, together with discussion of pipe-line practice and of forms of power previously employed.

DISKS

ROTATING. The Rims of Rotating Disks. Engineering, vol. 121, no. 3151, June 4, 1926, p. 649, 3 figs. Points out that width of rim which can be effectively supported by central web is point of importance in design of rotating disks; problem involved was virtually solved by J. Y. Nicholson, who derived expression for deformation of boiler shell in immediate neighbourhood of end plates, and this problem is mathematically identical with that involved in determining width of rim which can be effectively supported by web plate of rotating disk.

DOCKS

CAISSONS FOR. The Two Great Caissons for the New Canadian Government Graving Dock at Esquimalt, British Columbia. Eng. Jl., vol. 9, no. 6, June 1926, p. 308, 3 figs. Steel caissons are reversible; each has total of six decks and is equipped with two vertical-operated centrifugal pumps of 1,600-gal. per min. capacity.

DRAINAGE

PERFORATED PIPE FOR. Perforated Pipe for Subdrainage, A. S. Rosing. Contract Rec., vol. 40, no. 19, May 12, 1926, pp. 440-445, 11 figs. Advantages and application of new method of roadbed drainage; phases of railroad work for which pipe is especially suitable.

DRILLING MACHINES

PORTABLE. Portable Drilling Machines. Machy. (Lond.), vol. 28, no. 709, Apr. 29, 1926, pp. 144-147, 7 figs. Application to locomotive and heavy engineering work; types made at Selson Eng. Co., London.

RAILWAY SHOPS. The Drilling Machine in the Railway Shop, L. R. Gurley. Ry. Mech. Engr., vol. 100, no. 6, June 1926, pp. 351-358, 25 figs. Requirements for efficient operation; jigs fixtures and practical set-ups.

DROP FORGINGS

METALS. Drop Forging Metals, D. Forger. Metal Industry (N.Y.), vol. 24, nos. 4, 5 and 6, May and June 1926, pp. 141-142, 183-184 and 242-243, 1 fig. Describes British practice. Apr. and May: Aluminum alloys; importance of temperature control; types of furnace; design problems; dies; heat treating; machining and finishing; precautions in handling. June: Copper and brass.

DURALUMIN

HEAT TREATMENT, EFFECT OF. Some Mechanical Properties of Duralumin Sheet as Affected by Heat Treatment, R. J. Anderson. Am. Soc. Testing Matls.—Preprint no. 36, for mtg. June 21, 1926, 27 pp., 17 figs.

WORKING. Some Notes on Working Duralumin. Machy. (Lond.), vol. 28, no. 705, Apr. 1, 1925, pp. 15-16. Practical hints on its heat treatment, machining, rivetting and welding.

E

EDUCATION, ENGINEERING

EVOLUTIONARY TRENDS. Evolutionary Trends in Engineering Curricula, W. E. Wickenden. Jl. Eng. Education, vol. 16, no. 10, June 1926, pp. 658-668, 8 figs. Presents diagrams indicating general trends in evolution of engineering curricula during past fifty years.

GENERAL EDUCATION. The Engineering Course as a General Education, E. W. Whited. Jl. Eng. Education, vol. 16, no. 9, May 1926, pp. 615-620. Points out that engineering course is being recognized more and more as excellent system for general education; principal explanation of this fact is that type of mental training given in engineering course fits man for large number of vocations in life, even outside of engineering.

MECHANICAL ENGINEERING. Graduation Requirements in Mechanical Engineering, W. C. John. Jl. Eng. Education, vol. 16, no. 9, May 1926, pp. 581-60, 3 figs. Summary and analysis of graduation requirements in mechanical engineering; comparison of graduation requirements in publicly and privately supported institutions.

ELECTRIC ARC

PHOTOGRAPHY. Photography of Arcs, W. H. Tenney. Elec. Jl., vol. 23, no. 5, May 1926, pp. 249-253, 11 figs. Determination of characteristics of high-voltage arcs through assistance of photography.

ELECTRIC DISTRIBUTION SYSTEM

PROTECTIVE EQUIPMENT. Protective Equipment for Direct-Current Networks, M. N. Ewell. Elec. Jl., vol. 23, no. 5, May 1926, pp. 227-230, 7 figs.

ELECTRIC DRIVE

BOX FACTORY. Motor Driving Problems in Box Factory. Elec. World, vol. 87, no. 20, May 15, 1926, pp. 1043-1045, 5 figs. Power requirements; basic reasons for determining selection of motors for individual or group applications; trend toward driving.

ELECTRIC FURNACES

INDUCTION. On the Quantitative Theory of Induction Heating, C. R. Burch and N. R. Davis. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. Sci., vol. 1, no. 4, Apr. 1926, pp. 768-783, 3 figs. Investigates energetics of induction furnace, discusses conditions under which transfer of energy from inductor to charge is maximal, and influence of various operating parameters on power factor of loaded inductor.

RESISTANCE. Electric Conditions for Resistance-Furnace Operations (Le condizioni elettriche di funzionamento dei forni a resistenza), G. Rebora. Elettro-tecnica, vol. 13, no. 7, Mar. 5, 1926, pp. 137-141, 19 figs. Discusses electric phenomena in resistance furnaces and monophase a.c. operation, for production of carbide, ferroalloys, abrasives, etc.; develops calculations for principal elements.

ROTARY. Electric Rotary Furnaces Prove Highly Successful, I. S. Wishoski. Fuels & Furnaces, vol. 4, no. 6, June 1926, 66. 683-688, 4 figs. Automobile parts accurately carburized in three large rotary furnaces; small rotary furnace gives excellent results in heat treating ring gears.

ELECTRIC GENERATORS, A.C.

AUTOMATICALLY SYNCHRONIZING. Methods of Automatically Synchronizing Water-Wheel Generators, M. E. Reagan. Elec. Jl., vol. 23, no. 4, Apr. 1926, pp. 172-179, 6 figs.

LOSSES. A Contribution to Research on the Experimental Determination of the Losses in Alternators, E. Roth. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 5, May 1926, pp. 422-429, 8 figs. Deals with determination by simple tests of actual losses in alternators; reviews existing rules and states variation of losses in alternators as function of load and as function of power factor; records of experimental researches made by author which serve on one hand as basis for discussion of theoretical considerations which he develops and on other hand to compare actual losses with those obtained by methods given in rules at present in force.

ELECTRIC LOCOMOTIVES

FRANCE. Express Electric Locomotives for the Midi Railway Company of France. Engineering, vol. 121, no. 3150, May 28, 1926, pp. 622-625, 6 figs. Locomotives built at Tarbes Works of Constructions Electriques de France for Midi Railway; design embodies 3 pairs of driving wheels; power is transmitted through springs.

HIGH-SPEED. High-Speed Electric Locomotives. Int. Ry. Congress—Bul., vol. 8, no. 5, May 1926, pp. 431-459. Discussion by section and at general meeting.

ELECTRIC MOTORS

CONTROLLERS. Improving Control Operation by Changing Resistance on Motor Controllers, O. C. Callow. Indus. Engr., vol. 84, no. 6, June 1926, pp. 276-278, 2 figs. Causes of troubles encountered in blast furnace and coke plant, and diagrams showing method of overcoming them.

SLIP REGULATOR. The Mechanics of the Slip Regulator, L. A. Umansky. Gen. Elec. Rev., vol. 29, no. 6, June 1926, pp. 405-415, 18 figs.

ELECTRIC MOTORS, A.C.

INDUCTION. The Induction Motor Problem—Installation, M. Sampson. Textile World, vol. 69, no. 23, June 5, 1926, pp. 61, 63 and 65, 2 figs. Discussion of motor installation from engineering angle; characteristics of chains, gearing and belting drives for textile service; effect of location on humidity; individual motor drive incorporated in design of machine; application and installation of controls.

STATOR CONSTRUCTION. Alternating-Current Motors — Stator Construction, B. A. Briggs. Power, vol. 63, no. 21, May 25, 1926, pp. 814-817, 11 figs.

ELECTRIC RAILWAYS

DEPRECIATION. Depreciation as an Operating Expense, W. H. Maltbie. Elec. Ry. Jl., vol. 67, nos. 9, 10 and 13, Feb. 27, Mar. 6 and 27, 1926, pp. 354-356, 399-402 and 542-544. Feb. 27: Causes of depreciation. Mar. 6: Methods of setting up funds to provide for depreciation. Mar. 27: Determination of size of general reserve; practical method and replacement reserve; reserves under investment and reproduction theories for rate base.

ILLINOIS. From Receivership to Prosperity in Three Years. Elec. Ry. Jl., vol. 67, nos. 9, 10, 11 and 14, Feb. 27, Mar. 6, 13 and Apr. 3, 1926, pp. 357-362, 393-395, 439-443 and 593-595, 19 figs.

TRACTON RECORDERS. Improved Instrument for Car Operation Tests, A. W. Swan. Elec. Ry. Jl., vol. 67, no. 20, May 15, 1926, pp. 845-846, 5 figs. Improved traction recorder charts five individual records, namely, line voltage, station stops, total current, brake applications and speed in miles per hour.

ELECTRIC TRANSMISSION LINES

DESIGN. Construction of Power Transmission Lines, C. M. Goodrich. Can. Engr., vol. 50, no. 19, May 11, 1926, pp. 561-563, 6 figs. Considerations involved in design; loading classifications; various types of tower and pole; aluminum and copper cables. Paper presented at Montreal Branch of Eng. Inst. Canada.

STRINGING TENSIONS. Stringing Tensions for Unequal Spans, A. Still. Elec. World, vol. 87, no. 20, May 15, 1926, pp. 1049-1050, 1 fig.

TOWERS. Steel Transmission Towers for Williamette River Crossing at Portland, Oregon, H. F. Blood and A. H. T. Williams. West. Constr. News, vol. 1, no. 7, Apr. 10, 1926, pp. 30-33, 5 figs. 66,000-volt line carried across river on three large steel towers, allowing clearance for oceangoing ships in main channel.

TRANSMISSION STABILITY. A Mechanical Analogy to the Problem of Transmission Stability, S. B. Griscom. Elec. Jl., vol. 23, no. 5, May 1926, pp. 230-235, 11 figs.

ELECTRIC TRANSMISSION SYSTEMS

OVERHEAD. Overhead Systems Committee Reports. Jl. Electricity, vol. 56, no. 10, May 15, 1926, pp. 415-428, 7 figs.

ELECTRIC WELDING, ARC

COPPER CASTINGS. Arc Welding Heavy Copper Castings, P. M. Rauscher. Welding Engr., vol. 11, no. 5, May 1926, pp. 17-18, 5 figs. How copper blast-furnace castings are repaired by metallic arc process; work has to be kept hot for welding.

ELECTRICAL MACHINERY

THERMAL CAPACITY. Can the Thermal Capacity of Electric Machines be Made a Simple and Practical Element of Rating? A. E. Kennelly. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 5, May 1926, pp. 438-445, 12 figs. It is believed that thermal constants of electric machines in variable regime (especially their binary time constants), can, in many cases, be used in very simple way for practical purposes; it is not recommended that such thermal constants be introduced into rating of machines at present time, but that they should be regarded as useful subsidiary information concerning machines. Bibliography.

ELECTRICAL MEASUREMENTS

Three-Phase Power. A Method for Determining the Sign of the Smaller Wattmeter Reading in Balanced Three-Phase Power Measurements, H. K. Humphrey. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 5, May 1926, pp. 430-431, 1 fig.

ELECTRICITY SUPPLY

Concentrated Power System. Operating a Concentrated Power System, P. B. Juhnke. Elec. World, vol. 87, no. 25, June 19, 1926, pp. 1343-1347, 3 figs. Functions of load dispatcher; 60-cycle load dispatching more complicated than 25-cycle; load schedules and automatic load totalizing help; protecting service from bus short circuits; safeguarding downtown supply.

Economics. Economics of Electricity Supply, S. Insull. Elec. World, vol. 87, no. 21, May 22, 1926, pp. 1129-1132. Survey of national situation demands greater sales efforts; markets are available and industry situation calls for development programme; interconnection possibilities. Address made at Nat. Elec. Light Assn.

Interchange-Energy Contrast. Interchange of Energy, E. J. Fowler. Elec. World, vol. 87, no. 22, May 29, 1926, pp. 1187-1189.

ELEVATORS

Equipment. High-Speed Alternating-Current Elevator Equipment, E. Thurston. Power, vol. 63, no. 22, June 1, 1926, pp. 848-849, 3 figs. Non-scaling type of magnet, built like polyphase induction motor, is applied to operating controller contractors and brake; multi-speed squirrel-cage motors are used having speed ratios as high as six to one.

EXPLOSIVES

Pressure Wave. The Pressure Wave Sent Out by an Explosive, W. Payman and H. Robinson. Safety in Mines Research Board Paper, no. 18, 1926, 60 pp., 51 figs. Deals with experimental work carried out in laboratory in order to work out satisfactory experimental method and gain necessary experience for carrying out experiments with normal charges of explosives in field experiments and to obtain some more fundamental knowledge of phenomenon under investigation in order to be able to apply results of later work to consideration of methods of minimizing dangers involved in use of explosives in coal mines.

F

FANS

Resistance. Resistance in Fan Engineering, O. Stott. Colliery Eng., vol. 3, no. 26, Apr. 1926, pp. 177-182, 21 figs. Author tries to analyze what should be meant by resistance and also how it may be conveniently measured and indicated.

FILTRATION PLANTS

Welland, Ont. New Filtration Plant at Welland, Ont., E. R. Smallhorn. Can. Engr., vol. 50, no. 23, June 1, 1926, pp. 621-622, 4 figs. Comprises high-lift pumping station and filtration plant of 4 units each having capacity of 1,500,000 gal., making total of 6,000,000 gal. per day; total filtered water storage is 1,592,000 gal.; De Laval low- and high-lift pumps.

FIRE EXTINGUISHERS

CO_2 System. Carbon Dioxide Fire Extinguisher System, P. W. Eberhardt. Elec. World, vol. 87, no. 20, May 15, 1926, pp. 1058-1059, 4 figs.

FLOORS

Gypsum Concrete. Fire Test of Light-weight Floor of Poured Gypsum Concrete, A. H. Beyer. Eng. News-Rec., vol. 96, no. 24, June 17, 1926, pp. 993- , 2 figs.

FLOW OF AIR

Pipes. A Thermionic Valve Method of Measuring the Velocity of Air-Currents of Low Velocity in Pipes, J. A. C. Tergan. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. Sci., vol. I, no. 5, May 1926, pp. 1117-1120, 1 fig. Describes hot-wire anemometers of new type which has been found satisfactory for measurement of slow-moving streams of air in pipes.

Research. Tasks of Air Flow Research, L. Prandtl. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 365, June 1926, 11 pp. Describes tasks of Kaiser Wilhelm Institute for Air Flow Research, which is dedicated first of all to systematic study of phenomena of flow in contradistinction from other institutes. Translated from Naturwissenschaften, vol. 14, no. 16.

FLOW OF FLUIDS

Viscous Fluids. The Motion of Two Spheres in a Viscous Fluid, M. Stimson and G. B. Jeffery. Roy. Soc.—Proc., vol. 3, no. A757, May 1, 1926, pp. 110-124, 2 figs. Determination of motion set up in viscous fluid at rest at infinity by two solid spheres (equal or unequal) moving with equal small constant velocities parallel to their line of centres; solution is based on determination of Stokes' stream function for motion of fluid, and from this, forces necessary to maintain motion of spheres are calculated.

FLOW OF WATER

Kinetographic Flow Pictures. Kinetographic Flow Pictures, L. Prandtl and O. Tietjens. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 364, May 1926, 6 pp. 12 figs. According to method worked out by F. Ahlborn, flow of water can be photographed by strewing on its surface fine particles and making short time exposures; each particle travels certain distance during exposure and is photographed as short straight line; total of all these short lines produces picture which shows direction of flow at every point and also its velocity; describes device employed by authors to make such pictures. Translated from Naturwissenschaften, vol. 13.

Reducing the Formulas Most Generally Used for Calculating Channels and Conduits to a Monomial Form (Riduzione a forma monomia delle formole piu frequentemente usate per il calcolo dei canali e delle condotte), F. Contessini. Annali dei Lavori Pubblici, vol. 64, no. 1, Jan. 1926, pp. 15-25, 4 figs. Reduces formulas by Darcy, Bazin and Kutter and their derivatives to common equation, and gives table for coefficient of roughness, etc.

FLYWHEELS

Manufacture. Two Methods of Making Flywheels, F. H. Colvin. Am. Mach., vol. 64, no. 21, May 27, 1926, pp. 821-823, 8 figs. Fixtures and methods used in making both Hupp and Stutz flywheels; machines used in turning, drilling and balancing wheels.

FOREMEN

Training. Foremen Training is Essential to Plant Self-Government, C. McCormick, Jr. Am. Mach., vol. 64, no. 22, June 3, 1926, pp. 863-864. Prime object of foreman training is to obtain correct application of company policies; influence of foremen on production, quality and cost; promotion within ranks.

FORGING

Factors. Some Factors in Forging Steel, O. W. Ellis. Forging—Stamping—Heat Treating, vol. 12, no. 5, May 1926, pp. 158-163, 9 figs. Deals with factors affected by forging machine and those affected by material being forged.

FOUNDRIES

Electric Steel. Foundry Has Electric Ovens. Iron Age, vol. 117, no. 24, June 17, 1926, pp. 1703-1707, 4 figs. Completeness of electrical application is feature of Ross-Meehan steel foundries; core drying and annealing is done electrically; hard-iron grinding in malleable plant.

Ingot-Mold. First Ingot-Mold Foundry in West, R. A. Fiske. Iron Age, vol. 117, no. 23, June 10, 1926, pp. 1642-1644, 7 figs. Careful centreing of core bar in core box, pattern in flask and core in mold insure uniform wall thickness in ingot-mold; methods and equipment of foundry at South Chicago, Ill. See also description in Iron Trade Rev., vol. 78, no. 23, June 10, 1926, pp. 1499-1501, 7 figs.

Machine Shops, Co-operation with. Machine Tools and Foundry Practice. Metallurgist (Supp. to Engineer, vol. 141, no. 3672), May 28, 1926, p. 67. Consideration of facts suggests that adoption of grinding methods for treatment of castings, combined with casting much closer to dimensions in foundry, offers method of economy which engineers and foundrymen together should consider most carefully.

FUELS

Carbonization. Carbonization of Canadian Fuels, R. E. Gilmore. Can. Chem. & Met., vol. 10, nos. 2, 3, 4 and 6, Feb., Mar., Apr. and June 1926, pp. 31-34, 51-54, 85-87 and 140-144. Application of principles of high- and low-temperature carbonization to wood, peat and different classes of Canadian fuels; gasoline and substitute motor fuels in Canada, with special reference to synthetic methanol and synthol.

Gaseous. Industrial Fuels, H. H. Clark. Engrs'. Soc. West. Pa.—Proc., vol. 42, no. 2, Mar. 1926, pp. 100-108 and (discussion) 109-118, 7 figs. Principal gaseous fuels are natural, city and producer gas; use of city gas in Chicago.

Heating Value. Calorimetric Determinations of the Heating Value of Fuels, W. J. Wohlenberg. Combustion, vol. 14, no. 5, May 1926, pp. 317-319, 1 fig. Their exact relation to energy releasable in boiler furnace.

See also Coal; Lignite; Oil Fuel; Pulverized Coal.

FURNACES, HEATING

Continuous. Continuous Bloom and Billet Heating Furnaces, E. W. Trexler. Iron & Steel Engr., vol. 3, no. 6, June 1926, p. 300. Points out that elimination of water cooling in heating furnace is important from efficiency standpoint, as heat absorbed by cooling water is from 2 to 5 per cent of total heat supplied by fuel.

Re-Heating. Re-Heating Furnaces, F. G. Bell and R. Waddell. Iron & Coal Trades Rev., vol. 112, nos. 3032 and 3033, Apr. 9 and 16, 1926, pp. 609-610 and 648-650, 12 figs. Results of experiments carried out by Brown, Bayley's Works show that they have been able to reduce consumption of fuel reheating furnaces to a figure as low as, or lower than, can be obtained by any competitive system; that they can operate continuously, except for an hour or two at lighting up, with ordinary slack; that just as good results have been obtained in heating of their steel as with any other type of furnace tried; and that latest types of recuperative furnace fired with slack are definitely proved to be practically smokeless in operation.

G

GAS PRODUCERS

Operation. Gas Producer Operation, F. E. Leahy. Iron & Steel Engr., vol. 3, no. 6, June 1926, pp. 294-299, 11 figs. Results obtained from recording instruments installed to guide operators and check practice to secure results in daily practice close to what are obtained on tests made under skilled observers; discussion of charts obtained from steam flow meters and pressure recorders; effect of steam on gas produced; regulation of steam from gas pressure.

GASES

Ignition. Ignition of Gases by Sudden Compression, H. T. Tizard and D. R. Pye. Lond., Edinburgh and Dublin Philosophical Mag. & Jl. Sci., vol. 1, no. 5, May 1926, pp. 1094-1105, 4 figs. Experiments in which both time and pressures could be measured with greater accuracy than previously; results of typical experiments by which behaviour of mixtures of ether and air on compression in old and new apparatus can be compared.

GEAR CUTTING

Hypoid Rear-Axle. Design, Production and Application of the Hypoid Rear-Axle Gear, A. L. Stewart and E. Wildhaber. Soc. Automotive Engrs.—Jl., vol. 18, no. 6, June 1926, pp. 575-580 and 600, 8 figs. After defining hypoid gears and outlining their action, characteristics and advantages, authors compare them specifically with spiral-bevel gears and describe how axis of pinion is offset from axis of gear and how direction of offset determines whether spiral is right-handed or left-handed; newest method for producing hypoid gears; finish-cutting of pinion is only major operation which requires machinery different from that used for spiral-bevel gears and pinions.

Silent. Greater Economy in Present Method of Fabricating Silent Gears, H. R. Moyer. Automotive Industries, vol. 54, no. 22, June 3, 1926, pp. 934-937, 13 figs. Waste is largely eliminated by cutting material into small segments and molding to form annulus; new development is pressed steel centre; centres of molded material also used; development of Micarta gear.

Teeth, Wear of. The Relation of Load to Wear on Gear Teeth, E. Buckingham. Am. Mach., vol. 64, no. 20, May 20, 1926, pp. 777-780, 2 figs. Experiments show that in order to transmit power without appreciable wear, maximum specific stress given by Hertz equation should not exceed elastic limit. Paper presented before Am. Gear Mfrs.' Assn.

Wear of Gear Teeth, E. Buckingham. Machy. (N.Y.), vol. 32, no. 10, June 1926, pp. 798-799. Maximum loads that do not produce too rapid wear; investigations of gear drives for durability; formula and constants for determining maximum safe load and example of use of formula and tables. (Abstract.) Paper presented before Am. Gear Mfrs.' Assn.

GRINDING MACHINES

Disk. Disk-Grinding on Production Work, W. F. Sandmann. Machy. (N.Y.), vol. 32, no. 10, June 1926, pp. 800-801, 7 figs. Double-end disk grinder; automatic grinder.

GEOLOGY

Outrageous Hypotheses. The Value of Outrageous Geological Hypotheses. Science, vol. 63, no. 1636, May 7, 1926, pp. 463-468. Points out that in order to make such progress in geology in next 30 years as has been made in physics during last 30 years, violence must be done to many of accepted principles; inasmuch as great advances have been made by outraging in one way or other body of preconceived opinions, it is almost sure that advances yet to be made in geology will be at first regarded as outrages upon accumulated convictions of to-day.

GUNITE

Fireproofing Properties. Fireproofing Properties of Cement, B. C. Collier. Can. Engr., vol. 50, no. 13, Mar. 30, 1926, pp. 443-444. Encasement of structural steel members with gunite; conditions obtained with this method. Paper read before Am. Inst. Steel Construction.

GRAIN ELEVATOR

TRANSFER. Transfer Elevator at Owen Sound, Ont. Can. Engr., vol. 50, no. 20, May 18, 1926, pp. 571-574, 7 figs. New 1,000,000-bu. elevator built by Barnett-McQueen Constr. Co. connects with both Can. Nat. & Can. Pac. railway systems; plant is of reinforced concrete and fireproof throughout; main structure consists of 26 circular tanks.

H

HAMMERS

ELECTRO-PNEUMATIC. 30-Cwt. Power Hammer. Engineer, vol. 141, no. 3671, May 21, 1926, pp. 533-534, 2 figs. Electro-pneumatic hammer of overhanging type, with arch form of frame, made by B. & S. Massey.

HEAT

RADIATION, ENTROPY OF. On Entropy of Radiation, M. Saha and R. Kanto Sur. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. Sci., vol. 1, no. 4, Apr. 1926, pp. 890-893. Develops theorem which shows that if radiation is used as working substance, absolute zero can be obtained in space where all radiation has been completely annihilated.

HEAT TRANSMISSION

COEFFICIENTS FOR REFRIGERATION. Vital Heat Transfer Data for the Refrigerating Engineer, H. J. Macintire. Power, vol. 63, no. 22, June 1, 1926, pp. 857-858. Heat-transfer action; transfer in counter-current condensers; advantage of shell-and-tube type; coefficients in other apparatus.

RESEARCH. Some Results of Heat Transmission Research, F. B. Rowley. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 5, May 1926, pp. 339-348 and 374, 12 figs. Relates progress made at University of Minnesota.

HEATING AND VENTILATION

CANADA. Development of the Art of Heating and Ventilating in Canada, L. M. Arkley. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 6, June 1926, pp. 431-450, 17 figs.

HEATING

HUMID AIR. Humid Air as a Heating Medium, F. Brown. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 5, May 1926, pp. 331-338, 5 figs. Presents data showing how humid air as heating medium accomplishes primary object of development, economy of operation, by reducing steam consumption for comfortable heat; and secondary object, lesser temperature differential between floor and ceiling temperatures, or comfortable knee-height temperature by operation of radiator at temperatures lower than is possible in conventional steam installation.

HEATING, ELECTRIC

EQUIPMENT. Report of Electric Heat Committee for 1926, W. P. Chandler, Jr. Iron & Steel Engr., vol. 3, no. 6, June 1926, pp. 224-239, 9 figs. Statement by Central Power Station Duquesne Light Co., listing advantages of electric heat treatment; arc melting furnaces; renewal of interest in possibilities of duplexing with electric arc furnace; electric-steel melting furnace placed in operation at plant of Reading Steel Casting Co., Reading, Pa.; statement by Timken Roller Bearing Co. on making of steel by basic electric process; induction furnaces; resistance furnaces, (high-temperature applications); heat-treating furnaces for tool rooms; electric hot tops for molds; roll heaters; wire drying and annealing; galvanizing kettles; electric arc welding in steel industry, etc.

INDUSTRIAL LOAD. A Few Suggestions for Developing Industrial Heating Load, E. Fleischmann. N. E. L. A. Bul., vol. 13, no. 4, Apr. 1926, pp. 219-222. Suggests methods of developing and retaining good will of customers toward electric heat.

INDUSTRIAL PLANTS. Factors that Determine When Electric Heating Can Be Used to Advantage, W. S. Scott. Indus. Engr., vol. 84, no. 6, June 1926, pp. 272-275, 4 figs. Discussion of operating economies and desirable features that are inherent in this mode of heating.

HEATING, HOT-WATER

INDUSTRIAL PLANTS. How Forced Hot-Water System Heats Ford's Twin Cities Plant, E. H. Whittemore. Plumbers' Trade Jl., vol. 80, no. 10, May 15, 1926, pp. 968-969 and 983, 5 figs. Heat is supplied from steam power plant located at river bank and about 300 ft. away from building; water-heating equipment and piping system are so arranged that office section of building may be operated separately from rest of building.

HIGH-SPEED STEEL

MAGNETIC ANALYSIS. Report of Committee A-8 on Magnetic Analysis. Am. Soc. Testing Matls.—Preprint, no. 15, for mtg. June 21, 1926, 36 pp., 28 figs. Appendix contains article by T. Spooner, presenting results of investigation of correlation between magnetic and electrical properties and heat treatment of series of bars of high-speed steel, considers various testing methods.

HIGHWAYS

MAINTENANCE COSTS. Ten Years' Road Maintenance Costs in New York State. Eng. News-Rec., vol. 96, no 24, June 17, 1926, pp. 979- .

WIDENING AND RESURFACING. Widening and Resurfacing the King Edward Highway Without Detours, L. Garbi. Contract Rec., vol. 40, no. 22, June 2, 1926, pp. 542-543, 3 figs. Amiesite used to overhaul heavily-travelled thoroughfare from Montreal to international boundary; no detours were necessary and traffic was not delayed.

HYDRO-ELECTRIC DEVELOPMENTS

QUEBEC. 4,000 Men Will Be Engaged on Gatineau River Power Projects. Contract Rec., vol. 40, no. 22, June 2, 1926, pp. 547-551, 3 figs. Developments being undertaken by Can. Int. Paper Co.; details of various works involved.

Hydro-Electric Development in Quebec, C. V. Christie. World Power, vol. 5, no. 29, May 1926, pp. 231-237, 1 fig. Physical characteristics of province; water-power resources; main hydro-electric plants; utilization of electric power in pulp and paper industry; electric steam generators.

Development Work at Chelsea and Farmer's Rapids on the Gatineau, A. H. White. Contract Rec., vol. 40, no. 20, May 19, 1926, pp. 462-464, 4 figs. Four principal points for development at Maniwaki, Paugan Falls, Chelsea and Farmer's Rapids; two latter are now in process of developments.

ST. LAWRENCE RIVER. Water Power Development on the St. Lawrence River, F. P. Williams. Cornell Civ. Engr., vol. 34, no. 8, May 1926, pp. 199-201 and 214, 3 figs. Power development of river is definitely involved with proposed improvement for navigation; average flow of river; channels across which dams are to be built vary from one-half to about one mile in width; status of St. Lawrence project.

HYDRO-ELECTRIC PLANTS

AUTOMATIC. Automatic Non-Governing Hydro Plant, C. P. Scheller and W. B. Carr. Elec. World, vol. 87, no. 24, June 12, 1926, pp. 1285-1288, 4 figs. Self-operating features and elimination of governor favour development of water-power site with economy in regard to both first cost and cost of operation; complete tests gave satisfactory results.

GREAT BRITAIN. The New Hydraulic Power Station at Cardiff Docks. Engineering, vol. 121, nos. 3148 and 3150, Apr. 30 and May 28, 1926, pp. 554-556 and 562, and 617-619, 16 figs., partly on supp. plate. Work of converting old steam station into electrically-operated station making use of high-speed centrifugal pumps; main pumps are each capable of delivering 800 gal. per min. at pressure of 800 lb. per sq. in.; electric supply is brought into pumping station by 2 feeders at 6,600 volts, 3-phase, 50 cycles per sec.; pump motors, controllers, protective devices, etc.

I

INDUSTRIAL MANAGEMENT

FINANCIAL AND INDUSTRIAL INVESTIGATION. Operating and Turnover Ratios, A. Andersen. Mfg. Industries, vol. 11, no. 6, June 1926, pp. 441-444. Study of turnover ratios, which as a whole expresses relationship between operating results and capital employed, in other words, comparison between profit-and-loss figures and balance-sheet figures.

LABOUR ATTITUDE TOWARD. The American Labour Movement and Scientific Management, P. Devinat. Int. Labour Rev., vol. 13, no. 4, Apr. 1926, pp. 461-488. Discusses reasons for earlier opposition of trade units to scientific management, events which gradually led to its breakdown, and steps by which American Federation of Labour came to adopt its present attitude of readiness to collaborate with management in enlightened application to industry of scientific methods of organization.

MAINTAINING IMPROVED METHODS. Keeping Up Improved Operating Results, J. A. Piactelli. Mfg. Industries, vol. 11, no. 6, June 1926, pp. 435-439, 8 figs. Measures taken to maintain results accomplished at Maurer Plants of Barber Asphalt Co.

MANUFACTURING CONTROL. Timely Guide to Manufacturing Control, J. H. Barber. Mfg. Industries, vol. 11, no. 6, June 1926, pp. 417-420, 4 figs. Describes valves and fittings index of Walworth Co.; its general significance and methods employed.

PLANNING AND ROUTING. Planning and Routing Shop Work, J. S. Gray. Machy. (N.Y.), vol. 32, no. 10, June 1926, pp. 776-778. General duties of planning department; effect of planning on costs and on delivery dates; details of work of planning department; co-operation between shop and planning department.

SALES PROGRAMME. A Market Survey and Its Results, H. L. Keely. Mfg. Industries, vol. 11, no. 6, June 1926, pp. 421-434, 3 figs. Method of applying market survey for increasing sales of building material.

INDUSTRIAL PLANTS

POWER ANALYSIS. The Rewards to Management from a Real Analysis of Power, D. M. Myers. Factory, vol. 36, no. 5, May 1926, pp. 830-835, 870, 874, 876, 978 and 980, 12 figs. Frank discussion of question of purchased versus generated power, with reports on marked improvements in operation which have come from wide contact with industrial-plant problems.

INDUSTRIAL TRUCKS

ELECTRIC. Field of Application and Savings Effected by Industrial Trucks, H. J. Payne. Elec. World, vol. 87, no. 24, June 12, 1926, pp. 1292-1294, 2 figs. Description of operations and uses in various manufacturing plants where electric tractor has proved to be both economical and labour-saving feature.

PAPER MILLS. Cutting Handling Costs with Electrical Trucks. Paper Trade Jl., vol. 82, no. 23, June 10, 1926, pp. 59-63, 6 figs. Applications of electric trucks in various mills. (Abstract.) Paper presented before Am. Pulp & Paper Mills Supts'. Assn.

INSULATING MATERIALS, ELECTRIC

BREAKDOWNS. Breakdowns in Insulating Material. Brown Boveri Rev., vol. 13, no. 5, May 1926, pp. 115-121, 5 figs. Results of measurements of dielectric losses carried out in Brown Boveri testing laboratories; breakdown through heat; relation between allowable continued pressure and thickness of insulating layer; points out that beyond certain limit, it is of no use to thicken layer of insulation.

ELECTRICAL MACHINERY FOR. Recent Improvements in the Insulation of Electrical Machinery, K. G. Maxwell and A. Monkhouse. Instn. Elec. Engrs.—Jl., vol. 64, no. 352, Apr. 1926, pp. 439-463 and (discussion) 463-475. Review of more recent developments in manufacture and use of insulating materials; survey of prominent characteristics followed by summary of process improvements; authors put forward strong plea for standardization of nomenclature and test methods for determining essential properties of insulating materials; includes examples of standardizing of material terminology. Bibliography.

INSULATION, HEAT

PROBLEMS. Heat Insulation, C. F. Wade. Elec. Times, vol. 69, no. 1802, Apr. 29, 1926, pp. 543-544, 1 fig. Points out need of continuous attention in order to maintain non-conducting coverings in efficient condition.

INSULATORS, ELECTRIC

POWER ARC TESTS. Power Arc Tests on Insulators, J. T. Littleton and L. C. Nicholson. Elec. World, vol. 87, no. 20, May 15, 1926, pp. 1054-1056, 4 figs. Porcelain and pyrex insulators tested; analysis of results shows pyrex has good characteristics; use 1,800 ampere under maximum conditions on 6.6-kv. line.

SUSPENSION. Insulator Research. Elec. Light & Power, vol. 4, no. 6, June 1926, pp. 31 and 104-105, 1 fig. Investigation to determine what relation, if any, exists between ultimate mechanical strength of what are commonly called high-strength suspension insulators, and load which they can sustain indefinitely with electrical or mechanical failure. Subcommittee report before Nat. Elec. Light Assn.

Suspension Insulator Failures, R. Roberts. Elec. Engr. Australia & New Zealand, vol. 2, no. 12, Mar. 15, 1926, pp. 455-457, 4 figs.

INTERFEROMETERS

ETHER-DRIFT. Significance of the Ether-Drift Experiments of 1925 at Mount Wilson. Science, vol. 63, no. 1635, Apr. 30, 1926, pp. 433-443, 7 figs. Describes ether-drift interferometer, instrument which is generally admitted to be suitable for determining relative motion of earth and ether, that is, it is capable of indicating direction and magnitude of absolute motion of earth and solar system in space.

INTERNAL-COMBUSTION ENGINES

FUEL INJECTION. Fuel Injection, C. Hughes. Inst. Mar. Engrs.—Trans., vol. 37, Apr. 1926, pp. 791-818 and (discussion) 847-860, 17 figs. Discusses new features referring to pumping and injection of liquid fuels into internal-combustion engines; describes functioning of author's latest designs.

INDICATOR DIAGRAMS. Indicating the High-Speed Multi-Cylinder Internal-Combustion Engine, H. M. Jacklin. Soc. Automotive Engrs.—Jl., vol. 18, no. 6, June 1926, pp. 631-636, 4 figs. Details of construction, application, procedure and operation of standard slow-speed indicator which has been in successful operation for more than 500 hours of testing at Ohio State Univ.; composite indicator diagram obtained over great number of engine cycles, which is claimed to be distinct gain over anything else yet tried, since diagram is built up before eyes of testing engineer.

THEORY. Evolution of Internal-Combustion Engines, Especially Explosion Engines (L'évolution des moteurs à combustion interne et particulièrement des moteurs à explosion), E. Marcotte. Revue générale des Sciences, vol. 37, no. 7, Apr. 15, 1926, pp. 199-206. Discusses evolution of a fluid in an automobile or airplane engine; development of Diesel engine and Carnot cycle; 4-stroke and 2-stroke engines; combustion; anti-knock mixtures.

See also Airplane Engines; Automobile Engines; Diesel Engines; Oil Engines; Semi-Diesel Engines.

IRON

CORROSION. Testing Corrosion of Iron, T. Fujihara. Chem. and Met. Eng., vol. 33, no. 6, June 1926, p. 347.

INVENTIONS

PATENTS AND. Patents and Inventions, G. S. Roxburgh. Eng. Jl., vol. 9, no. 6, June 1926, pp. 291-297. General review of subject, with details of requirement under Canadian Patent Act.

IRON AND STEEL

CORROSION. Report of Committee A-5 on Corrosion of Iron and Steel. Am. Soc. Testing Matls.—Preprint, no. 12, for mtg. June 21, 1926, 42 pp., 21 figs. Report of inspection of Fort Sheridan, Pittsburgh and Annapolis tests; total immersion tests; proposed tentative specifications for coating on zinc-coated (galvanzide) wire; galvanized iron or steel telephone and telegraph line wire; galvanized iron or steel tie wires; tests of metallic-coated products.

The Influence of Alternating Currents on the Electrolytic Corrosion of Iron, A. J. Allmand and R. H. D. Barklie. Faraday Soc.—Trans., vol. 22, part 1, no. 1, no. 64, Jan. 1926, pp. 34-35, 5 figs. Investigates corrosion of iron in alkaline solutions by direct current, alternating current and by alternating current superposed on direct current, and shows that superposition of the two types of current causes relatively increased corrosion; similar result was found when using typical subsoil drainage liquid saturated with CO_2; experiments were also carried out on accelerating effects of added alkaline chloride on corrosion in alkaline solutions.

L

LATHES

CENTRES. Design of Lathe Centres, F. Horner. Machy. (N.Y.), vol. 32, nos. 9 and 10, May and June 1926, pp. 7.2-716 and 793-797, 16 figs. Typical designs for different classes of work.

LIGHT

ETHER-DRIFT MEASUREMENTS. Reports of Ether-Drift Measurements, A. E. Kennelly. Elec. World, vol. 87, no. 20, May 15, 1926, pp. 1045-1047. Recent data of Dr. Miller deny fundamental postulate of Einstein theory; observed drifts attain 10 km. per sec.; some speculations advanced.

UNDULATORY THEORY. Centennial of the Undulatory Theory of Light. Science, vol. 63, no. 1633, Apr. 16, 1926, pp. 387-393. History of undulatory theory developed by Augustin Fresnel.

LIGHTING

COTTON MILLS. Artificial Lighting for Cotton Mills, K. M. Reid. Textile World, vol. 69, no. 23, June 5, 1926, pp. 69-71 and 73, 10 figs. Good lighting increases production, reduces spoilage and accidents, improves hygienic conditions and factory discipline, and lessens labour turnover; layouts recommended for each department; lint or dust may reduce light output one-third.

STREET. Street Lighting with 25,000-Lumen Lamp, F. L. Mowry and O. F. Haas. Elec. World, vol. 87, no. 24, June 12, 1926, pp. 1297-1298, 3 figs.

TEXTILE MILLS. Latest Developments in Mill Lighting, R. A. Palmer. Textile World, vol. 69, no. 18, May 1, 1926, pp. 73, 75 and 77, 9 figs. Review of recent progress; tests show that installation of modern lighting in weave shed of dress-goods mill increased production 25 per cent; tests in other mills; studies on vision; inside-frosted lamp; local lighting should only supplement general lighting.

LIGNITE

STEAM GENERATION, USE IN. The Economic Use of North Dakota Lignite for Steam Generation, G. B. Wharen. Mech. Eng., vol. 48, no. 6, June 1926, pp. 583-585, 1 fig. Principal deposits; characteristics of North Dakota lignite; firing methods; possibility of utilizing lignite in pulverized form; pulverization; cost of steam production.

LOCOMOTIVE BOILERS

PITTING AND CORROSION. A Study into Causes of Pitting and Corrosion in Locomotive Boilers, W. M. Barr. Ry. Rev., vol. 78, no. 23, June 5, 1926, pp. 977-983, 13 figs. Theory of corrosion; effect of scale on corrosion; effect of air and dissolved gases in water; water treatment; recommendation for reduction in corrosion and pitting.

WAGON-TOP TYPE. Boiler of the Union Pacific Type Locomotive. Boiler Maker, vol. 26, no. 5, May 1926, pp. 123-125, 3 figs. Boiler, designed for 220-lb. working pressure, has largest firebox ever equipped with Gaines arch; it is of wagon-top type.

LOCOMOTIVES

DIESEL-ELECTRIC. The Diesel-Electric Locomotive and Its Relation to Heavy Electrification. Mech. Eng., vol. 48, no. 6, June 1926, pp. 585-589. Extracts from reports of three addresses given before Metropolitan Sections of four National Engineering Societies in New York City, as follows: Diesel-Electric Locomotive and Its Various Applications, H. Cooke; Diesel-Electric Locomotive, Its Field and Advantages, N. W. Storer; Advantages of the Oil-Electric Locomotive Over Electrification on Short-Line and Switching Operations, C. H. Stein; and general discussion.

INDUSTRIAL. Industrial Locomotives. Engineer, vol. 141, no. 3671, May 21, 1926, p. 532, 2 figs. Locomotive with vertical boiler made by Société John Cockerill, Belgium.

OIL-ELECTRIC. Railroads Turning to Heavy Oil Engines for Locomotive Service. Automotive Industries, vol. 54, no. 22, June 3, 1926, pp. 924-925, 3 figs. Power plants of oil-electric type offer advantages of more economical operation, reduced maintenance costs, elimination of much capital investment.

The Oil-Electric Locomotive in Railroad Service. Can. Ry. Club—Officials Proc., vol. 25, no. 3, Mar. 1926, pp. 20-40, 3 figs. Points out that economies of oil-electric locomotive have been firmly established in past two years in practical demonstrations, and possibilities offered warrant its rapid development to determine extent of its application under present railroad conditions; it offers immediate solution to present costly and objectionable steam operation of yard switching, terminal, branch line and local freight service, where noise and smoke become public nuisance and detrimental to real estate values.

PERFORMANCE. Steam Locomotive Performance. Theoretical and Actual, M. T. Grime. Ry. Gaz., vol. 44, nos. 21 and 22, May 21 and 28, 1926, pp. 689-690. Locomotive-cylinder performance; effect of superheating on condensation; uniflow engine; restricted cut-off locomotive; locomotive-boiler performance; feedwater heating.

LUBRICANTS

EQUIPMENT FOR APPLYING. Equipment Used for Applying Lubricants, F. E. Gooding. Indus. Engr., vol. 84, no. 5, May 1926, pp. 213-218 and 228, 15 figs. Methods and equipment for applying lubricants continuously or intermittently to different designs of bearings used on machines.

LUBRICATING OILS

SELECTION. The Selection of Lubricating Oils for Working Conditions of Bearing Load, Speed and Temperature, G. B. Vroom. Am. Soc. Nav. Engrs.—Jl., vol. 38, no. 2, May 1926, pp. 289-300, 6 figs. For petroleum industry, combined alignment chart and viscosity-temperature diagram, which are presented, should be of value in determining brand and viscosity selection from line of oils to meet specific needs of customers.

LUBRICATION

AXLE BOXES. Reduction of the Cost of Traction: Lubrication of Axle Boxes for all Rolling Stock. Int. Ry. Congress—Bul., vol. 8, no. 5, May 1926, pp. 412-419. Deals with plain, roller and ball bearings; lubricants.

M

MACHINE SHOPS

ELECTRIC HEAT FOR. Electric Heat for the Machine Shop, P. F. Creasy. Am. Mach., vol. 64, no. 22, June 3, 1926, pp. 865-868, 8 figs. Variety of applications; uniformity of product and better working conditions claimed.

MACHINE TOOLS

LOCATING DEVICES. Positive Locating Devices Vital, F. Horner. Can. Machy., vol. 36, no. 22, June 3, 1926, pp. 23-25, 19 figs. Points out that vital factor in design and operation of machine tools and other machinery is facility with which parts can be locked or located beyond all possibility of movement.

MASS PRODUCTION, EFFECT OF. The Effect of Mass Production on Machine Tool Design, A. C. Pletz. Am. Mach., vol. 64, no. 22, June 3, 1926, p. 854. (Abstract.) Paper presented before Cincinnati Section, Am. Soc. Mech. Engrs.

PERMANENT EXHIBIT. A Permanent Machine Tool Exhibit, J. W. Roe. Am. Mach., vol. 64, no. 23, June 10, 1926, pp. 889-892. Proposed outline for section on machine tools and shop practice of Museum of the Peaceful Arts.

REPLACEMENT POLICIES. Getting the Most Out of Your Machine Tool Dollar, R. A. DeVlieg. Am. Mach., vol. 64, no. 24, June 17, 1926, pp. 929-930. Points out that production guaranties must be met under average conditions rather than under favourable ones; purchaser must make allowances for actual conditions.

Getting the Most Out of Your Machine Tool Dollar, J. E. Gleason. Am. Mach., vol. 64, no. 21, May 27, 1926, pp. 809-811. Seven years is average age of machine equipment in Gleason Works; points considered in replacing; managers are convinced that they cannot afford to not buy modern equipment.

MATERIALS HANDLING

ELEVATOR AND CONVEYOR SYSTEM. Conveyor System. Conveyor System Makes Roof Work, R. A. Fiske. Iron Age, vol. 117, no. 21, May 27, 1926, pp. 1487-1489, 5 figs. Installation of conveyor and elevator system in metal-furniture plant in Kenosha, Wis., which made feasible placing ovens on roofs of 6-storey buildings, and also through re-designing of ovens so that drying time was reduced from 4 hours to 1 hour 20 minutes.

FACTORIES. Maker and User Profit by New Methods, E. M. Olin. Mfg. Industries, vol. 11, no. 6, June 1926, pp. 413-4 6, 6 figs. Handling equipment and straight-line layout cut costs and reduce selling price of Westinghouse Electric Products Co.

MACHINE DESIGN AND. Machine Design and the Handling Problem, F. L. Eidmann. Am. Mach., vol. 64, no. 22, June 3, 1926, pp. 855-856, 5 figs. Heavy machines make difficult handling jobs; designer can provide means of handling castings and moving finished machine; proper and improper base designs.

MEASUREMENTS

FINE. Recent Developments in the Art of Fine Measurement, J. E. Sears. Engineering, vol. 121, no. 3151, June 4, 1926, pp. 652-654, 8 figs. Recent experience shows that it is not possible to get agreement of interpretation between different observers of lines better than 0.000001 in., and this accuracy could be surpassed at present by material end standards with ends finished optically flat and parallel, and by natural standard based upon wave lengths of light; author refers to advance made in this direction; interference methods of measurement; triode valve applied to measurement of small displacements; measurements of internal diameters. (Abstract.) Lecture presented before Roy. Instn.

MEASURING INSTRUMENTS

LEVELS. Measuring Vertical Distances, F. Johnstone-Taylor. Can. Machy., vol. 35, no. 19, May 13, 1926, pp. 17-18, 5 figs. Principal function of level is to find difference in elevation between any two points, or conversely, to set point of prescribed elevation above or below some other point.

METALLOGRAPHY

A.S.T.M. REPORT. Report of Committee E-4 on Metallography. Am. Soc. Testing Matls.—Preprint, for mtg. June 21, 1926, no. 22, 34 pp., 2 figs. Selection and preparation of samples; solutions for carbides, etc., in alloy steels; microhardness; bibliography of scratch-hardness methods as applied to metals; glossary of terms relating to radiography; proposed tentative recommended practice for radiographic testing of metal castings, and for care of eyes when using metallographic microscope.

METALS

COLD DEFORMATION. Cold Deformation of Corrosion Fringes (Les franges d'écrouissage ou de corrosion), A. Portevin. Académie des Sciences—Comptes Rendus, vol. 182, no. 8, Feb. 22, 1926, pp. 523-525, 4 figs. Study of effects of chemical reagents on polished surfaces of metals subjected to cold deformation, and in particular of alternate bright and dark striations or "fringes" produced.

CORROSION. Corrosion, Tarnishing and Tinting of Metals, U.R. Evans. Engineering, vol. 121, no. 3151, June 4, 1926, p. 667. Shows that corrosion preferentially attacks those portions to which oxygen has no direct access, and not those exposed to oxygen. Review of two lectures before Roy. Instn.

FLOW OF GRAIN. The Influence and Importance of the Flow of the Grain of Metals. Machy. (Lond.), vol. 28, no. 705, Apr. 1, 1926, pp. 9-13, 11 figs. Flow of metal in crankshafts; gear blanks; bushes and tires.

OXIDATION. The High-Temperature Oxidation of Metals, J. S. Dunn. Roy. Soc.—Proc., vol. 3, no. A757, May 1, 1926, pp. 203-209, 1 fig. Oxidation of three copper-zinc alloys was investigated and shown to be controlled by diffusion through protective film of oxide; rate of oxidation shown to vary exponentially with temperature; theory of diffusion in solid solutions.

MICROSCOPES

METALLURGICAL. The Metallurgical Microscope in the Selection and Treatment of Metals, G. Sachs. Metal Industry (Lond.), vol. 28, no. 18, Apr. 30, 1926, pp. 419-420, 4 figs.

MILLING CUTTERS

COST REDUCTION. Reducing Costs of Cutters and Cutter Grinding, D. A. Hampson. Am. Mach., vol. 64, no. 20, May 20, 1926, p. 784. Use of cutters of single style or make is factor in lowered costs; gives working comparison.

MINES

Rock and Air Temperatures. Rock and Air Temperatures in Deep-Level Mines, M. O. Tillard and E. C. Ranson. Chem. Met. & Min. Soc. S. Africa—Jl., vol. 26, no. 8, Feb. 1926, pp. 184-201 and (discussion) 201-208, 5 figs. Deals with problems arising with rise of rock temperature and resultant heating of mine air at depth; effect of surface conditions on air entering mine; degree of heating of mine air under varying conditions and resultant cooling of rock; how heat is acquired and lost by ventilating current at various stages of its journey through mine; question of conditions beyond present working depth.

MOULDING METHODS

Car Wheels. Mechanical Moulding of Car Wheels, R. F. Ringle. Can. Machy., vol. 35, no. 21, May 27, 1926, pp. 21-22, 5 figs. Methods employed by Brown Car Wheel Works, Buffalo, N.Y.; how obstacles were overcome that previously had curtailed use of molding machines in car-wheel factories.

Grooved Pulleys. The Moulding of Grooved Pulleys, E. Ronceray. Foundry Trade Jl., vol. 33, nos. 510 and 511, May 27 and June 3, 1926, pp. 367-368 and 393-395, 12 figs. First question to be settled is arrangement of various parts; moulding with dry cores; using cope; moulding in two parts of box without cope of core; moulding without cope or core or turning over. June 3: Vertical moulding using sectional patterns; stripping by rotation; double-sided pattern plates.

MOTOR BUSES

Electric Drive. Review of the Electric Drive Type of Transmission, H. L. Andrews. New York Railroad Club—Official Proc., vol. 36, no. 6, Apr. 16, 1926, pp. 7982-7988, 4 figs. Simplicity, continuous torque, ease of control and durability among various derived advantages.

MOTOR TRUCKS

Impact Tests. General Results of the Co-operative Motor Truck Impact Tests, J. A. Buchanan and J. W. Reid. Soc. Automotive Engrs.—Jl., vol. 18, no. 6, June 1926, pp. 581-592, 26 figs. Authors state eight preliminary deductions drawn from present available data and discussed mode of static and impact-test accomplishment, and describe accelerometer used; illustrated analysis of highway and obstruction tests.

Inspection. Inspection, A Means for Economical Motor-Truck-Fleet Maintenance, F. E. Hatosy. Soc. Automotive Engrs.—Jl., vol. 18, no. 6, June 1926, pp. 637-638 and (discussion) 638-640. Author enumerates main details of adequate inspection.

N

NICKEL STEEL

Heat Treatment. The Effect of Mass in the Heat Treatment of Nickel Steel, W. Rosenhain, R. G. Batson and N. P. Tucker. Iron & Steel Inst.—Advance Paper, no. 13, for mtg. May 1926, 33 pp., 28 figs. Results of mechanical tests and microscopical examination; steels were heat-treated in form of round bars of four different sizes; heating was carried out in recuperative furnace designed to give uniform heating at high temperatures.

NON-FERROUS METALS

Standard Specifications. Report of Committee B-2 on Non-Ferrous Metals and Alloys. Am. Soc. Testing Matls.—Preprint, no. 18, for mtg. June 21, 1926, 35 pp., 8 figs. Committee reports on pure metals in ingot form, wrought metals and alloys, white metals, methods of chemical analysis; method for determination of aluminum in small quantities; properties of high-strength aluminum casting alloys; proposed tentative specifications for aluminum-bronze castings; sand castings of copper and tin and zinc alloys; steam or valve bronze sand castings; composition-brass or ounce-metal sand castings; aluminum-base sand-casting alloys in ingot form; aluminium sheet.

O

OIL

Refinery. Chemical Engineering Applications in an Oil Refinery, S. D. Kirkpatrick. Chem. & Met. Eng., vol. 33, no. 5, May 1926, pp. 270-273, 7 figs.

OIL ENGINES

Air Filters. Self-Cleaning Air Filter of Low Resistance. Oil Engine Power, vol. 4, no. 6, June 1926, pp. 354-355, 6 figs. Describes protectomotor marketed by Staynew Filter Corp.; basis of device is filtering cloth of special close texture; examples of applications.

Developments. Recent Oil Engine Developments, J. L. Chaloner. Diesel Engine Users' Assn.—Report of Discussion, for mtg. Apr. 17, 1925, no. 51, 48 pp., 22 figs. General review of many types of engines available for power purposes, taking as basis recent exhibits at Wembley Exhibition, 1924.

Fuel Pumps. Care, Adjustment and Maintenance of Oil Engine Fuel Pumps, A. B. Newell. Nat. Engr., vol. 30, no. 5, May 1926, pp. 197-199. Practical discussion on care of fuel pumps, their proper adjustment, and hints on their maintenance; fuel-pump troubles on different types of engines and how to prevent them.

Heavy-Oil. The Campbell Vertical Heavy-Oil Engine. Engineering, vol. 121, no. 3151, June 4, 1926, pp. 656-658, 6 figs. 100-b.hp. engine constructed by Campbell Gas Engine Co., Halifax, and results of demonstration to show suitability of these engines for synchronizing to work in parallel on a network.

OIL FUEL

Applications. Oil-Burning for General Uses, F. Burgess. Junior Instn. Engrs., vol. 36, Apr. 1926, pp. 300-310, 2 figs. Advantages, economy and disadvantages of oil fuel; oil burners; steam-jet, air-jet and pressure-jet systems; fuel heater and pumps.

Railways. Fuel Oil for Railways, J. C. Martin, Jr. Mech. Eng. (Supp.), vol. 48, no. 6, June 1926, pp. 671-672. Points out reasons that economically warrant continuance of its use on railways, even to extent of its allotment for use in locomotive fireboxes for steam-generating purposes should its conservation in future become national issue.

OPEN-HEARTH FURNACES

Comparison of Different Capacities. Comparison of Open-Hearth Furnaces of Various Sizes, S. J Cort. Am. Iron & Steel Inst.—Advance paper, for mtg. May 21, 1926, 16 pp. Comparison of operations of furnaces of different capacities; author emphasizes that inherently there is no reason why as good steel cannot be made in large as in small furnaces. See also abstract in Iron Age, vol. 117, no. 21, May 27, 1926, pp. 1493-1494; and Am. Metal Market, vol. 33, no. 1.2, June 12, 1926, pp. 6-7 and 18.

Practice. Data Relating to Basic Open-Hearth Steel Practice, A. N. Diehl. Am. Iron & Steel Inst.—Advance Paper, for mtg. May 21, 1926, 59 pp., 25 figs. and 19 tables on supp. plates. Submits data and information based on tests carried out at Duquesne Works of Carnegie Steel Co., on furnaces rated capacities varying from 50 to 75 tons; in addition to records and analysis, graphic charts have been prepared and tables and various element balances compiled, together with actual practice results on coal, recarburizers, alloys and conclusions drawn as to problematical action of different metalloids; discusses construction of open-hearth furnace; type of heats investigated, method of testing metal and presentation of results. See also brief abstract and discussion in Iron Age, vol. 117, no. 21, May 27, 1926, pp. 1491-1492.

OXY-ACETYLENE CUTTING

Cast Iron. Cutting Cast Iron with the Torch. Welding Engr., vol. 11, no. 5, May 1926, pp. 25-26, 5 figs. Development of special torch which provides for preheating of cutting jet of oxygen. Translated from Revue de la Soudure Autogène.

OXY-ACETYLENE WELDING

Copper Fireboxes. Welding Copper Fireboxes, H. Young. Welding Engr., vol. 11, no. 5, May 1926, pp. 27-29, 6 figs. Oxy-acetylene process used for repair of practically all defects; many welds may be made in place.

Gas-System Regulation. Regulation for the Installation and Operation of Gas Systems for Welding and Cutting. Acetylene Jl., vol. 27, no. 12, June 1926, pp. 596-600. Regulations of National Board of Fire Underwriters, as recommended by National Fire Protection Assn.

Sheet Aluminum. Oxy-Acetylene Welding of Sheet Aluminum, J. W. Meadowcroft. Acetylene Jl., vol. 27, no. 12, June 1926, p. 591, 1 fig. Method developed in Philadelphia plant of E. G. Budd Mfg. Co.

P

PAINTS

Hiding Power. A Photometric Method for Measuring the Hiding Power of Paints, H. D. Bruce. U. S. Bur. Standards—Technologic Papers, no. 306, Jan. 16, 1926, pp. 173-190, 8 figs. Results of investigation carried out to develop method for measuring from dry films, hiding power of paints.

PAPER

Colouring. Paper Colouring, I. Ekholm. Paper Trade Jl., vol. 82, no. 19, May 13, 1926, p. 56.

PAPER MACHINERY

Speed Regulator for Sectional Drives. Speed Regulating Controllers for Sectional Paper Machine Drives, R. T. Kintzing. Elec. Jl., vol. 23, no. 4, Apr. 1926, pp. 163-168, 5 figs. Review of regulating systems for sectional drives, and details of latest type of regulator which is truly differential in action and must produce 100 per cent speed correction before its action stops.

PAPER MANUFACTURE

Paperboard. Paperboard and Its Manufacture, A. O. Bragg and R. H. Harding. Paper Trade Jl., vol. 82, nos. 19 and 20, May 13 and 20, 1926, pp. 51-55, 3 figs., and 45-47, 2 figs. May 13: Chip and news board; miscellaneous setup grades; folding boxboards; test liners and test boards. May 20: Preliminary treatment of paper stock; various systems required.

Bibliography. Current Paper Trade Literature, C. J. West. Paper Trade Jl., vol. 82, nos. 18, 19 and 22, May 6, 13 and 20, 1926, pp. 63-64, 58-60 and 50-52.

Cellulose Hydration. Hydration of Cellulose in Papermaking, J. Strachan. Paper Industry, vol. 8, no. 2, May 1926, pp. 235-237.

PAPER MACHINERY

Electric Drive. Sectional Electric Drive for Paper Machines, R. N. Morris. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 5, May 1926, pp. 432-437, 10 figs.

PAPER MANUFACTURE

Pulp Bleaching. Cold Bleaching at High Densities, M. E. Boehm. Paper Industry, vol. 8, no. 2, May 1926, pp. 239-241.

Pulp Manufacture. Problems in the Manufacture of Sulphite Pulp, B. T. Larrabee. Paper Mill, vol. 49, no. 23, June 5, 1926, pp. 18, 20 and 58. Practical suggestions whereby minimum loss of wood can be obtained, and which will enable pulp superintendents to maintain maximum yield and consequently effect saving in cost of wood and materially reduce cost of finished pulp. Paper read before Am. Pulp & Paper Mill Supts'. Assn.

PAPER MILLS

Belt Drive. Paper Mill Applications of the Pulmax Drive, S. E. Frost. Paper Mill, vol. 49, no. 18, May 1, 1926, pp. 14 and 46, 5 figs. Discusses applications of Pulmax short centre drive, principle of which depends upon obtaining large arcs of contact of belt on pulleys at same time maintaining small unproductive belt tension.

PAVEMENTS, ASPHALT

Temperature, Effect of. Temperature as a Factor in the Stability of Asphaltic Pavements, W. J. Emmons and B. A. Anderton. Pub. Roads, vol. 7, no, 2, Apr. 1926, pp. 46-48, 5 figs.

PEAT

Utilization. Possibilities for the Commercial Utilization of Peat, W. W. Odell and O. P. Hood. U. S. Bur. of Mines—Bul., no. 253, 1926, 154 pp., 32 figs. Composition of peat; classification of peat deposits; distribution of peat in United States; winning of peat fuel; laboratory experiments with Minnesota peat; machined peat fuels; carbonization of peat and recovery of by-products; production of ethyl alcohol from peat; special prepared-peat products; agricultural utilization of peat lands; suggestions for utilizing peat resources of United States.

PILES

Driving. Underwater Piledriving and Cofferdam Sealing, J. C. Pritchard. Eng. News-Rec., vol. 96, no. 23, June 10, 1926, pp. 930-933, 5 figs. Precast concrete piles 48 and 68 ft. long driven under water; cofferdam sealed with tremie-placed concrete in deep water-works intake at St. Louis.

PISTONS

Flow of Heat in. Flow of Heat in Pistons, H. A. Huebotter and G. A. Young. Purdue Univ.—Bul., vol. 9, no. 12, Dec. 1925, pp. 5-114, 67 figs. Shows how satisfactory distribution of metal in plain pistons is obtained; suggestions regarding ribs, piston-rings, ring-land radial clearance, and methods of expansion control; principles of piston design are developed by mathematical analysis of heat flow from hot gas through piston and into cylinder wall; analytical study is supplemented by laboratory tests.

PLATES

Corrugated. The Elastic Stability of a Corrugated Plate, W. R. Dean. Roy. Soc.—Proc., vol. 3, no. A757, May 1, 1926, pp. 144-167, 5 figs. Deals with elastic stability of corrugated plate under thrust along its generators.

Mild-Steel. Lives of Maximum Principal Stress in Thin Mild-Steel Plates of Rectangular Shape Fixed Along the Edges and Uniformly Loaded, B. C. Laws and A. O. Allen. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. Sci., vol. 1, no. 5, May 1926, pp. 1039-1042, 1 fig. It was sought to determine in what manner stress varies from point to point and how plate changes in form under load; microscopic observations of deflexions were made at points of intersection of ordinates drawn on plate surface parallel to sides of rectangle and represented graphically.

POLES, WOODEN

TREATED AND UNTREATED. Conclusions Reached Through Service Tests of Treated and Untreated Poles, R. M. Wirka. Elec. Light & Power, vol. 4, no. 6, June 1926, pp. 29-30. Untreated poles set green will generally live longer life than untreated poles set after seasoning; open-tank butt treatment with creosote is more effective than any other kind of treatment included in experiments; two-coat brush treatment is better than single coat of same preservative. (Abstract.) Paper read before Nat. Elec. Light Assn.

POWER

GROWTH AND DISTRIBUTION, UNITED STATES. Growth and Distribution of Primary Power, S. B. Ladd. Power, vol. 63, no. 24, June 15, 1926, pp. 328-330, 5 figs. Presents charts based on reports of Bureau of Census, showing growth of primary power installations of United States.

WATER AND STEAM, CALIFORNIA. Water Power and Steam Power in California Utilities, H. A. Barre. Mech. Eng. (Supp.), vol. 48, no. 6, June 1926, p. 662. Brief analysis of power situation to determine respective contributions of water power and steam power to existing conditions, and their probable future effects.

POWER FACTOR

IMPROVEMENT. Power Factor and Production Cost, R. C. Muir. Elec. World, vol. 87, no. 20, May 15, 1926, pp. 1047-1049.

PRECIPITATION

ELECTRIC. Electrical Precipitation in the Chemical Industry, H. W. C. Henderson. Indus. Chemist, vol. 2, no. 15, Apr. 1926, pp. 161-165, 7 figs. Application of Lodge-Cottrell precipitators.

PRESSES

PLASTIC MATERIALS. Presses for Plastic Materials and Hot Pressing. Machy. (Lond.), vol. 28, no. 705, Apr. 1, 1926, pp. 6-7, 5 figs. Press exhibited at British Industries Fair in Birmingham, made by Taylor & Challen, for plastic materials and for hot-pressing brass.

PRESSURE VESSELS

WELDED. Are Welded Pressure Vessels Safe? E. E. Thum. Power, vol. 63, no. 23, June 8, 1926, pp. 886-889, 7 figs. Outlines procedure control and inspection that should result in safe and satisfactory welds; fundamental principles of oxwelded design; material for welding rod.

PULVERIZED COAL

BOILER FIRING. Pulverized Fuel at Dover Power Station, E. K. Scott. Combustion, vol. 14, no. 5, May 1926, pp. 320-321, 2 figs. Test figures obtained at Dover Corp., with recently developed system of firing pulverized coal.

EXPLOSION HAZARDS. Explosion Hazards from the Use of Pulverized Coal at Industrial Plants, L. D. Tracy. U. S. Bur. Mines—Bul., no. 242, 1925, 99 pp., 36 figs. Presents both bad and good features of pulverized-coal plants and gives recommendations for safe installation and operation; opinion based largely on results of tests at experimental mine and in laboratory dust gallery.

PUMPING ENGINES

TRIPLE-EXPANSION. The Chelvey Pumping Station of the Bristol Waterworks Company. Engineering. vol. 121, no. 3151, June 4, 1926, pp. 659-661, 4 figs., partly on p. 664. Extension of existing pumping plant by addition of triple-expansion engine driving deep-well and surface pumps, together with 3 Lancashire boilers, superheaters, economizers and usual auxiliaries; engine is inverted vertical type, with cylinders carried on cast-iron standards behind and polished steel columns in front.

PUMPING STATIONS

POWER GENERATION. Generating Power for the Pumping Plant, Prof. E. A. Allcut. Power House, vol. 19, no. 11, June 5, 1926, pp. 46-48. Reviews present practice and future developments. Paper read before Can. Section, Am. Water Works Assn.

PUMPS

POWER-DRIVE EQUIPMENT. Power-Drive Equipment for Industrial Pumps, G. Fox. Indus. Engr., vol. 84, no. 5, May 1926, pp. 208-212, 8 figs. Discussion of operating characteristics of pumps which affect selection of motor control and drive connection.

PUMPS, CENTRIFUGAL

AUTOMATIC PRIMERS. Automatic Primers for Centrifugal Pumps, F. H. Bradford. Am. Water Works Assn.—Jl., vol. 15, no. 6, June 1926, pp. 647-649. A. P. C. O. automatic primer for centrifugal pumps consists of tank divided by partition in middle into two parts, one above the other, arranged for connections to pump; lower half is connected to suction and upper half to discharge side of pump; its purpose is to automatically prime valveless pump without use of foot valve or any other mechanical contrivance which might be subject to wear and tear.

CHARACTERISTICS. Centrifugal Pumps, M. D. Engle. Elec. Light & Power, vol. 4, no. 4, Apr. 1926, pp. 21-23 and 86, 6 figs. Discusses characteristics from standpoint of purchaser and points out most desirable form of characteristic for various services for which centrifugal pumps are used in power stations; consideration on drive for different pumps.

THEORY. The Theory of Centrifugal Pump in Practical Form and Its Extension on the Other Machines, K. Okamoto. Soc. Mech. Engrs. (Japan),—Jl., vol. 29, no. 108, Apr. 1926, pp. 173-234, 40 figs. Presents improved formulas for manometric head and impelling horse power of centrifugal pumps having specially formed impellers which may be applied widely in practice.

PYROMETERS

RECORDING. Recording Pyrometers. Metal Industry (Lond.), vol. 28, no. 20, May 14, 1926, pp. 461-462, 3 figs. Points out need for robust types, easily inspected; method of recording; details of Resilia spring mounting.

Q

QUAYS

CONCRETE. Concrete Quay Built to Carry 50-ft. Pile of Rock, Eng. News-Rec., vol. 96, no. 24, June 17, 1926, pp. 976-977, 2 figs. Thick, reinforced-concrete slab floated on wood piles replaces structure which collapsed under heavy load at Buffalo, N.Y.

R

RAILWAY ELECTRIFICATION

CHICAGO SUBURBAN SERVICE. Electrification of the Illinois Central Railroad Suburban Service in Chicago, W. M. Vanderluis. West. Soc. Engrs.—Jl., vol. 31, no. 3, Mar. 1926, pp. 75-93 and (discussion) 93-96, 10 figs.

RAILWAY MOTOR CARS

DEVELOPMENTS. Rail Motor Cars and Internal-Combustion Locomotives (Les automotrices et locomotives à combustion interne), A. Bourgain. Nature (Paris), nos. 2712, Mar. 27 and Apr. 3, 1926, pp. 200-205 and 217-221, 16 figs. Development of traction on rails by means of internal-combustion engines; design of Schneider and Moyse loco-tractors; development of various types of transmission gears by Fieux, Hele-Shaw, Collardeau; various types of railway motor cars.

GASOLINE-ELECTRIC. Gas-Electric Coaches Built for C. & A., L. C. Paul. Ry. Rev., vol. 78, no. 22, May 29, 1926, pp. 943-946, 6 figs. Eight-wheel, double-truck coaches seat 35 passengers and can turn around in their own length.

RAILWAY REPAIR SHOPS

WELDING AND AIR EQUIPMENT. Welding and Air Equipment in the Danville Shops, F. W. Curtis. Am. Mach., vol. 64, no. 24, June 17, 1926, pp. 941-943, 9 figs. Welding of locomotive units; both electric and oxy-acetylene equipment used; labour-saving tools operated by air; home-made press for brasses.

RAILWAY SHOPS

SCRAP HANDLING IN. Lacakawanna Reduces Scrap Handling Costs 72 Per Cent. Ry. Age, vol. 80, no. 27, June 5, 1926, pp. 1471-1473, 6 figs. New facilities at Scranton, Pa., retire 6 old plants and release 29 men from force.

RAILWAY SIGNALLING

POWER LINES. New York Central Completes New Signal Power Line, R. B. Elsworth. Ry. Signalling, vol. 19, no. 6, June 1926, pp. 217-220, 5 figs. Transmission voltage of 4,600 employed to supply ample power for signal and train-control systems as well as other roadway facilities.

RAILWAY SWITCHES

AUTOMATIC. Automatic Electric Switches for Street Car or Railway Lines, Hervé System (Dispositif d'aiguillage automatique électrique pour tramways ou chemins de fer Système breveté Hervé), M. Weiler. Industrie des Voies Ferrée et des Transports Automobiles, vol. 20, no. 230, Feb. 1926, pp. 110-113, 3 figs. Design and operation of switch controlled from platform of electric car, action being entirely mechanical, reducing short circuits to minimum.

REFRACTORIES

COKE OVEN. Refractory Problems By-Product Coke Plant, M. J. Conway. Iron & Steel Engr., vol. 3, no. 6, June 1926, pp. 292-293, 2 figs. Presents table compiled by Am. Soc. for Testing Material, and describes kind of refractory used in construction of by-product ovens, together with approximate load and temperatures that brick are subject to.

REFRIGERATION

ELECTRIC. Present and Future of Domestic Electric Refrigeration, H. G. Scott. Refrig. Eng., vol. 12, no. 10, Apr. 1926, pp. 338-339. Review of developments and work of Society for Electrical Development.

REINFORCED CONCRETE

DEVELOPMENTS. Reinforced Concrete, A. E. Lindau. Am. Iron & Steel Inst.—Advance Paper, for mtg. May 21, 1926, 16 pp., 4 figs. Outline of development of concrete industry and relation to steel industry; advantage of reinforced concrete lies in economy; kinds of reinforcement. See also abstract in Iron Age, vol. 117, no. 21, May 27, 1926, pp. 1495-1496 and 1553.

ROAD MATERIALS

TEST SPECIFICATIONS. Report of Committee D-4 on Road and Paving Materials. Am. Soc. Testing Matls.—Preprint, no. 70, for mtg. June 21, 1926, 33 pp., 5 figs. Proposed revisions of existing standard and of tentative specifications and methods of tests; proposed tentative method of test for distillation of bituminous materials suitable for road treatment; for asphalt filler for brick pavements, for residue of specified penetration, for testing bituminous emulsions, etc.; recommended practice in bituminous paving-plant inspection.

ROADS

CORRUGATIONS IN. Corrugations in Roads: Their Cause and Their Examination. Roads & Road Construction, vol. 14, no. 40, Apr. 1, 1926, pp. 103-104, 2 figs.

ROADS, CONCRETE

STRESSES. Stresses in Concrete Pavements Computed by Theoretical Analysis, H. M. Westergaard. Pub. Roads, vol. 7, no. 2, Apr. 1926, pp. 25-35, 11 figs. Summarizes results of long period of study, in which author has developed by mathematical analysis method by which stresses in road slabs may be computed; by use of formulas, charts and tables, method can be applied conveniently for design of concrete and road slabs; it also offers means of computing critical stresses in existing pavements.

ROADS, EARTH

MAINTENANCE. Maintaining Dirt Roads. Public Wks., vol. 57, no. 4, May 1926, pp. 117-120, 6 figs. More than 2,500,000 miles of third-class roads, mostly dirt and gravel, present maintenance problem of greatest importance; some figures relative to maintenance work done by counties; equipment used, frequency and results obtained.

ROLLING MILLS

COLD STRIP ROLLING. The Cold Rolling of Strip Steel, C. B. Huston. Gen. Elec. Rev., vol. 29, no. 6, June 1926, pp. 386-393, 12 figs. Purpose of cold rolling; coiling and pickling; general design of mill; operation and control; tandem and other combinations; magnetic time control.

WIRE-ROD. Wire-Rod Mills, J. D. Wright. Gen. Elec. Rev., vol. 29, no. 6, June 1926, pp. 380-386, 13 figs. Rod-rolling industry; development and methods in wire-rod rolling; Garrett and continuous mills; analysis of rod-mill load; steps in rod-rolling in modern mill; electrification of these mills.

ELECTRIC MOTORS FOR. The Application of Synchronous Motors to Steel Mill Main Roll Drives, H. A. Winne. Gen. Elec. Rev., vol. 29, no. 6, June 1926, pp. 394-404, 14 figs.

S

SCALES

TYPES AND USES. Scales Speed Up Mass Production, F. L. Prentiss. Iron Age, vol. 117, no. 23, June 10, 1926, pp. 1635-1638, 7 figs. Monorail scale for weighing raw material; how counting scale is used; sorting parts with scale; testing springs for resistance; electric recording apparatus for conveyor scale.

SEMI-DIESEL ENGINES

HIGH-SPEED. The Fundamental Principles of High-Speed Semi-Diesel Engines. Büchner. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 358, Apr. 1926, 26 pp., 13 figs. Discussion of fuel mixing and ignition, with special reference to engines with precombustion chambers. Translated from Jahrbuch der Brennkrafttechnischen Gesellschaft, vol. 5, 1924.

SEWERS

DIAGRAMS FOR DESIGNING. Two Diagrams for Use in Designing Sanitary Sewers. J. R. McComas. Eng. News-Rec., vol. 96, no. 23, June 10, 1926, pp. 951-952. 2 figs. Presents diagrams, one showing number of persons that may be served by several sizes of sanitary sewers on various grades at per capita flows indicated, and other rational curve for converting average sewage flow into flow for design.

SHEARS

PLATE. Bergue Multiple Shears for Sheet Rolling Mills (Cisaille multiple, système De Bergue), Génie Civil, vol. 88, no. 15, Apr. 10, 1926, pp. 329-332, 5 figs. De Bergue electrically-driven metal-cutting machine used for cutting a number of sections with one operation and with minimum of manual work.

SHEET METAL

TENSILE PROPERTIES. Effects of Size and Shape of Test Specimen on the Tensile Properties of Sheet Metals, R. L. Templin. Am. Soc. Testing Matls.—Preprint, no. 37, for mtg. June 21, 1926, 21 pp., 13 figs. Investigation covering extensive series of tension tests on three types of sheet metals, namely: (1) material having comparatively high tensile strength and low elongation, (2) material having comparatively low tensile strength and high elongation, (3) material having both high tensile strength and high elongation; results indicate quite definitely that tensile strength and yield point of material are affected in only few extreme cases by size and shape of test specimen used; elongation is affected quite seriously by total cross-sectional area rather than by form of test specimen.

SHOVELS

POWER. Modern Tendencies in Power Shovels, F. L. Stone. Min. Congress Jl., vol. 12, no. 5, May 1926, pp. 347-349, 7 figs.

SMOKE

ABATEMENT. How Cities Can Control the Smoke Nuisance, H. B. Meller. Nat. Mun. Rev., vol. 15, no. 5, May 1926, pp. 270-276. Experiences in Pittsburgh in solving smoke problem; author states that smoke emission, regulated by law, has decreased 80 per cent within last fifteen years.

STADIUMS

TORONTO. The Erection of Toronto's New Stadium. Contract Rev., vol. 40, no. 21, May 26, 1926, pp. 495-498, 11 figs. Large steel and concrete structure seating 20,000 people built in winter time in 4½ months.

STEAM

HIGH-PRESSURE. Advantages and Disadvantages of High Steam Pressure in Industrial Plants, J. Pope. Stone & Webster Jl., vol. 38, no. 5, May 1926, pp. 622-642, 7 figs. For purpose of discussion, high-steam pressure is considered to be any pressure in excess of 200 lb. per sq. in.; theoretical and practical considerations; relative cost of equipment for various steam pressures; examples of use of high-pressure steam.

SUPERHEATING. Proposed Method for the Automatic Superheating of Steam. Engineer, vol. 141, no. 3671, May 21, 1926, p. 516. Discusses way by which steam may be automatically raised in temperature without use of any running machinery whatever; principle is reverse of that employed in ordinary refrigerating cycle.

STEAM ENGINES

UNIFLOW. First and Largest Uniflow Engine on Blooming Mill. Power, vol. 63, no. 25, June 22, 1926, pp. 968-972, 8 figs. Four-cylinder condensing uniflow engines—one on continuous mill that at 45 per cent will develop 14,000 i.hp., and reversing engine having maximum rating of 30,000 i.hp.; capacity is 100 tons of steel per hour, at steam consumption of 280 lb. per ton of steel for reversing engine.

STEAM POWER PLANTS

ELECTRIC AUXILIARIES. Electrically-Driven Steam Power Plant Auxiliaries, J. W. Dodge. Gen. Elec. Rev., vol. 29, nos. 5 and 6, May and June, 1926, pp. 340-346 and 427-439, 25 figs. May: Standardizing methods of driving auxiliaries; classification of equipment; power supply from different sources; relays; motors and control. June: Motors for various pump drives; generator-ventilating fans; draft-fan drives; stokers and coal feeders; coal-handling equipment.

HIGH-PRESSURE. Investigations of the 60-Atmos. Steam Plant at the works of A. Borsig, Berlin-Tegel (Untersuchungen an der 60 atp Dampfkraftanlage von A. Borsig), E. Josse. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 21, May 22, 1926, pp. 677-684, 11 figs. Description of plant; boiler test showed 82.9 per cent efficiency with minimum and 79.3 per cent efficiency with maximum calorific value; investigation of back-pressure steam engine, showing efficiency at 844 hp. with 57.8 atmos. absolute initial pressure, 400-deg. cent. initial steam temperature, 12-atmos. absolute back pressure and 211 deg. steam temperature back of low-pressure cylinder; a thermodynamic efficiency of 91 per cent for the whole engine, and 92.7 per cent for high-pressure cylinder alone, was obtained.

Why Higher Pressures Are Advantageous for Industrial Plants, W. Slader. Power, vol. 63, no. 23, June 8, 1926, pp. 883-885. Higher initial pressure makes possible increased extraction pressures and opens way for use of bled steam for even high-temperature process work.

HYDRAUCONE APPLICATION TO. How to Fight Low Water in a Condensing Plant, J. R. James. Power, vol. 63, no. 24, June 15, 1926, pp. 930-931, 2 figs. Falling water level in Great Lakes is serious problem for plants in that region; solution described is interesting adaptation of hydraulic-turbine practice to steam plant.

INCREASED COAL PRICES, EFFECT OF. The Effect of Increased Coal Prices on the Private Power Plant, E. Douglas. Nat. Engr., vol. 30, no. 6, June 1926, pp. 237-239. Cost of purchased current in future will be based on market value of coal; sidelight on current rates from hydro-electric systems; comparison of power costs of private plants and public-utility service.

INDUSTRIAL PLANTS. Selecting a Power and Heat Supply for Industrial Plants, M. K. Bryan. Mech. Eng., vol. 48, no. 6, June 1926, pp. 567-571, 8 figs. Basis on which schemes used to supply heat and power to industrial plants may be compared; curves illustrating power and steam demands of different industries.

STEAM TURBINES

AUXILIARY PUMPS FOR. Auxiliary Pumps for 30,000-k.w. Steam Turbine. Engineer, vol. 141, no. 3673, June 4, 1926, p. 590, 3 figs. Exhibited by Sulzer Bros., Ludwigshafen, at Leipzig Fair; for use in connection with 3-cylinder steam turbine of 30,000 k.w.; circulating water pump, air ejector pump and condensate pump are all mounted on single shaft, which is arranged for direct coupling to 600 hp. 3-phase Brown-Boveri motor running at 960 r.p.m.

EXTRACTION. Utilization of Extraction Steam. South. Power Jl., vol. 44, no. 5, May 1926, pp. 50-55. Part I, by E. D. Dickinson, discusses types and operation of extraction turbines. Part II, by A. D. Somes, discusses ways in which various types of steam turbines may be applied to economical production of power and process steam for industrial purposes. Part III, by R. G. Standerwick, deals with methods of regulating flow of steam through turbines, with particular reference to extraction and mixed-pressure applications.

LARGE. Some Problems in Connection with the Design of Large Turbines, W. B. Flanders. Elec. Jl., vol. 23, no. 5, May 1926, pp. 213-221, 7 figs. Points out that desire for highest efficiency must not be allowed to overshadow practical needs of operator on one hand nor financial balance of investment on the other; discusses types of design.

MIXED-PRESSURE. Mixed-Pressure Turbine Saves $6,000 a Year, W. Arnold. Power, vol. 63, no. 21, May 25, 1926, pp. 810-811, 2 figs. At plant of Pearson & Ludascher Lumber Co., Philadelphia, power formerly purchased is now generated from exhaust steam heretofore blown to atmosphere.

STEEL

ABRASION. Abrasion of Carbon Steels. Soc. Mech. Engrs. (Japan)—Jl., vol. 29, no. 109, May 1926, pp. 273-298, 21 figs. Study of relative abrasion of various carbon steels at state of sliding frictional condition per unit work, coefficient of friction being kept constantly; test was carried out by means of abrasion-testing machine designed by author; specimens were taken from Swedish steels in form of hollow concentric cylinder. (In Japanese.)

ARSENIC, EFFECT OF. The Effects of Arsenic on Steel, A. E. Cameron and G. B. Waterhouse. Iron & Coal Trades Rev., vol. 112, no. 3039, May 8, 1926, pp. 843-845.

ALLOY. *See Alloy Steel.*

DEFORMATION. Initial Permanent Deformation in Soft Steel (Les premières deformations permanentes dans les aciers doux), J. Seigle. Génie Civil, vol. 88, nos. 14, 15 and 16, Apr. 3, 10 and 17, 1926, pp. 315-317, 332-336 and 357-358, 45 figs. Discusses appearance of Piobert lines when elastic limit is exceeded in tensile strength test of bars, etc.; Fry reagent which colors those zones of permanent deformation, lines or zones of initial deformation; examples of tension and bending, and of compression.

FATIGUE. The Fatigue of Steel and Its Recovery, Y. Fujii. Kyoto Imperial Univ., College of Eng.—Memoirs, vol. 4, no. 2, Mar. 1926, pp. 37-62, 47 figs. Investigation of fatigue followed by physical and chemical phenomena, recovery condition of fatigued steels and nature of fatigue.

HARDNESS AT HIGH TEMPERATURE. The Hardness of Carbon Steels at High Temperatures, I. G. Slater and T. H. Turner. Iron & Steel Inst.—Advance Paper, no. 14, for mtg. May 1926, 4 figs. Also abstract in Iron & Coal Trades Rev., vol. 112, no. 3039, May 28, 1926, pp. 842-843, 4 figs.

HIGH-SPEED. *See Steel, High-Speed.*

INGOTS, HETEROGENEITY OF. The Heterogeneity of Steel Ingots. Engineering, vol. 121, nos. 3149 and 3150, May 21 and 28, 1926, pp. 610-612 and 645-646. Deals with observed facts and theoretical aspects of present problems involved. Report of Sub-committee before Iron & Steel Inst. See also Engineer, vol. 141, no. 3671, May 21, 1926, pp. 528-530.

INGOTS, SILICATE DISTRIBUTION IN. A Note on the Distribution of Silicates in Steel Ingots, J. H. S. Dickenson. Iron & Steel Inst. Advance Paper, no. 6, for mtg. May 1926, 20 pp., 18 figs. Method used for estimation of non-metallic impurities; distribution of silicates in two typical ingots and in large ingots; microscopic appearance of separated silicates. See also abstract in Engineering, vol. 121, no. 3150, May 28, 1926, pp. 640-641, 4 figs; and in Iron & Coal Trades Rev., vol. 112, no. 3039, May 28, 1926, pp. 828-831, 14 figs.

MAGNETIC SHEET. The Power Losses in Magnetic Sheet Material at High Flux Densities, C. E. Webb. Instn. Elec. Engrs.—Jl., vol. 64, no. 352, Apr. 1926, pp. 409-427 and (discussion) 427-435, 6 figs. Describes series of tests both by a.c. and ballistic methods on wide range of sheet materials, and also construction of new Lloyd square for tests at still higher flux densities; also more detailed series of tests, both a.c. and ballistic, on representative specimen of each type of material. Bibliography.

STANDARDS. Report of Committee A-1 on Steel. Am. Soc. Testing Matls.—Preprint, no. 9, for mtg. June 21, 1926, 59 pp., 3 figs. Recommendations affecting standards and tentative standards; proposed revisions in standards for steel; proposed tentative specifications for open-hearth carbon-steel rails; for manufacture of open-hearth steel girder rails; soft-steel track spikes; steel tie plates; marine-boiler steel plates; hot-rolled bar steels; cold-finished bar steels and shafting; cold-rolled strip steel; pipe flanges for high-temperature service, etc.

STRUCTURE. On Ghost Lines and the Banded Structure of Rolled and Forged Mild Steels, J. H. Whiteley. Iron & Steel Inst.—Advance Paper, no. 15, for mtg. May 1926, 6 pp., 8 figs. It is shown that only when variations in percentage of phosphorus between two adjacent areas in iron exceed 0.07 per cent, do they cause removal of carbon, between Ar3 and Ar1, from richer area; evidence is given showing that in certain cases carbon may actually move from one region to another of higher phosphorus concentration; it is shown that ghost lines cannot adequately be accounted for by theory that they are due to crystallization of ferrite on non-metallic inclusions. See also abstract in Engineering, vol. 121, no. 3149, May 21, 1926, pp. 613-614, 4 figs.; also Iron & Coal Trades Rev., vol. 112, no. 3039, May 28, 1926, pp. 832-833, 8 figs.

TENSILE STRENGTH AND HARDNESS. The Ratio of the Tensile Strength of Steel to the Brinell Hardness Number, R. H. Greaves and J. A. Jones. Iron & Steel Inst.—Advance Paper, no. 7, for mtg. May 1926, 18 pp., 3 figs. Ratio of tensile strength to Brinell hardness number is dependent on hardness of material and on its yield ratio; for given class of steel ratio decreases with increase of yield ratio and also decreases with increases of hardness up to 375 to 450, depending on composition of steel; summary of ratio of tensile strength to Brinell hardness number, calculated from data obtained in Research Department, Woolwich, and from sources indicated. Bibliography. Also abstract in Iron & Coal Trades Rev., vol. 112, no. 3039, May 28, 1926, pp. 847-848; and Engineering, vol. 121, no. 3151, June 4, 1926, pp. 673-674, 2 figs.

STEEL CASTINGS

ELECTRIC HEAT-TREATING. Electric Heat-Treating of Steel Castings, L. E. Everett. Elec. World, vol. 87, no. 23, June 3, 1926, pp. 1233-1236, 4 figs. Practical advantages of electric furnaces in annealing field; utilization of electric energy as source of heat compared with fuel-fired furnaces; method of application.

STEEL, HIGH-SPEED

HARDENING AND TEMPERING. The Hardening and Tempering of High-Speed Steel, A. R. Page. Iron & Steel Inst.—Advance Paper, no. 11, for mtg. May 1926, 24 pp., 40 figs. Preliminary investigations on effect of hardening and tempering on microstructure, etc., of two steels; effect of time and temperature of hardening and tempering on hardness of these same steels. See abstract in Iron & Coal Trades Rev., vol. 112, no. 3039, May 28, 1926, pp. 833-836, 33 figs.

STEEL WORKS

OPERATION. Problems of Steel Mill Operation, A. J. Whitcomb. Indus. Engr., vol. 84, no. 6, June 1926, pp. 249-259, 14 figs. Trends that are being followed in solving problems involving use of electrical and mechanical power-drive equipment; present tendencies in conversion, distribution and application of electrical energy in iron and steel industry.

STOKERS

LUBRICATION. Lubrication of the Mechanical Stoker, A. F. Brewer. Power, vol. 63, no. 23, June 8, 1926, pp. 895-896. Deals with oiling of worm and spur gearing used for speed-reduction purposes; bearings of electric motors, turbines, steam engines and of such shafting as is involved in operation of movable grates; and steam cylinders where steam engines are used as driving units.

STREAM POLLUTION

PAPER MILLS. Pulp and Paper Mill Discharge in Relation to the Purity of Streams, V. P. Edwardes. Paper Mill, vol. 49, no. 24, June 12, 1926, pp. 10, 12, 42 and 44. Paper-mill waste; waste from straw pulp; sulphite mill waste; legal aspects of problem; recommendations; technical outlook for waste reduction. Report submitted to Am. Pulp & Paper Mill Supts'. Assn.

STREET RAILWAYS

MULTIPLE-UNIT OPERATION. Multiple-Unit Operation of Tramways and Light Railways. English Elec. Jl., vol. 3, no. 4, Jan.-Mar. 1926, pp. 188-195, 10 figs.

STRUCTURES

TIMBER. Design of Details in Timber Structures, R. H. Lindgren. Boston Soc. Civil Engrs.—Jl., vol. 13, no. 5, May 1926, pp. 216-232, 10 figs. Discusses details usually encountered in timber design; methods shown, either alone or in combination, will ordinarily be sufficient to solve majority of cases.

ULTIMATE DESIGNING. In Advocacy of Ultimate Designing. Eng. News-Rec., vol. 96, no. 24, June 17, 1926, p. 994. Review of small pamphlet essay in German, by M. Mayer, advocating what is sometimes called ultimate designing, that is, calculating with limiting forces, or assuming for each influencing factor most unfavourable limiting condition that is practically conceivable, then planning construction so that when all these unfavourable conditions concur it will yet be little short of failure.

T

TAR

LOW-TEMPERATURE. A Study of a Tar from the Low-Temperature Carbonization of Coal, R. Parrish and F. M. Rowe. Chem. & Industry, vol. 45, no. 17, Apr. 23, 1926, pp. 99T-106T. Examination of low-temperature tars by method recommended to depict salient characteristics.

TEMPERATURE MEASUREMENTS

INSTRUMENTS. The Science of Temperature Measurement, H. M. Brown. Indus. Chemist, vol. 2, no. 15, Apr. 1926, pp. 166-168, 7 figs. Deals with four types of temperature-measuring instruments, namely, mercurial thermometer, electrical resistance thermometer, electrical thermocouple instrument and optical pyrometer.

TESTS AND TESTING

MATERIALS. Some Practical Aspects of the Testing of Materials, M. Moser. Metallurgist (Supp. to Engineer, vol. 141, no. 3672), May 28, 1926, pp. 79-80. Deals with tensile, hardness and bend testing; author emphasizes necessity for exercising discretion in choosing localities from which specimens should be taken from large masses of material. (Abstract.) Address before German Assn. for Testing Eng. Matls.

METHODS. Report of Committee E-1 on Methods of Testing. Am. Soc. Testing Matls.—Preprint no. 3, for mtg. June 21, 1926, 58 pp., 34 figs. Reports of sub-committee on mechanical and impact testing; volatility, plasticity and consistency, determination of water, shape and size and methods for density; report on testing of thin sheet metals; facilities and methods for making impact tests and their interpretation; proposed methods of impact testing.

TEXTILE MILLS

LOCATING HIDDEN WASTES. Mechanical and Material Research in Management, T. P. Gates. Mech. Eng., vol. 48, no. 6, June 1926, pp. 579-582, 5 figs. Method for locating hidden wastes in textile manufacturing that has shown marked results, and its application in mercerizing problem.

TEXTILES

TESTING. Report of Committee D-13 on Textile Materials. Am. Soc. Testing Matls.—Preprint no. 77, for mtg. June 21, 1926, 19 pp., 4 figs. Proposed general methods of testing textile fabrics; specifications for tolerances and test methods for rayon, and for electrical cotton tapes.

TOOLS

MANUFACTURE. The Division of Labour in Tool Manufacturing, G. A. Pennock. West. Soc. Engrs.—Jl., vol. 31, no. 3, Mar. 1926, pp. 97-102. Describes modern organization of specialists, each performing only part of operations in making tools; such system should obviously bring many economies and comparison of costs given by author reveals savings under newer order; these refer only to toolmaking expense.

TORSION

TWIST METER FOR TESTS. A New Twist Meter for Torsion Tests, J. H. Smith. Am. Soc. Testing Matls.—Preprint, no. 84, for mtg. June 21, 1926, 4 pp., 2 figs. New type of instrument for accurately measuring twist in torsion tests, designed in such manner as to be quickly attached to and removed from test specimens.

TRACTORS

CATERPILLAR. The Development of the Caterpillar Tractor and Its Application to Industry, P. E. Holt. Mech. Eng. (Supp.), vol. 48, no. 6, June 1926, pp. 657-661, 7 figs. Historical; inception of idea of endless-track principle and its development into workable machine; caterpillar in World War; standardization and refinement in manufacture; universal application to industry.

LUBRICATION. Tractor Lubrication and Lubricants. Lubrication, vol. 12, no. 4, Apr. 1926, pp. 37-48, 19 figs. Relation of physical characteristics of tractor oils to operating conditions; tractor-engine oil requirements; mechanical conditions involved; transmissions, final drives and other gearing.

TRANSFORMERS

110,000-VOLT. 110,000-Volt Transformers for 100,000-HP. Transmission Scheme. English Elec. Jl., vol. 3, no. 4, Jan.-Mar. 1926, pp. 145-157, 19 figs. Transformers being installed in power station at Bhira, near Bombay, India, are of core-type construction with windings of 2 vertical limbs; they are oil-immersed, water-cooled by means of internal cooling coil, and arranged for outdoor service.

STATIC. Notes on the Testing of Static Transformers, J. L. Thompson and H. Walmsley. Instn. Elec. Engrs.—Jl., vol. 64, no. 353, May 1926, pp. 505-526 and (discussion) 527-547, 40 figs. Usual methods adopted in commercial testing; discusses drying out of transformers, determination of dryness and measurement of insulation resistance; measurement of iron and load loss, and methods for obtaining greater accuracy; measurement of form tractor and its effect on loss measurements; methods for determining ohmic resistance.

VOLTAGE RATIO CONTROL. Transformer Voltage Ratio Control Under Load, L. H. Hill. Elec. Jl., vol. 23, no. 5, May 1926, pp. 261-266, 13 figs. Methods of tap changing; installations described are typical of tap changing under load equipments in use, and to some extent indicate trend of development toward simpler and more compact equipment.

TUNNELS

VEHICULAR. Work Begun on New Mersey Tunnel, A. L. Murphy. Compressed Air Mag., vol. 31, no. 5, May 1926, pp. 1627-1629, 4 figs. Construction of world's largest subaqueous vehicular tunnel under Mersey River at Liverpool, Eng.; will have internal diameter of 44-ft. and be over two miles long.

V

VACUUM VESSELS

EVAPORATIVE LOSSES. On the Evaporative Losses of Vacuum-Jacketed Vessels of the Dewar Type, R. M. Archer. Phys. Soc. Lond.—Proc., vol. 38, part 3, Apr. 15, 1926, pp. 247-272, 7 figs. Particulars of experiments made by author in Oxygen Laboratory of Air Ministry; describes separation of neck and radiation losses, and also method of testing absorbents under working conditions.

VALVES

PIPE-LINE. Valves for the Fourth Thirlmere Pipe Line. Engineer, vol. 141, no. 3672, May 28, 1926, pp. 550-552, 10 figs. Laying of fourth line completes aqueduct between Lake Thirlmere and Manchester; fourth line consists of 29 siphons having aggregate length of 32 mi. and are controlled by valves at each end; on longer siphons there are manual sluice valves, reflux valves, automatic stop valves and double-ball air valves; all of these appliances are described.

RELIEF. A High-Pressure Relief Valve, F. A. Ernst and F. C. Reed. Mech. Eng., vol. 48, no. 6, June 1926, pp. 595-597, 11 figs. Difficulties encountered with valves of commercial design; steps taken in evolving dependable design; details regarding materials and processes of manufacture.

VISCOSIMETERS

AIR-BUBBLE. The Air-Bubble Viscometer, G. Barr. Lond, Edinburgh & Dublin Philosophical Mag. & Jl. Sci., vol. 1, no. 2, Feb. 1926, pp. 395-405, 1 fig Effects of length of bubble and diameter of tube have been examined and rate of rise determined for several oils of known viscosity and surface tension, for water and for glycerin in different tubes; above certain limit, length of bubble is without appreciable effect on rate of rise; air-bubble viscosimeter may be used with confidence for approximate comparison of viscosities of materials of same class.

VOLTAGE REGULATION

REGULATORS. Compensating for Voltage Drop with Automatic Voltage Regulators, J. H. Ashbaugh. Elec. Jl., vol. 23, no. 5, May 1926, pp. 243-246, 8 figs. Points out there are many instances where compensation would result in improved operating conditions.

W

WATER PIPES

CORROSION. Prevention of Corrosion and "Red Water," J. R. Baylis. Am. Water Wks. Assn.—Jl., vol. 15, no. 6, June 1926, pp. 598-633, 12 figs. Theory of corrosion; solubility equilibrium of iron salts; tendency for iron to go into solution; factors influencing corrosion of iron; pitting and tuberculation; corrosion of zinc and of lead; brass and copper pipe; concrete and cement-lined pipes; treatment of water to prevent corrosion and red water.

WATER TREATMENT

CHLORINATION. Review of Nineteenth Annual Report on Water Examination. London Metropolitan Water Board, M. C. Whipple. New England Water Wks. Assn.—Jl., vol. 40, no. 1, Mar. 1926, pp. 33-39. Review of report which records interesting observations upon subject of chlorination and tastes in drinking water.

WATER WORKS

HAMILTON, ONT. Water Works Extension, Hamilton, Ont. Can. Engr., vol. 50, no. 23, June 8, 1926, pp. 631-635, 5 figs. Report, prepared by city engineer and consulting engineers, strongly advises immediate construction of filtration plant, reservoir, new intake and additional pumping facilities.

INTAKES. Intakes for Water Works, J. J. Traill. Water Wks., vol. 65, no. 6, June 9, 1926, pp. 261-263. Information on Canadian installations. Paper presented before Can. Section, Am. Water Works Assn.

TORONTO DUPLICATE SYSTEM. Toronto Duplicate Water Works System, W. Gore and H. G. Acres. Can. Engr., vol. 50, no. 22, June 1, 1926, pp. 611-615, 6 figs. Report recommends construction of 10-ft. intake tunnel, filtration plant and pumping station at Victoria Park; 10-mile tunnel to link Victoria Park plant with John Street station and with new station at Parkside Drive; additional reservoir capacity provided.

WELDING

BOILERS. Autogenously and Electrically-Welded Boilers and Containers, E. Hohn. Mech. Eng., vol. 48, no. 6, June 1926, pp. 603-609, 71 figs. Results of investigation of strength and tenacity of parts welded together. Translated from Zeit. des Vereines deutscher Ingenieure, Jan. 23 and Feb. 6, 1926.

ELECTRIC. *See Electrical Welding, Arc.*

OXY-ACETYLENE. *See Oxy-Acetylene Welding.*

WELDS

X-RAY TESTS. X-Ray Tests of Welds Reveal Some Defects, But Not All. Power, vol. 63, no. 21, May 25, 1926, pp. 800-803, 12 figs. Investigation indicates that X-ray examination of fusion-welded joints is of value in revealing certain types of defects, particularly voids and oxide inclusions; X-ray missed defects due to insufficient fusion.

WINDING ENGINES

CONTROL FOR ELECTRIC DRIVE. A New System of Control for Electrically-Driven Machines and Cranes, J. Bentley. Instn. Elec. Engrs.—Jl., vol. 64, no. 353, May 1926, pp. 567-578, 10 figs. Describes arrangement of contactors, resistances, etc., together with patent speed-load device as applied to electric winch and its method of working and performance under various conditions of hoisting and lowering loads; simpler, more compact and less costly system, obtained as result of experiment is developed, with curves giving various speeds obtained at different loads and description of safety devices, etc.

WINDMILLS

ELECTRICITY GENERATION. Windmills for the Generation of Electricity. Engineer, vol. 141, no. 3673, June 4, 1926, pp. 586-587. Results of work carried out at experimental station by Inst. of Agricultural Engineering, Oxford Univ., covering (1) testing of several actual plants to obtain data on output, general performance and suggestions for improvements; (2) collection of economic data for benefit of public; and (3) collection of meteorological data, particularly probabilities of wind and calms.

WIRE

ELASTICITY. The Elasiticity of Wires and Cables, H. W. Swift. Engineering, vol. 121, nos. 3148 and 3150, Apr. 30 and May 28, 1926, pp. 547-548 and 615-617, 6 figs. Critical comparison of available methods of determining modulus of elasticity, and account of tests made to determine comparative accuracy and reliability of certain of them; methods of measurement are: (1) extensometers of special type on short lengths; (2) verniers on long vertical lengths; (3) methods depending on sag in horizontal span.

WROUGHT IRON

STANDARD SPECIFICATIONS. Report of Committee A-2 on Wrought Iron. Am. Soc. Testing Matls.—Preprint, no. 10, for mtg. June 21, 1926, 3 pp. Sub-committee report on tubes and pipe and on merchant bar iron.

Institute Committees for 1926

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A

ABRASIVE WHEELS

Standardization. Grinding Wheels. U. S. Bur. of Standards—Simplified Practice Recommendation, no. 45, 1926, 23 pp., 33 figs. Study conducted by Bur. of Standards resulted in reduction from 715,200 to 255,800 varieties of grinding wheels.

AERODYNAMICS

Wind-Tunnel Research. The Resistance of the Airship Models Measured in the Wind Tunnels of Japan. Tôkyô Imperial Univ.—Report of Aeronautical Research Inst., vol. 2, no. 15, Mar. 1926, 84 pp., 28 figs. Report of investigation to compare resistance or resistance coefficient of airship models measured at different wind tunnels and by different methods to deduce some properties, if any, peculiar to wind tunnels and aerodynamical balances employed.

AIRCRAFT

Defense Against. The Past and Future of Defense Against Aircraft, B. F. Harmon. Coast Artillery Jl., vol. 63, nos. 5 and 6, Nov. and Dec. 1925, pp. 449-460 and 555-566. Shows great importance of roles played by Air Service. Illustrates importance of Air Service roles, particularly reconnaissance, by reference to opening phases of World War; anti-aircraft means of defence, etc.

Steam Power Plants for. Steam Power Plants in Aircraft, E. E. Wilson. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 239, June 1926, 30 pp., 2 figs. Analysis of proposal to use steam power plants in aircraft.

AIRCRAFT CONSTRUCTION MATERIALS

Compression Rubbers. Compression Rubbers, G. H. Dowty. Flight (Aircraft Engr.), vol. 18, no. 25, June 24, 1926, pp. 60-62, 7 figs. Properties of compression rubbers and results of tests of various types of compression rubbers.

AIRPLANE ENGINES

Air-Cooled. Adaptation of the Radial Air-Cooled Engine, R. W. A. Brewer. Aviation, vol. 20, no. 25, June 21, 1926, pp. 942-944, 12 figs. Special problems of installation; cowling and cooling; materials for manifolds.

Navy Air-Cooled Engines Development, E. E. Wilson. Aviation, vol. 21, no. 2, July 12, 1926, pp. 59-61, 3 figs. Weight per horse power of air-cooled engines; fuel consumption favours water-cooled engines; Navy's programme for development of air-cooled engines.

Fuel-Injection Valves. An Investigation of the Characteristics of Steel Diaphragms for Automatic Fuel-Injection Valves, W. F. Joachim. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 234, Apr. 1926, 22 pp., 15 figs. Research on steel diaphragms undertaken at Langley Memorial Aeronautical Laboratory as part of general investigation of fuel-injection engines for aircraft; work determined load-deflection, load-deformation and hysteresis characteristics for single diaphragms having thickness from 0.002 to 0.012 in. and for similar diaphragms tested in multiple having total thicknesses from 0.012 to 0.18 in.

AIRPLANE PROPELLERS

Design. Propeller Design—A Simple System Based on Model Propeller Test Data, F. E. Weick. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 237, May 1926, 19 pp., 12 figs. Simple system for designing propellers of standard form; based on tests of 13 Navy models; method has given satisfactory results in Bur. of Aeronautics, U. S. Navy Department.

Propeller Design—Extension of Test Data on a Family of Model Propellers by Means of the Modified Blade Element Theory, F. E. Weick. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 236, May 1926, 8 pp., 6 figs. Describes method to extend data obtained from tests on 13 model propellers to include all propellers of same form likely to be met in practice.

Theory. Theory of Airscrews, S. Kawada. Tôkyô Imperial Univ. of Aeronautical Research Inst.—Report, vol. 1, no. 14. Mar. 1926, pp. 361-404, 8 figs. Attempts to elucidate mechanism of action of airplane propeller in air, based on Prandtl's theory of airfoil.

AIRPLANES

Control at Low Speeds. On the Control of Airplanes at Low Speeds, B. V. Korvin-Kroukovsky. Aviation, vol. 20, no. 25, June 21, 1926, pp. 946-947, 3 figs. Supporting existing control methods as adequate for control under all conditions.

Line Assembly. Line Assembly of Airplanes at the Breguet Works. (La fabrication des avions "à la chaine" aux usines Breguet), Aéronautique, vol. 8, no. 85, June 1926, pp. 193-196, 6 figs. Description of methods employed in vertical erection of wings and assembly of fuselages and frames of Breguet 19 metal biplane, with routing diagrams.

Metal. Metal Aeroplane Construction, A. B. Miller. Junior Instn. Engrs., vol. 36, May 1926, pp. 325-343, 17 figs. Review of construction at present stage of selective process which continues its development due to search for light and permanent structure, capable of production and maintenance, in same way as any other manufactured article, by engineering industry; factors leading to choice of metals as most suitable construction materials are: weight economy, lack of deterioration of spares in storage, good supply of raw material, and facilities for mass production and standardization.

Spar and Wing-Rib Tests. Comparison of Tests on Experimental 15-Inch Metal Spars and 11-Foot Chord Metal Wing Ribs, J. S. Newell. Air Service Information Circular, vol. 6, no. 556, Mar. 1, 1926, 43 pp., 54 figs. Results and conclusions of tests made at McCook Field.

Velocity. The Effect of Flight Path Inclination on Airplane Velocity, W. S. Diehl. Nat. Advisory Committee for Aeronautics—Report, no. 238, 1926, 11 pp., 6 figs. Systematic study of relations between flight velocity and its horizontal component in power glides; effect of inclination of flight path on horizontal velocity; effect of slight deviation from horizontal flight path.

AIRSHIPS

Electric Hazards. Electric Hazards of Airship Traffic (Die elektrischen Gefahren des Luftschiffverkehrs), Wiegand. Zeit. für Technische Physik, vol. 7, no. 5, 1926, pp. 238-239. Discusses formation of strong electric fields and electric sparks, electrostatic field in atmosphere, electric charge of airships, etc., and shows how dangers may be eliminated.

AIRWAYS

Meteorological Conditions. Meteorological Conditions Along Airways, W. R. Gregg. U. S. Natl. Advisory Comm. for Aeronautics, Report No. 245, 1926, 16 pp., 8 figs. Chicago-Fort Worth airway studied to show kind of meteorological information needed to determine operating conditions along airways.

ALLOYS

Aluminum. *See Aluminum Alloys.*
Iron. *See Iron Alloys.*
Nickel. *See Nickel Alloys.*

ALUMINUM ALLOYS

Duralumin. *See Duralumin.*

Refining Processes. Processes of Refinement in Aluminum Alloys (Die Veredelungsvorgänge in vergütbaren Aluminiumlegierungen), K. L. Meissner. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 12, Mar. 20, 1926, pp. 391-401, 13 figs. Nature of automatic refinement of duralumin; explanation of refining phenomena according to Merica; tests by Fraenkel on electric conductivity and chemical resistance; influence of age hardening at room and at higher temperatures; effect of compound Mg_2Si; refining process according to Hanson and Gayler, Hond and Konno; refining of magnesium-free aluminum containing copper by artificial age hardening; peculiarities of magnesium and magnesium-free alloys when used in light-metal construction; tests with lautal; critical dispersion.

ALUMINUM BRONZES

Heusler Ferromagnetic. Crystal Structure of Heusler Alloys (Ueber die Kristallstruktur der Heuslerschen Legierungen), L. Harang. Physokalische Zeit., vol. 27, no. 7, Apr. 1, 1926, pp. 204-205, 1 fig. Determination of structure of Heusler ferromagnetic aluminum-manganese bronzes; there is no simple relationship between magnetic properties and appearances of different lattices.

AMMETERS

Multiple Range. The Multi-Range Ammeter of Constant Resistance, L. G. A. Sims and M. H. Hunt. Experimental Wireless, vol. 3, no. 34, July 1926, pp. 425-428, 4 figs. Derives equations for computing values of shunt and series resistance required so that set of such resistance could be constructed and mounted with instrument, together with switches, for changing resistances according to desired ratio.

AMMONIA CONDENSERS

Troubles, Prevention of. Preventing Ammonia Compressor Troubles, H. J. Macintire. Power Plant Eng., vol. 30, no. 12, June 15, 1926, pp. 708-710, 1 fig. Discusses factors that may reduce efficiency of compressor, such as incorrect pressures, non-condensable gases and poor heat transfer in system.

Operation. Operating Characteristics of Ammonia Condensers, W. H. Motz. Power, vol. 63, no. 26, June 29, 1926, pp. 1012-1014, 7 figs. Influence upon condenser pressure of initial temperature and quantity of cooling water, amount of surface, and disposition of surface; condenser pressures for various conditions and effect of reduction of condenser pressure on power consumption.

AUTOMOBILE ENGINES

Crankcase-Oil Dilution. Oil Rectification. Automobile Engr., vol. 16, no. 216, June 1926, pp. 226-228, 5 figs. Details of device for preventing crankcase dilution.

Oil Filtration. Improved Engine Oil Filtration. Motor Transport, vol. 42, no. 1109, June 14, 1926, pp. 670-671, 4 figs. Describes three types of special oil filters which, it is claimed, yield more mileage for less consumption and wear; absorbent-pad type, Skinner combined filter and recovery unit, and Renault oil purifier.

AUTOMOBILES

Headlights. New Headlight Has Long Range Without Glare, M. A. Hall. Automotive Mfr., vol. 68, no. 3, June 1926, pp. 5-7, 3 figs. Headlight demonstrated by Gen. Elec. Co. at Schenectady which has long range without glare; wide side beam with backward rays which illuminates ditches and road signs and requires no focusing.

Photometric Measurements and Glare Tests of Automobile Headlights (Misure forometriche e di abbagliamento in fari per autoveicoli), E. Perucca. Elettrotecnica, vol. 13, no. 3, Jan. 25, 1926, pp. 45-46, 11 figs. Suggested tests for automobile headlamps; convenient method for halving distance required for photometric measurements by means of reflection by plane mirror; describes several headlights and give results obtained by testing them in manner suggested.

AUTOMOTIVE FUELS

Anti-Knock. Motyl and Motalin (Motyl und Motalin), Ostwald. Petroleum, vol. 22, no. 14, May 10, 1926, pp. 525-530, 8 figs. Discusses low volatility, impurities and knocking of gasoline; production of motalin, dapolin colored yellow by addition 4 per cent of motyl, which prevents knocking, iron carbonyl replacing dangerous tetraethyl lead.

France. Better Use of Liquid Fuels (Sur la meilleure utilisation des combustibles liquides), P. Dumanois. Annales des Combustibles Liquides, vol. 1, no. 1, 1926, pp. 49-78. Increasing efficiency of explosion engines by increasing compression, and consequent appearance of spontaneous ignition and detonation; anti-knock compounds and possibility of using heavier oil.

B

BEAMS

Continuous. Apparatus for Drawing Influence Lines of Continuous Beams. (Appareil Donnant le Tracé des Lignes d'Influence des poutres continues), G. Colonnetti. Génie Civil, vol. 88, no. 24, June 12, 1926, pp. 523-526, 9 figs. Description of the "influentiograph," a drafting-board device for this purpose, and methods of using it.

Reinforced Concrete. The Design of Reinforced Concrete Beams and Slabs for High-Strength Concrete, E. S. Andrews. Concrete & Constr. Eng., vol. 21, no. 6, June 1926, pp. 424-426, 2 figs. Shows diagram prepared in order to facilitate design of beams and slabs when higher stresses are employed.

BEARINGS

Babbitted. Babbitting Bearings. Mech. World, vol. 79, no. 2060, June 25, 1926, pp. 489-490, 8 figs. Discusses method for babbitting bearings; removing old babbitt; housing; tools for cutting oil grooves, etc.

Motor, Lubrication of. Lubricating Motor Bearings, F. E. Gooding. Indus. Engr., vol. 84, no. 7, July 1926, pp. 311-315, 10 figs. Problems in lubricating motor bearings and methods used by manufacturers of motors and bearings to reduce operating troubles.

BEARINGS, BALL

Calculation. Construction of Ball Bearings (Ueber die Konstruktion von Rillenkugellagern), A. Palmgren. Maschinenbau, vol. 5, no. 10, May 20, 1926, pp. 452-455, 6 figs. Discusses bearings derived from Stribeck type; effect of contact between balls and race on load capacity; shows by calculations that bearings without filling groove and small number of balls are preferable.

Journal-Thrust. Journal-Thrust Ball Bearings. Automobile Engr., vol. 16, no. 216, June 1926, p. 208, 8 figs. Combination journal and thrust bearing somewhat similar to French duplex bearing; another type is known as U or Universal bearing, in which advantage is taken of thrust-resisting feature to build up effective double-journal and double-thrust bearing.

BELT DRIVE

Individual vs. Group. Group Drives More Economical for Most Conditions, L. H. Hopkins. Belting, vol. 28, no. 6, June 1926, pp. 15-17, 1 fig. Group drives show greater efficiency from standpoint of operation, maintenance and initial cost and are more adaptable to slight speed changes.

BLASTING

Detonators. Detonators and Tests for Detonators, C. S. Hurter. Dupont Explosives Service Bul., July 1926, 4 pp. Discussion of principal factors which determine efficiency of blasting caps; function of detonator and its essential elements; action of detonator; relative merits of various explosives; substances for detonators; tests for detonators.

BOILER FEEDWATER

Deaeration. Importance of Care of Feedwater in Economic Boiler Operation (Die Bedeutung der Speisewasserpflege für den wirtschaftliches Dampfkesselbetrieb), H. Riemer. Sparwirtschaft, nos. 4 and 5, Apr. and May 1926, pp. W55-W60 and W-76-W81, 18 figs. Formation of boiler scale, solubility of gases in water, deleterious effect of organic compounds. Physical and chemical processes of feedwater purification.

Softening. The Why and How of Water Softening, S. O. Andros. Steam Power, vol. 5, no. 5, June 1926, pp. 3, 5 and 12, 4 figs. Gives case representing typical condition arising from use of raw water and water-softening method employed.

BOILER FURNACES

Air Preheating. A New Air Preheater. Eng. & Boiler House Rev., vol. 39, no. 11, May 1926, pp. 520-524, 2 figs. General principle of new Perry design which, it is claimed, is considerably less in weight and bulk than existing types of preheaters or economizers, while for high duties, advantages, together with low cost, are increased.

Preheating Combustion Air in Boiler Firing (Ueber die Vorwärmung der Verbrennungsluft bei Dampfkesselfeuerungen), E. Mikocki. Sparwirtschaft, vol. 3, no. 5, May 1926, pp. W73-W76. Discusses recent tests made and advantages of air preheating; types of preheaters, including that of Schwabach and Ljungström.

Utilization of the Waste Heat of Boiler Installations to Preheat the Combustion Air, E. Blau. Combustion, vol. 14, no. 6, June 1926, pp. 374-377, 2 figs. By preheating combustion air, 70 per cent of heat of flue gases can be recovered; temperature in combustion chamber is increased appreciably, and consequently combustion on grate proceeds more vigorously; system of air heaters in common use. Translated from German.

Excess-Air Reduction. Limiting Factors in Reducing Excess Air in Boiler Furnaces, E. G. Bailey. Mech. Eng., vol. 48, no. 7, July 1926, pp. 703-709, 16 figs. Study of interrelationship and relative importance of three factors most closely related to excess air; namely, furnace temperature, unburned fuel, and heat loss in chimney gases.

BOILER OPERATION

Control. Regulating Devices and Measuring Instruments in Boiler Plants (Neue Regeleinrichtungen und Messgeräte für Dampfkesselanlagen), Elektrotechnik u. Maschinenbau, vol. 44, no. 12, Mar. 21, 1926, pp. 60-63, 5 figs. Roncka automatic regulator known as multimeter, which controls velocity of combustion, air supply, feedwater supply, fuel supply, etc.; examples of applications.

BOILER PLATE

Caustic Embrittlement of. Caustic Embrittlement, S. W. Parr and F. G. Straub. Power, vol. 63, no. 26, June 29, 1926, pp. 994-998, 10 figs. Summary of results of studies carried on at engineering experiment stations of Univ. of Illinois to discover process whereby seemingly good boiler plate becomes worthless after few years of service.

BOILERS

Economy, Determination of. Determining Boiler Economy, D. Cochrane. Power House, vol. 19, no. 12, June 20, 1926, pp. 23-24. Determination of economy in coal consumption, in weight of boiler, in first cost, and in maintenance of total life.

Heat Transfer. Heat Transfer in Boilers, C. F. Wade. Elec. Times, vol. 69, no. 1808, June 17, 1926, pp. 705-707, 4 figs. Trend of design of steam boilers; transfer of heat by radiation and by conduction aided by convection.

Therm as Unit of Capacity. The "Therm" as a Unit of Boiler Capacity, H. W. Brooks. Combustion, vol. 14, no. 6, June 1926, p. 377. It is believed that therm would lend itself ideally to solution of problem.

BORING MACHINES

Stern-Bush. Stern-Bush Boring Machine. Engineering, vol. 121, no. 3152, June 11, 1926, p. 692, 8 figs. Details of machine for rebushing stern-tube liner of vessel in position.

BRIDGES, HIGHWAY

Concrete. New Bridge Over the Thames at Caversham. Engineer, vol. 141, no. 3676, June 25, 1926, p. 656, 5 figs. partly on p. 666. Approach roads between reinforced-concrete retaining walls run up towards bridge on either side of river; there are three abutments connected by two-arched bridge having clear spans of 126 ft. and 106 ft. respectively; total length, 457½ ft.

BRIDGES, RAILWAY

Concrete. Concrete Bridge Designed for Elastic Movement, C. R. King. Eng. News-Rec., vol. 96, no. 25, June 24, 1926, pp. 1022-1024, 5 figs. Swedish railroad bridge in cold climate uses steel hinges, different concrete mixes, large expansion joints, and expansion slide plates under floor.

Raising. Chicago & Eastern Illinois Raises Bridge by a Novel Method, J. E. Bernhardt. Ry. Eng. & Maintenance, vol. 22, no. 7, July 1926, pp. 263-265, 3 figs. Existing 103-ft. steel span is lifted vertically 23½ ft. by locomotive power to permit dredging operations.

BRIDGES, SUSPENSION

Delaware River. The Delaware River Bridge, C. E. Chase and C. Carswell. Contractors & Engrs'. Monthly, vol. 12, no. 6, June 1926, pp. 45-52, 10 figs. Wire-cable suspension bridge with main span of 1,750 ft.; main piers are located shoreward of pierhead lines on each side of river; piers are founded upon rock and were constructed by use of pneumatic caissons.

C

CABLES, ELECTRIC

Internal Vacua, Effect of. The Effect of Internal Vacua, W. A. Delmar. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 7, July 1926, pp. 627-629. Considers rate of pressure equalization in cables and relative effects of slow equalization upon long and short cables, indicating that there may be considerable difference in dielectric properties depending on length and past history in regard to temperature cycles; suggests means of overcoming these differences.

Paper-Insulated. The Quality Rating of High-Tension Cable with Impregnated Paper Insulation, D. W. Roper and H. Halperin. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 6, June 1926, pp. 505-515, 12 figs. Laboratory tests to determine what high-voltage tests cable, known to be of good quality, will withstand; careful examination and dissection of samples of cable as received from factory and samples removed from lines which have failed in service or which have been in service for number of years without failure; comparison of operating records of cable with examination of samples, etc.

Pulling Tensions. Reduced Pulling-In Tensions on Cables, C. H. Shaw. Elec. World, vol. 88, no. 1, July 3, 1926, pp. 17-18, 4 figs. Improvement in transmission cables requires equal betterment of installation practice; studies on pulling tensions for 132-kv. cable in monolithic ducts reveal great reductions through use of soapstone.

CABLEWAYS

Funicular Lines. Safety Devices in Cableways for Passenger Traffic (Dispositif de sécurité dans les funiculaires aériens pour voyageurs), F. Crestin. Génie Civil, vol. 88, no. 22, May 29, 1926, pp. 482-485, 14 figs. Discusses principal causes of cable deterioration; safety devices, brakes, etc., and describes Mont Blanc line and its equipment.

CAISSONS

Sinking. A Problem in Plant Layout on Saturated Sand. Eng. News-Rec., vol. 96, no. 25, June 24, 1926, pp. 1016-1017, 4 figs. Sinking circular caisson 82 x 63 ft. deep in sand below tide level calls for pile foundation for new Jamaica, L.I., sewage treatment plant.

CANALS

Welland. The Welland Ship Canal, J. B. Walker. Sci. Am., vol. 135, no. 1, July 1926, pp. 32-33, 6 figs. Progress on 25-foot waterway with 30-foot locks that will open Great Lakes to ocean.

CAR DUMPERS

Grain Elevators. Dumping Plant for Grain Cars. Engineering, vol. 121, nos. 3151 and 3153, June 4 and 18, 1926, pp. 650-652 and 716-720, 47 figs., partly on supp. plates. Details of Metcalf dumping plant for No. 3 grain elevator of Harbour Commissioners of Montreal; it comprises 4 dumpers, capable of unloading 7 cars per hr. containing 2,500 bu. of wheat each.

CAR LIGHTING

Equipment and Maintenance. Requirements for Present-Day Car Lighting. Ry. Elec. Engr., vol. 17, no. 7, July 1926, pp. 213-216, 1 fig. Discusses various types of equipment and quality of maintenance, which are vital factors for satisfactory illumination.

CAR WHEELS

Specifications. Report of Committee on Wheels. Ry. Age, vol. 80, no. 34, June 15, 1926, pp. 1830-1839, 12 figs. Developments in wrought-steel and cast-iron wheels; grinding of wheels; vertical flange defect; brake-burned wheels, etc. See also Ry. Rev., vol. 78, no. 25, June 19, 1926, pp. 1139-1142, 2 figs. Report before Am. Ry. Assn.

CARS, FREIGHT

Repairing Steel Cars. Ry. Jl., vol. 32, no. 7, July 1926, pp. 27-32, 15 figs. Describes unit spot system of repairing steel cars in railway shops; system affords systematic programme of work and more efficient and economic operation of forces.

Temperature Measurement. Temperature Measurement in the Boiler House, D. Brownlie. Eng. & Boiler House Rev., vol. 39, no. 12, June 1926, pp. 568-572, 4 figs. Discussion of instruments employed.

Specifications. Report of Committee on Car Construction. Ry. Age, vol. 80, no. 32, June 12, 1926, pp. 1713-1723, 13 figs. Sub-committee on fundamental calculations for design of box cars; test of cast-steel truck side frames; design of box cars; moisture content of lumber used in box cars; self-clearing hopper car; amplification of definitions designating letters for car equipment; lettering and marking cars, etc.

CARS, REFRIGERATOR

Bunkers. Divided Basket Bunkers Save Ice. Ry. Age, vol. 80, no. 38, June 26, 1926, pp. 1956-1959, 7 figs. Discusses economies to be obtained by use of wire basket bunkers divided by vertical air spaces which effect reduction in ice-carrying capacity and considerable increase in ice surface exposed to air circulating through bunker; results of test trips.

Iceless. North Shore Runs Iceless Refrigerator Cars. Ry. Rev., vol. 78, no. 24, June 12, 1926, pp. 1081-1083, 7 figs. These cars entirely eliminate necessity for precooling, icing service and salt drippings along right-of-way; refrigerating machine consists of 2½-ton capacity. Phoenix unit-type twin-cylinder ammonia compressor, driven by electric motor through Morse silent chain; describes process of refrigeration.

CASE-HARDENING

Irregular Carburization. Irregular Carburization of Iron and Iron Alloys—The Cause and Prevention, W. J. Merten. Am. Soc. for Steel Treating—Trans., vol. 9, no. 6, June 1926, pp. 907-920 and (discussion) 920-928 and 1004, 17 figs. Sets forth physico-chemical reactions within carburizing container; shows that chemistry of steel plays only minor role in success of satisfactory production of proper depth and uniformity of case and that physical structure of steel and mechanical arrangement of steel articles and carburizers for correct chemical reactions are major factors.

CAST IRON

Cooling Tests. Cooling Tests on Different Cast-Iron Test Pieces (Abkühlungsversuche ad verschiedenen Gusseisenproben), F. Roll. Giesserei-Zeitung, vol. 23, no. 11, June 1, 1926, pp. 295-297, 7 figs. By means of cooling-off curves, temperature variations in cross-sections of different gray-iron castings are measured; observations were also made of structure and segregation; separate parts of test pieces form heat reservoirs that give off heat slowly to more rapidly cooling thinner cross-sections.

Corrosion of. "Simply Cast Iron," H. I. Young. Indus. Chemist, vol. 2, no. 17, June 1926, pp. 254-257. Cast iron, in order to withstand corrosion conditions, must have certain composition and all its impurities must be controlled; discussion of problem with sugestions for elimination of difficulties.

Graphitization. Graphitization at Constant Temperature, H. A. Schwartz. Am. Soc. for Steel Treating—Trans., vol. 9, no. 6, June 1926, pp. 883-906, 5 figs. Mathematical analysis of data of graphitization; demonstrates that rate of graphitization is determined by rate at which carbon can migrate in iron; progress of graphite formation with time is shown to be expression of changing migratory distances, and concentration gradients produced by reaction; reference is made to range through which graphitizing rate varies in commercial material; effect of silicon on this constant. Bibliography.

CEMENT

Alumina. Properties of Aluminous Cements. Concrete, vol. 29, no. 1, July 1926, pp. 46-47 and 49, 1 fig. Results of experiments in use of high alumina cements; high temperatures generated during setting period; action of frost on setting properties; volumetric changes; relation between setting and hardening; resistance of aluminous cement salt solutions. Translated from Chemiker Zeitung.

Hydraulic. Hydraulic Cements from Copper Slags, G. Agde and P. Assmann. Pit & Quarry, vol. 12, no. 7, July 7, 1926, pp. 87-92, 4 figs. Factors which render slag usable or otherwise; description of slag; preparation of natural cements; compressive strengths; setting times. Translated from Zeit. für Angewandte Chemie.

CEMENT, PORTLAND

Strength of. Predicting the 28-Day Tensile Strength, M. A. Durland. Concrete, vol. 29, no. 1, July 1926, pp. 40-42, 4 figs. Results of study conducted during past 6 years on more than 8,000 cement samples, each consisting of three briquettes tested by Road Materials Laboratory at Kansas State Agriclutural College; samples made up with standard Ottawa sand; study shows relation between 7-day and 28-day strength of these briquettes.

Tension Tests. Report of Special Sub-Committee on Survey of Tension Tests of Portland Cement for 1925. Am. Soc. for Testing Matls.—Preprint, no. 40 for mtg. June 21, 1926, 13 pp., 2 figs. Information from laboratories testing cement which would permit classification of results of standard briquette tests according to tensile strength; survey probably consitutes most comprehensive statistical study of cement tests which has ever been carried out since it summarizes results of over 1,000,000 briquette tests.

CENTRAL STATIONS

Design. Power Station Design, V. E. Alden. Elec. Light & Power, vol. 4, no. 7, July 1926, pp. 17-18, 84 and 86, 2 figs. Before designing new power station, ideals or objectives of station should be clearly defined; basic facts as to conditions affecting construction should be determined and accurate forecast should be made of conditions under which station will operate.

Lignite-Burning. Progress in Lignite Power Plant Construction in Germany, A. Peucker. Elec. World, vol. 87, no. 26, June 26, 1926, pp. 1392-1393. Changes in methods of fuel and ash handling, additions to boiler plant and turbine installation and raising of power factor from 0.67 to 0.90 greatly increase capacity of Zschornewitz power house.

CHIMNEYS

Calculation. Calculation of Chimneys for Central-Heating Boilers. (Ueber Schornsteinberechnung für Central-Heizungskessel), Seeling. Verband der Central-lieizungs-Industries — Mitteilungen der Wärmetechnischen Abteilung, Jan-Mar. 1926, pp. 32-38. Calculation of chimney before it is built, so that it can be proportioned to dimensions of boiler, and in conformity with Berlin building code.

CIRCUIT BREAKERS

High-Speed. The High-Speed Circuit Breaker in Railway Feeder Networks, J. W. McNairy. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 7, July 1926, pp. 619-626, 10 figs. Method of insulating grounded sections of extensive feeder networks supplying power to railways without disturbing power supply to other sections.

COAL

Carbonization. Low-Temperature Carbonization of Fuel, D. Brownlie. Power House, vol. 19, no. 13, July 5, 1926, pp. 19-20, 42 and 44, 3 figs. Different processes of carbonization, operated in conjunction with steam boiler, general furnace and power plant.

Low-Temperature Carbonization. D. Brownlie. Chem. News, vol. 132, no. 3447, May 7, 1926, pp. 296-299. Consideration of processes for production of free-burning smokeless fuel involving mechanical compression or briquetting of charge before and during carbonization.

COAL DEPOSITS

Identification of Seams. Identification of Coals, T. B. Williams. Economic Geology, vol. 21, no. 4, June-July 1926, pp. 364-374, 7 figs. Investigation of coal by use of selenium oxychloride; characteristics of selenium-oxychloride reactions; preparation of treatment of samples; this method of treatment of polished surfaces of coal offers quick and easily-controlled means of bringing into relief delicate detail of plant structure; as means of treating coal surfaces in order to distinguish one seam from another it offers much promise.

Heating-Value Determination. Graphical Method of Determining the Heating Value of Coal. (Méthode graphique de détermination du pouvoir calorifique du charbon), A. de Zawaritxky. Chaleur & Industrie, vol. 7, no. 72, Apr. 1926, pp. 191-199, 10 figs. Ten charts and instructions for their use.

Pulverized. *See Pulverized Coal.*

COAL HANDLING

Conveyors. Conveyors for Coal and Ash Handling in Boiler Plants (Der gegenwärtige Stand des Transportwesens zur Bekohlung und Entaschung von Dampfkesseln), F. Riedig. Fördertechnik u. Frachtverkehr, vol. 19, nos. 11 and 12, May 28 and June 11, 1926, pp. 157-160 and 176-180, 25 figs. Discusses systems of mechanical handling of coal, types of bucket conveyors, conveying bands, spirals and tubes; also transportable types: cableways, ash handling by suction and hydraulic system, combination of mechanical and wet process.

Unloaders. Hydraulic Unloading of Coal (Le déchargement hydraulique du charbon), P. Calfas. Génie civil, vol. 88, no. 13, Mar. 27, 1926, pp. 289-292, 6 figs. Plant of St. Ouen central station, where coal is unloaded by means of strong water jets, cars being run out crosswise on inclined track, coal and water running into canal, along track, and water being re-used indefinitely; used for rapid unloading of large quantities of coal.

COAL MINES

Bituminous. Principal Factors in the Development of Bituminous Coal Mines, A. W. Hesse. Modern Min., vol. 3, no. 6, June 1926, pp. 189-192. Factors effecting efficient production as well as safety, including ventilation, coal-cutting machinery and shooting, sprinkling and rock dusting, transportation equipment, system of communication and tipple operation.

COAL MINING

Cutting Machines. Machine Coal-Cutting at Shakerley Collieries. Iron & Coal Trades Rev., vol. 112, no. 3040, June 4, 1926, p. 887, 2 figs. Details of chain coal cutter installed; motive power is compressed air, operating through very powerful but compact pair of reciprocating cylinders of locomotive type.

Machine Loading. How to Shoot Coal for Machine Loading Without Making Too Much Slack, B. L. Lubelsky. Coal Age, vol. 30, no. 1, July 1, 1926, pp. 9-12, 7 figs. Increasing quantity of permissible often merely shatters coal without widening breakage area; more holes with same weight of explosive give better results but must be properly placed.

Underground Transportation. Underground Transportation and Its Relation to Efficient Mining. Min. Congress Jl., vol. 12, no. 7, July 1926, pp. 512-521, 13 figs. Contains following articles: Importance of Good Track for Safe, Efficient and Low-Cost Haulage, A. A. Culp; Track Work, Details and Maintenance, F. C. Hohn; Selecting a Mine Car Design, C. E. Watts; Despatching for Long Haulage, J. B. Hicks.

COKE MANUFACTURE

Coal for, Selection of. The Selection of Coals for the Manufacture of Coke, H. J. Rose. Am. Inst. of Min. & Met. Engrs.—Advance Paper, no. 1577-F, July 1926, 40 pp., 30 figs. Suitable coals; behaviour of coking coals when heated; coke formation in by-product oven; determination of coking properties of coal; correlation of chemical composition and coking properties; classification by volatile matter content; coal classes and coke structure; coking coal deposits in United States; chemical and physical characteristics desired in coke.

COLD STORAGE

Temperature Measurement. The Measurement of Temperature and Carbon Dioxide in Cold Stores. Ice & Cold Storage, vol. 29, no. 340, July 1926, pp. 181-184, 9 figs. Describes thermometers of electrical-distance type used to observe from one convenient position all temperatures throughout cold-storage room.

COLUMNS

Underpinning by Girders. Remove Cast-Iron Column Carrying Ten Stories. Eng. News-Rec., vol. 96, no. 25, June 24, 1926, pp. 1030-1031, 3 figs. Lower portion of cast iron column in old 10-storey building in Philadelphia removed by use of system of steel diaphragms and timber shores for temporary support of column at second-floor level, while lower portion was removed and new steel girders and columns were installed to span store-front opening.

CONCRETE

Cement-Water Ratio. The Cement-Water Ratio Theory in Practice. Concrete, vol. 21, no. 7, July 1926, pp. 495-498, 2 figs. Water-cement ratio; concrete proportions and consistency.

Hardening. Silicium Fluoride as Hardener for Concrete, E. Schmidt. Eng. Progress, vol. 7, no. 6, June 1926, pp. 166-167, 4 figs. Treating concrete with silicium fluoride; prevents formation of lime dust from factory floors and lengthens wear of concrete.

Mixing. The Design and Control of Concrete Mixes, W. C. Voss. Boston Soc. of Civ. Engrs.—Jl., vol. 13, no. 6, June 1926, pp. 281-291, 3 figs. Considers questions of strength, wear and economy.

Inundation Method for Constant Concrete. Concrete, vol. 29, no. 1, July 1926, pp. 37-38, 1 fig. Blaw-Knox inundation method for supplying correct amount of water in concrete; practical application of method to concrete construction job in general.

Specification Problems. Concrete Specification Problems, C. M. Chapman. Am. Soc. for Testing Matls.—Preprint, no. 52, for mtg. June 21, 1926, 18 pp. Topics discussed include: Subjects to be covered in comprehensive specification; necessity for separate specifications for concrete for different types of service; possibility of developing special cements for particular services; necessity for developing test methods for determining suitability of fine and coarse aggregates and water for making concrete; methods for designing concrete mixtures.

CONCRETE CONSTRUCTION, REINFORCED

Members for Bending. Design of Reinforced Concrete Members for Bending Combined with Thrust or Tension, O. Faber. Concrete & Constr. Eng., vol. 21, no. 6, June 1926, pp. 448-464, 9 figs. Members subject to bending combined with thrust include arches, members in trusses and nearly all pillars, columns, piles, etc., which are, as a rule, more or less eccentrically loaded; members subject to bending combined with tension include silo walls and members in trusses.

CONVERTERS

BINARY. The Binary Converter, F. Creedy. Elecn., vol. 96, no. 2505, June 4, 1926, pp. 570-571 and 577, 5 figs. New machine for direct to alternating-current transformation, having variety of possible applications.

CONVEYORS

BELT. Material Handling with Belt Conveyors. Buildings, vol. 65, no. 6, June 23, 1926, pp. 261-263, 6 figs. How aggregate for 9-story reinforced-concrete building at Atlanta, Ga., was conveyed 400 ft.

SCREW. The Screw Conveyor and Its Manufacture, D. C. Wright. Am. Mach., vol. 64, nos. 24 and 25, June 17 and 24, 1926, pp. 931-933 and 977-980, and vol. 65, no. 1, July 1, 1926, 19 figs. Different types of screw conveyors; design of sectional flight conveyor; efficiency in manufacture; methods of production for flight sections. June 24: Methods of piercing rivet holes in sectional flight circles; forming or shaping sections; continuous flight conveyors and their construction. July 1: Manufacturing conveyor backbone; shrinking collars and pipes; assembling sectional and continuous flight conveyors.

COST ACCOUNTING

SYSTEMS. Estimating the Cost of a New Product. Indus. Mgmt. (Lond.), vol. 13, no. 6, June 1926, pp. 243-246, 5 figs. Describes possibilities of scientific costing system and indicates far-reaching character of advantage to be derived by making full use of statistics thus obtained.

CRANES

STORM BRAKES. Storm Brakes for Cranes and Transporters. Indus. Mgmt. (Lond.), vol. 13, no. 6, June 1926, pp. 239-240, 4 figs. Describes two mechanical devices by means of which cranes and loading and unloading bridges and telphers are automatically secured to their rail tracks to prevent damage by storm; appliances, which are of German origin, have brake power capable of resisting pressure of 20 tons.

CRANKSHAFTS

DIESEL ENGINE. Forging and Twisting a Three-Throw Crankshaft for Diesel Engines (Das Schmieden und Verdrehen von dreifach gekröpften Kurbelwellen für Dieselmaschinen), P. Schweissguth. Werkstattstechnik, vol. 20, no. 10, May 15, 1926, pp. 306-307, 17 figs. Older and more recent methods of forging; elongation of fibre in twisting; precautions in twisting and subsequent precautions.

CUPOLAS

REACTIONS, CHEMISTRY OF. Some Notes on the Chemistry of the Cupola, F. C. Thompson. Foundry Trade Jl., vol. 33, no. 514, June 24, 1926, pp. 491-495, 4 figs. General discussion of chemistry of reactions involved in cupola practice; thermal balance of cupola; reactions with carbon; lime or limestone; reactivity of coke and addition of further air through auxiliary tuyeres; bibliography.

CUTTING METALS

TURNING. Temperature of Cutting Point in Lathe Work and Dependence on Form of Chip Cross-Section (Die Schneidentemperatur beim Drehen in Abhängigkeit von der Form des Spanquerschnittes), K. Gottwein. Maschinenbau, vol. 5, no. 11, June 3, 1926, pp. 505-506, 3 figs. At given values of chip cross-section and cutting-speed, temperature at point of tool is affected by ratio of depth of cut to feed; temperature drops if this ratio increases; gives number of micrographs in systematic order for comparison.

D

DAMS

ASPHALT GROUTING. Asphalt Grouting Under Hales Bar Dam, G. W. Christians. Eng. News-Rec., vol. 96, no. 20, May 20, 1926, pp. 798-802, 9 figs. New method of sealing and its operative procedure; fissured or cavernous strata of water-bearing rock successfully sealed by forcing in asphalt in plastic condition heated by electric wire; large underflow cut-off; procedure described in detail.

MASONRY. Masonry Dams and Weirs, S. K. Gurtu. Indian Eng., vol. 78, nos. 5, 6, 7, 8, 9, 10, 11, 13, 14, 17, 19, 20, 23 and 24, vol. 79, nos. 2, 4, 6, 9, 11, 12, 18 and 21, Aug. 1, 8, 15, 22, 29, Sept. 5, 12, 26, Oct. 3, 24, Nov. 7, 14, Dec. 5, 12, 1925, Jan. 9, 23, Feb. 6, 27, Mar. 13, Apr. 3, May 1 and 22, 1926, pp. 67-69, 82-83, 95-98, 109-111, 123-124, 138-139, 150-151, 180-181, 194-195, 235-237, 263-264, 279-280, 320-322 and 335-336, and pp. 25-26, 52, 82-83, 122-123, 150-151, 192, 248-249 and 290-291, 63 figs. Design; water pressure; forces which tend to destroy dams; densities and specific gravity of different materials; principles of designing stable dams; examples; causes of failures; lines of restoration of Tigra dam.

DIELECTRICS

ABSORPTION AND BEHAVIOUR. Dielectric Absorption and Theories of Dielectric Behaviour, J. B. Whittehead. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 6, June 1926, pp. 515-524. Historical outline of dielectric theory; dielectric absorption and related phenomena; dielectric behaviour under alternating electric force; compares alternating theory and experiment.

MEASUREMENT. Three Methods of Measuring Dielectric Power Loss and Power Factor, E. D. Doyle and E. H. Salter. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 6, June 1926, pp. 556-563, 11 figs. Methods of measurement in commercial use at Electrical Testing Laboratories, New York City.

DIESEL ENGINES

ELECTRIC DRIVE VS. Comparative Calculations of the Cost of Power from Diesel Engines and from High-Tension 3-Phase Current (Vergleichsberechnung zwischen Antrieb durch Dieselmotor und Bezug von hochgespanntem Drehstrom), Hack. Chemiker-Zeitung, vol. 50, no. 48, Apr. 28, p. 301. Calculation of direct and indirect operating costs for Diesel engines and for electric motors.

15,000-HP. The 15,000-hp. Diesel Engine, M.A.N. Type, Built by Blohm & Voss for Hamburg Central Station (Der 15,000 PS-Dieselmotor, Bauart MAN, erbaut von Blohm & Voss für die Hamburgischen Elektricitätswerke), W. Ladahn. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 24, June 12, 1926, pp. 818-825, 18 figs. Details of double-acting 9-cylinder Diesel engine driving 13,000-kva. generator at plant in Neuhof; consisting of 3 parts, 9-throw crankshaft is forged of Siemens-Martin steel. See also description in Oil Engine Power, vol. 4, no. 7, July 1926, pp. 416-420 and 430, 8 figs.

GENERATOR SET. A 10,000-KW. Diesel-Generator Set. Engineer, vol. 141, no. 3676, June 25, 1926, pp. 662-663, 5 figs. Details of 15,000-B.hp. engine and 10,000-kw. 3-phase generator installed in Neuhof power station, Hamburg; engine is coupled direct to alternator, which is believed to be largest of kind ever built for Diesel-engine work.

TORSIONAL VIBRATION. Torsional Vibration in the Diesel Engine, F. M. Lewis. Marine Eng. & Shipping Age, vol. 31, no. 7, July 1926, pp. 415-423, 5 figs. Amplitude of vibration at critical speeds in multi-cylinder engines; damping forces; elastic hysteresis; elimination of vibration; mathematical analysis.

DISKS

ROTATING, STRESSES IN. The Effect of Axial Restraint on the Stress in a Rotating Disk, W. G. Green. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. of Sci., vol. 1, no. 6, June 1926, pp. 1236-1251, 3 figs. Study of problem of rotating disk carried on shaft; presence of shaft prevents parts of disk near axis shifting so far in direction of axis as they would if there were no shaft; illustrative problem is given to trace consequences of this effect.

DURALUMIN

HEAT TREATMENT. Effect of Heat Treatment on Duralumin, R. J. Anderson. Forging—Stamping—Heat Treating, vol. 12, nos. 5 and 6, May and June 1926, pp. 169-172 and 208-211 and 219, 32 figs. Summary of results of study on effect of various heat treatments on microstructure of duralumin sheet; object of work was to examine effects of wide variety of heat treatments and throw light on age-hardening phenomenon. June: Effect of temperature of quenching and aging; effect of time period of aging; effect of quenching medium; features of microstructure. (Abstract.) Thesis submitted to Mass Inst. Technology.

E

ECONOMIZERS

HEAT TRANSMISSION IN. Temperatures and Heat Exchange in a Cast-Iron Economizer. (Temperaturen und Wärmeaustausch an einen gusseisernen Speisewasservorwärmer), H. Reiher and G. Neidhardt. Archiv für Wärmewirtschaft, vol. 7, no. 6, June 1926, pp. 153-157, 3 figs. Gives results of measurements of temperatures and flue-gas velocity in a Green economizer from which coefficient of heat transmission is calculated.

ELECTRIC CONDUCTORS

TROLLEY SUPPORTS. Roller Conductor Supports Used on Crossing Tower, E. F. Pearson. Elec. World, vol. 88, no. 1, July 3, 1926, pp. 21-22, 2 figs. Centre tower of two-span river crossing is furnished with trolley frame conductor carrier, which eliminates dead-end construction.

ELECTRIC CURRENTS

SHORT CIRCUITS. Short-Circuit Calculating Table of the Variable Resistor Unit, Direct-Current Type, I. T. Monseth and R. DeCamp. Elec. Jl., vol. 23, no. 6, June 1926, pp. 299-305, 7 figs. This table provides easy method for making system studies and has proved to be remarkably flexible.

ELECTRIC FURNACES

CARBURIZING. Progressive Carburization in Rotary Electric Furnaces, H. E. Martin. Am. Soc. for Steel Treating—Trans., vol. 9, no. 6, June 1926, pp. 933-937, 1 fig. Reasons why electrical heat was selected for additional carburizing and heat-treating furnaces at plant of Dodge Bros.; details of rotary carburizing furnaces, cycle of operations, heat-control arrangement and advantages.

CASTINGS AND INGOTS. Electric Furnaces for Castings and Ingots, E. T. Moore. Elec. Jl., vol. 23, no. 6, June 1926, pp. 279-284, 9 figs. Details of Edmoore electric furnace of rolling-rocker type, installed by Reading Steel Casting Co.; it has capacity of 7 to 15 tons, is equipped with three electrodes, and circular shell composed of boiler plate having inside diameter of 12½ ft.

POWER FACTOR. Power Factor of Electric Furnaces (Le Facteur de puissance des fours électriques), M. Bergeon. Société Française des Electriciens—Bul., vol. 6, no. 55, Mar. 1926, pp. 292-296, 3 figs. Establishes empirical formula, showing that it is desirable to reduce frequency and increase voltage and multiply circuits as was done by Miguet in his 100,000 A furnace.

ELECTRIC GENERATORS

LOSS DETERMINATION. The Retardation Method of Loss Determination, J. A. Johnson. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 6, June 1926, pp. 546-556, 11 figs. Advantages of retardation method of loss determination and of procedure followed in testing Niagara generators.

ELECTRIC GENERATORS, A.C.

SYNCHRONOUS. Variable Armature Leakage Reactance in Salient-Pole Synchronous Machines, V. Karapetoff. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 7, July 1926, pp. 665-669, 4 figs. Author assumes leakage inductance to consist of two parts, one of which is constant (average inductance), and other varying harmonically at double frequency, reaches maximum opposite centres of poles.

ELECTRIC LOCOMOTIVES

CHARACTERISTICS. Report of Committee on Electric Rolling Stock. Ry. Age, vol. 80, no. 35, June 16, 1926, pp. 1853-1863, 8 figs. Tractive-power characteristics of electric locomotives; probable effect of height of centre of gravity; locomotives of Virginian electrification; design of multiple-unit and trailer cars for terminal service of trunk-line railroads; electrification progress. See also Ry. Rev., vol. 78, no. 25, June 19, 1926, pp. 1142-1149, 4 figs. Report before Am. Ry. Assn.

MOTOR-GENERATOR. Motor-Generator Locomotives for the Great Northern. Ry. Age, vol. 81, no. 1, July 3, 1926, p. 20. Two locomotives weighing 250 tons each, under construction for Great Northern Railway; maximum tractive effort based on 30 per cent coefficient of adhesion is 122,940 lb.; total wheel-base, 60 ft.

SINGLE-PHASE. A Single-Phase 50-Cycle Electric Locomotive. Engineer, vol. 141, no. 3674, June 11, 1926, pp. 606-608, 11 figs. Built by F. Krupp Corp., Essen, Germany; equipped with novel type of compensated single-phase motor without commutator, which is claimed to possess running qualities of 3-phase motor.

ELECTRIC MOTORS, A.C.

GRAPHICAL THEORY OF. The Graphical Theory of the Polyphase Synchronous Motor, H. Cotton. World Power, vol. 5, nos. 30 and 31, June and July 1926, pp. 315-326 and 33-34, 23 figs. Mathematical treatment.

SYNCHRONOUS. The Graphical Theory of the Polyphase Synchronous Motor, H. Cotton. World Power, vol. 5, no. 30, June 1926, pp. 315-326, 13 figs. This type of motor can be run idle as far as production of mechanical power is concerned, when, if its excitation is increased sufficiently, it will work at very low leading power factor; most of its kva. capacity will then be leading wattless, with result that motor will perform considerable amount of power-factor correction; when used in this way it is usually called synchronous condenser.

ELECTRIC MOTORS, D.C.

BRUSHES FOR. Brushes for D.C. Machines, Their Composition, Properties and Application, E. B. Stavely. Modern Min., vol. 3, no. 6, June 1926, pp. 176-180, 3 figs. Properties of brushes, including current-carrying capacity, contact resistance, abrasives, etc.; composition and selection of brushes for mining applications.

ELECTRIC TRANSMISSION LINES

LIGHTNING, EFFECT OF. Lightning and Other Experiences, M. L. Sindeband and P. Sporn. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 7, July 1926, pp. 641-651, 12 figs. Experiences with 55 mi. 132-kv. transmission line since 1917; analyzes cases of lightning trouble and steps taken to reduce its frequency; its bearing on tower line design from continuity-of-service standpoint.

SAG. Sag Calculations for Transmission Lines, H. B. Dwight. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 6, June 1926, pp. 564-568, 2 figs. Presents set of sag formulas in form of convergent series which give accurately results of hyperbolic catenary formulas; they are useful for calculating almost any practical transmission line span, long or short.

ELECTRIC WELDING, ARC

CRANE RUNWAYS. Welded Crane Runway, A. F. Davis. Am. Welding Soc.—Jl., vol. 5, no. 5, May 1926, pp. 35-41, 7 figs. Work of Morgan Eng. Co., Alliance, O., in building great industrial crane runway without use of rivets; involved in welded job are 65 tons of steel for supporting frames and crane girders, which provide runway of 245 ft.

DIRECT-CURRENT. Welding Plants for D.C. Arc Welding (Schweissanlagen für Gleichstrom-Lichtbogenschweissung), K. Meller. Elektro-Jl., vol. 6, no. 6, Mar. 25, 1926, pp. 83-91, 17 figs. Discusses developments in electric welding, static characteristics of machines, shunt-wound machines with separate or self-excitation high-frequency current superposed on welding current; transformers, etc.

GASEOUS ATMOSPHERE. Electric Arc Welding in Gaseous Atmosphere. West. Machy. World, vol. 17, no. 6, June 1926, pp. 245-246, 5 figs. By surrounding ordinary welding electrodes with atmosphere of hydrogen or certain other gases, it has been found possible to produce ductile welds; gas acts as flux and shield against oxygen and nitrogen of air, preventing formation of oxides and nitrides of iron in molten metal.

RESEARCH. Research, the Beacon of Progress in Arc Welding, H. M. Hobart and W. Sparagen. Am. Welding Soc.—Jl., vol. 5, no. 5, May 1926, pp. 13-17 and (discussion) 27-35. Problems in arc welding which require study.

STAINLESS STEEL. Electric Welding the New Stainless Steels, C. J. Holslag. Am. Welding Soc.—Jl., vol. 5, no. 5, May 1926, pp. 57-60. Procedure is same as for iron and steel welding except that iron or steel electrode is useless and in general wire drawn for welding of material to be welded gives best results.

ELECTRICITY SUPPLY

BRITISH COLUMBIA. Electrical Developments in British Columbia, H. Vickers. World Power, vol. 5, no. 30, June 1926, pp. 287-292. Electric drive on lumber and shingle mills, mines and urban railways.

TARIFFS. Power Factor and Tariff, E. V. Clark. Instn. Elec. Engrs.—Jl., vol. 64, no. 354, June 1926, pp. 625-632 and (discussion) 640-654. Author contends that wattless component of current, despite its having no energy content, involves supply undertaking in extra running costs, and that therefore charge should be levied for supplying it; three-part tariff is proposed, embracing periodic charge per kva. of maximum demand, charge per kw.-hr. of energy and charge per kva.-hr. of lagging wattless component; question of metering three-part tariff.

ELECTROMETERS

QUADRANT. Zero Method of Measuring Power with the Quadrant Electrometer, W. B. Kouwenhoven and P. L. Betz. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 7, July 1926, pp. 652-661, 9 figs. Zero deflection of electrometer is obtained by opposing torque produced by a.c. load by means of counter torque set up by continuous potentials introduced into electrometer circuit; continuous potentials required are small in value and easily handled.

F

FANS

CASINGS AND INLETS. Experiments on Fan Casings and Fan Inlets, H. Briggs and J. N. Williamson. Mech. World, vol. 80, no. 2062, July 9, 1926, pp. 30-32, 7 figs. Function of fan casing and Rateau's diffuser; methods of measurement; velocity of air inside casing; measurement of centripetal and circumferential re-entry; effects of modifying profile of casing; experiments with narrower spiral casing; experiments with five types of inlet duct; conclusions.

FILTRATION PLANTS

INTAKE PIPE. Laying Intake Through Earth Dike Under Service. Eng. News-Rec., vol. 96, no. 25, June 24, 1926, pp. 1010-1014, 8 figs. Intake for new 90-m.g.d. filters for Denver water works put through Marston Lake embankment in cofferdam, subaqueous pipe placed by divers from barges.

FIRE FIGHTING

FORESTS. Forest Fires and Weather, A. E. Moss. Jl. of Forestry, vol. 24, no. 5, May 1926, pp. 555-556. Studies as to effect of weather conditions of fire hazard in coniferous stands; author attempts to correlate frequency and area of fires with record of weather for same days.

FLOOD CONTROL

FREEPORT, ILL. Flood Protection for Freeport, Ill., W. G. Potter. Am. City, vol. 35, no. 1, July 1926, pp. 69-73, 3 figs. Discusses three projects for problem of flood control and compares their advantages.

FLOTATION

DATA ON. Abstracted and Tabular Data on Flotation, I. J. Koulaieff. Ariz. Min. Jl., vol. 10, no. 3, June 30, 1926, pp. 5-6 and 18. Experience of copper industry with flotation; bibliography; amount of reagent used in 1923-1924; evolution of copper ore concentration at Morenci, Arizona; differential flotation of copper and iron sulphides; floating and leaching copper-molybdenum ores; selective flotation at Nacozrari; New copper Queen concentrator, etc.

FLOW OF GASES

HIGH SPEEDS. On the Flow of Gases at High Speeds, T. E. Stanton. Roy. Soc.—Proc., vol. 3, no. A758, June 2, 1926, pp. 306-339, 15 figs. Experimental study of distribution of pressure and velocity in jets flowing through orifices of different forms, with special reference to existence of minimum section of jet and its variation in position and magnitude; relation between pressure in receiver and pressure in jet for increasing and constant rates of discharge, and possibility of characteristics of high-speed jets being affected by dimensions of orifice and viscosity of air; study of motion of jets at speeds above velocity of sound, and nature of wave motion set up on their emergence into quiescent air.

FLUE-GAS ANALYSIS

CO_2 RECORDS. CO_2 Records and Their Interpretation, C. F. Wade. Elec. Rev., vol. 98, no. 2533, June 11, 1926, pp. 863-865, 1 fig. Points out that in case of large boiler units, two combustion records should be kept, first being taken at middle chamber and preferably including CO_2 and CO charts for observation and control of air and fuel regulation, while plain CO_2 recorder installed at point of gas will, by comparison with first record, furnish evidence as to physical state of boiler settings with regard to air leakage and overall conditions.

FORGING

MACROSTRUCTURE TEST. Flow of Metal in Forging and the Use of Macrostructure Testing (La bavure d'estampage et l'utilité des essais de macrostructure), E. Dercherf. Revue Universelle des Mines, vol. 10, no. 4, May 15, 1926, pp. 162-168, 6 figs. Discusses forging or deformation and control of flow lines or fibre lines; macrographic tests to reveal flow lines, etc.

FOUNDRIES

COST ACCOUNTING. Foundry Costs, J. A. Thomas. Machy. (N.Y.), vol. 32, no. 11, July 1926, p. 874. In foundry specializing on class of work that is about uniform in weight and labour cost per unit, average cost per pound is satisfactory basis for determining selling prices; however, if foundry output is diversified, average cost would be useless.

FUEL ECONOMY. Foundry Fuel Economies, W. J. May. Mech. World, vol. 79, no. 2058, June 11, 1926, pp. 450-451. Chief form of economy is to have good furnaces; where used, air blast should be capable of adjustment; coke should be used in as nearly exact proportions as can be managed, but amount varies with kind of furnace used.

QUANTITY PRODUCTION. Foundry Quality in Quantities, A. Lenz. Can. Foundryman, vol. 17, no. 6, June 1926, pp. 7-15, 13 figs. Factors effecting quantity production in foundries; control of mills; elimination of risers; need of close checking; floor and conveyor moulding; assembling of cores; keeping stock at minimum, etc. See also Foundry Trade Jl., vol. 33, no. 514, June 24, 1926, pp. 481-485, 7 figs.

FOUNDRY EQUIPMENT

PRODUCTION-INCREASING. Costs Show Lower Trend on Installing New Foundry Equipment, P. Dwyer. Foundry, vol. 54, no. 12, June 15, 1926, pp. 464-468 and 478, 7 figs. Details of equipment which has directly or indirectly increased production from 200 to 600 tons per month; ladle-handling devices; sand-handling equipment.

SAND-HANDLING. Materials-Handling Equipment in Foundries (Fördervorrichtungen in Giessereien), Walther. Glasers Annalen, vol. 98, no. 10, May 15, 1926, pp. 163-166, 6 figs. Describes equipment of Eickhoff Machine Works foundry at Bochum, Germany, especially for handling of sand, main principle of which is to keep labour in place and move material whenever possible.

FREIGHT HANDLING

RAIL AND HIGHWAY TRANSPORTATION. Co-ordination of Rail and Highway Freight Transportation Within the Terminal Area, F. J. Scarr. West. Soc. Engrs.—Jl., vol. 31, no. 4, Apr. 1926, pp. 128-134. Shows that highway transportation has definite field; concludes that rail transportation, poorly adapted to efficiently handle terminal transportation, will gradually be relieved of responsibility for performing so-called retail service and be permitted to confine its efforts to that for which it is best suited, handling of mass transportation over long distances; highway transportation will ultimately assume major role in intra-terminal complete movement of freight; inter-line interchange of l.c.l. freight, and movement of freight between rail carrier and trader's door.

FUELS. *Oil Fuel; Pulverized Coal.*

FURNACES, HEATING

FUELS. *See Oil Fuel; Pulverized Coal.*
Laffargue. Chaleur & Industrie, vol. 7, no. 73, May 1926, pp. 264-268, 2 figs. Necessity for short flame; working temperatures; fuel requirements per ton of metal heated; length of tunnel kiln; calculation of furnace.

G

GAS ENGINES

INDICATORS. Indicators for Gas Engines. Gas Engr., vol. 42, no. 602, June 1926, pp. 125-127, 9 figs. Various designs of indicators recently developed and precautions necessary in their use.

GEARS

HOBBED. The Generation of Tooth Forms by a Hob, E. A. Limming. Machy. (Lond.), vol. 28, no. 717, July 8, 1926, pp. 397-399, 3 figs. Analysis of action of hob when generating tooth forms for spur or helical gears.

MEASURING INSTRUMENT. Gear-Measuring Equipment. Machy. (Lond.), vol. 28, no. 714, June 17, 1926, pp. 301-304, 9 figs. Gear-measuring instrument made by Maag Co., Zurich, Switzerland; measurements obtained with this instrument are made with reference to theoretically correct involute curves; instrument for examining involute tooth profiles and comparing these with correct theoretical shape; also serves to examine symmetry of two profiles of tooth.

TOOTH FORMS. Spur Gear Tooth Form. Machy. (N.Y.), vol. 32, no. 11, July 1926, pp. 905-906, 1 fig. Reasons underlying tentative American standard which has been completed by Sub-committee No. 4 of Sectional Committee on Standardization of Gears, and approved by Am. Eng. Standards Committee; problem related to standardization of gear-tooth forms.

The Design of Gear Tooth Forms, E. Buckingham. Am. Mach., vol. 64, nos. 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 21, 23, 24 and 25, Feb. 25, Mar. 4, 11, 18, 25, Apr. 1, 8, 15, 22, May 6, 13, 27, June 10, 17 and 24, pp. 299-302, 345-347, 391-394, 439-441, 465-467, 509-512, 555-562, 595-598, 635-637, 719-722, 745-751, 817-820, 895-898, 945-948 and 973-975, 69 figs. Attempt to solve present-day gear problems by employing fundamental principles as foundation. Feb. 25: Discusses conjugate tooth action, involute curve, involute trigonometry, involute tooth design, strength of gear teeth and their durability under load. Mar. 4: Construction of line of action from given tooth profile and reverse; requirements for interchangeable tooth forms; cycloid curve. Mar. 11: Characteristics of cycloid, epicycloid and hypocycloid curves; application to tooth forms and resulting lines of action; cycloidal blower rotors. Mar. 18: Basic racks to generate spline shafts; theory of involute curve and its chief characteristics when used as gear tooth profile form. Mar. 25: Action of involute against straight line; summary of involute curve properties; its application to gear tooth profiles; duration of contact. Apr. 1: Combined rolling and sliding takes place between 2 involutes in contact; calculation of ratio of sliding. Apr. 8: Tooth and bearing pressures; simple solution of involute tooth gear problems through use of involute functions in tabulated form. Apr. 15: Further solutions of general involute tooth-gear problems; relation of gear to meshing rack; duration of contact; under-cutting. Apr. 22: Nomenclature and definitions of gear teeth; 14½-deg. composite of gear teeth with tabulated formulas for their proportions. May 6: Form milling of gears and action of gears produced by this method; effect of eccentricity; effect of errors in Milling. May 13: Tabular data on correcting tooth depth with various combinations of range milling cutter. May 27: Introduction of straightsided hobs and racks resulted in 14½-deg. generated gear tooth system; effect of under-cutting on length of contact. June 10: 20-deg., full-depth tooth gear system; tooth proportions and length of contact. June 17: 20-deg. stub-tooth gear system for gears of small number of teeth. June 24: 14½-deg. variable-centre system.

GRINDING MACHINES

INTERNAL. An Ingenious Internal Grinder. Automobile Engr., vol. 16, no. 216, June 1926, pp. 224-225, 4 figs. Fully automatic machine with hydraulic table drive.

LOCOMOTIVE AXLES. Locomotive Axle Grinding. Brit. Machine Tool Eng., vol. 3, no. 39, May-June 1926, pp. 407-408, 2 figs. Describes 18-in. by 84-in. plain grinding machine equipped for grinding of locomotive axles built by Churchill Grinding Machine Co.

GUNITE

Uses of. Some Uses of Gunite, B. C. Collier. Coal Mine Mgmt., vol. 5, no. 1, Jan. 1926, pp. 29-31, 53-54, 56, 58 and 60, 2 figs. Various uses of gunite (mixture of sand and cement applied with cement gum) in mines to prevent slaking, and for stoppings, fireproofing, fire fighting, prevention of corrosion, etc.; instructions for use.

H

HARBOURS

Breakwater. Construction of a Breakwater-Head at Madras, C. R. White. Dock & Harbour Authority, vol. 6, no. 69, July 1926, pp. 266-267, 3 figs. Building of circular well head 85 ft. 9 in. high with external diameter of 48 ft., and internal diameter of 18 ft. 6 in. and sinking it off existing end of breakwater to depth of 35 ft. 6 in. with sea bed.

HARDNESS

Rockwell and Brinell. Some Comparisons Between Rockwell and Brinell Hardness, C. R. Brumfield. Am. Soc. Steel Treating—Trans., vol. 9, no. 6, June 1926, pp. 841-856, 7 figs. Results obtained in testing both hard and soft metals by Rockwell and Brinell hardness tests; establishes relation between Brinell hardness and each type of Rockwell hardness in which most influential factor is area of contact with piece tested; tables show comparative Rockwell and Brinell hardness for various metals.

Testers. The Durometer—An Instrument for Testing Hardness, A Suaveur. Am. Soc. for Steel Treating—Trans., vol. 9, no. 6, June 1926, pp. 929-932 and 1000, 2 figs. New instrument used in determining hardness of metals and manner in which it functions.

HEAT TRANSMISSION

Calculation. Heat Transmission from Solids to Fluids in Turbulent Flow (De warmteovergang van vaste lichamen op turbulent stroomende vloeistoffen), F. K. Th. Van Iterson. Ingenieur, vol. 41, no. 17, Apr. 24, 1926, pp. 321-333, 12 figs. Calculation of coefficient of heat transmission; air preheating and preheaters; aircooling, etc.

Coaxial Cylinders, Between. Heat Transfer in the Annular Space Between Two Coaxial Cylinders, S. R. Parsons. Phys. Rev., vol. 27, no. 6, June 1926, pp. 788-792. Two brass tubes are mounted with common axis, one inside of other, and are warmed by driving hot air in turbulent flow through annular space between them; purpose of work was to show whether or not heat is transmitted more readily to one of two surfaces than the other.

HEATING

Central, Steam and Water. Central Heating Plant for Canadian Government Buildings, P. H. Bryce. Heating & Ventilating Mag., vol. 23, no. 7, July 1926, pp. 78-81, 5 figs. Principal features of combination steam and water heating system for federal group in Ottawa.

HEATING, HOT-WATER

Cast-Iron Radiators. Dissipation of Heat by Cast-Iron Water Radiators, F. E. Giesecke. Heat. & Vent. Mag., vol. 23, no. 6, June 1926, pp. 67-72, 9 figs. Recent tests which show fallacy in use of comparatively small pipes and superiority of two-pipe over one-pipe water-treating systems.

HEATING, STEAM

Low-Pressure. The Argument for Low-Pressure Heating Plants, A. L. Sanford. Heat. & Vent. Mag., vol. 23, no. 7, July 1926, pp. 76-77. Comparison of high- versus low-pressure systems and description of typical heating installations in Minneapolis public schools.

Requirements. Analyzing Steam Heating Requirements, W. L. Berry. Elec. World, vol. 88, no. 1, July 3, 1926, pp. 5-7, 2 figs. Methods used by Union Electric Light & Power Co., St. Louis, to determine actual steam requirements and amount of exhaust steam wasted.

HIGH VOLTAGES

Testing Equipment. High-Voltage Direct-Current Testing Equipments. Engineer, vol. 141, no. 3676, June 25, 1926, pp. 658-660, 8 figs. High-voltage testing equipments employing thermionic valve rectifiers brought out by Ferranti, Ltd.

Testing Laboratories. High-Voltage Laboratories, A. P. M. Fleming. World Power, vol. 6, no. 31, July 1926, pp. 16-26, 14 figs. Transformer arrangement; power supply; measurement of high-voltage; auxiliary apparatus; buildings and equipment.

HIGHWAYS

Capacity. Capacity of Highways, R. F. Kelker, Jr. West. Soc. Engrs.—Jl., vol. 31, no. 4, Apr. 1926, pp. 140-147, 2 figs. Points out that two roads of medium width will carry more traffic than one road of double width and cost will be less per unit of traffic carried; this fact is important in designing highway system as area will be better served by two separate roads than by one of extreme width.

Improved. The Development of Improved Highways, T. H. MacDonald and H. B. Fairbank. West. Soc. Engrs.—Jl., vol. 31, no. 4, Apr. 1926, pp. 113-121. Rapid progress in last decade; new types developed; state systems; plan for ultimate growth; building for future.

Planning and Layout. The Planning and Layout of Highways and the Economics of Highway Transportation. West. Soc. Engrs.—Jl., vol. 31, no. 4, Apr. 1926, pp. 111-113. Committee report sets forth number of conclusions based on papers presented at meeting of Apr. 21, 1926.

Vertical Curves for Designing. Application of Vertical Curves to Highway Design, M. W. Furr. Eng. News-Rec., vol. 96, no. 20, May 20, 1926, pp. 819-820, 2 figs. How designing, checking and drafting curve may be somewhat simplified by semi-mechanical method.

HOUSES

Steel. The Day of the Metal House is at Hand, P. Winchell. Can. Machy., vol. 36, no. 1, July 1, 1926, pp. 25 and 27. Result of careful investigation as to use of steel in residential dwellings.

HYDRAULIC TURBINES

Propeller-Type. Propeller Turbine Aids Low Head Developments, J. S. Carpenter. Power Plant Eng., vol. 30, no. 12, June 15, 1926, pp. 703-704, 3 figs. High specific speeds decrease first cost and increase output of turbine at reduced heads.

Size Limitations. Developments in Hydro-Electric Practice, C. R. Martin. Purdue Eng. Rev., vol. 21, no. 4, May 1926, pp. 7-10, 4 figs. Size of hydro-electric machinery is becoming limited by mechanical restrictions.

Specific Speed. The Character of the Specific Speed, B. Eck. Indian Eng., vol. 79, no. 20, May 15, 1926, pp. 278-280, 1 fig. Objections which can be raised against definition now in use; states relationship between turbines, centrifugal pumps and related engines, and shows how non-dimensional term related to specific speed can be found from physical considerations.

HYDRO-ELECTRIC PLANTS

Earthquakes, Effect on. Effect of Earthquake Shocks on Hydro-Electric Plants (L'influence des tremblements de terre sur les installations hydro-électriques), M. Legouez. Société Française des Electriciens—Bul., vol. 6, no. 54, Feb. 1926, pp. 121-126, 2 figs. Inertia of upper stories of buildings and of masses of water must be taken into account; damage is usually due to landslides, insufficiently solid foundations, or lack of elasticity in buildings; work should not be built where there is change in geological structure of earth; details of damage to electrical apparatus in Japanese earthquake in 1923; Italian rules for constructing foundations.

I

ICE MANUFACTURE

Sub-Cooled Raw Water. Reversing the Ice-Making Process, C. H. Herter. Power Plant Eng., vol. 30, no. 12, June 15, 1926, pp. 710-711. Discussion of feasibility of making ice from sub-cooled raw water.

ILLUMINATION

Effect of Mixtures of Artificial Light and Daylight. The Effect of Mixing Artificial Light with Daylight on Important Functions of the Eye, C. E. Ferree and G. Rand. Illuminating Eng. Soc.—Trans., vol. 21, no. 6, July 1926, pp. 588-609 and (discussion) 609-612, 4 figs. Experiments on effect of artificial light, daylight and mixtures of daylight and artificial light on acuity, speed of vision, power to sustain acuity, and ocular fatigue; on effect of time of day artificial light is turned on; on relation of time of day and adaptation of eye.

Relative Values of Different Types of. Relative Value of Daylight, Tungsten Filament and Mercury Arc Light, and Mixtures, as Measured by Visual Acuity, F. E. Carlson. Illuminating Eng. Soc.—Trans., vol. 21, no. 6, July 1926, pp. 613-636 and (discussion) 636-640, 20 figs. Determination by laboratory methods, relative values of various types of industrial illuminants and daylight, particularly as applied to work on metals.

INDUSTRIAL MANAGEMENT

Planning. Planning and Routing Shop Work, J. S. Gray. Machy. (Lond.), vol. 28, no. 715, June 24, 1926, pp. 342-344. Work of planning department; effect of planning on cost and delivery dates; co-operation between shop and planning department and advantages to be gained by proper planning.

Production-Control. A New Electrical Production Control System, L. Ederer. Soc. of Indus. Engrs.—Bul., vol. 8, no. 6, June 1926, pp. 3-5. Electrical control equipment consisting of series of substations placed at convenient points throughout plant and connected electrically to central station in such a manner that information is sent directly from substations and recorded at central station.

Production Planning. Factors in Industrial Organization, R. Wendorby. Indus. Mgmt. (Lond.), vol. 13, no. 6, June 1926, pp. 251-252. Author divides controlling factors into five groups, namely, intelligent buying, centralized storage and expeditious distribution, efficient production, prompt and reliable inspection, and rapid transit.

INDUSTRIAL ORGANIZATION

Improvements. Industry's Silent Revolution—and What It Portends, M. W. Alexander. Iron & Trade Rev., vol. 78, no. 25, June 24, 1926, pp. 1622-1625, 4 figs. Effects upon industry of rapid increase of population; improvements in organization and in technical processes; increase in influence of corporately-owned establishments, etc.

INDUSTRIAL RELATIONS

Future Prospects. Future Relationship Between Employer and Employed. Indus. Mgmt. (Lond.), vol. 13, no. 6, June 1926, p. 247. Symposium of opinions received from leaders of industry on future relationship between employer and employed and its bearing on industrial reconstruction.

Personnel, Study of. Influence of Personnel on Industry, R. A. C. Henry. Eng. Jl., vol. 9, no. 7, July 1926, pp. 333-336. Necessity of studying personnel in industry and possibility of creating better relationship between employer and employee.

INDUSTRIAL TRUCKS

Electric. The Expanding Uses of the Electric Industrial Truck, H. J. Payne. Factory, vol. 36, no. 6, June 1926, pp. 1035, 1130, 1134 and 1138. Comprehensive report shows opportunities for use of electric trucks in many industries not yet familiar with them and for their use in new ways by present owners.

INSURANCE

Group Life. Making Life Insurance Easy for Employees, J. J. Birch. Indus. Mgmt. (N.Y.), vol. 71, no. 6, June 1926, pp. 349-350. General Electric Company has recently inaugurated group-life and salary-allotment insurance plan for optional use for its employees; types of salary-allotment policies; total permanent-disability benefits.

INTERNAL-COMBUSTION ENGINES

Portable. Light Engines for Special Purposes (Der Leichtmotor für Sonderzwecke), K. R. H. Praetorius. Automobil-Rundschau, vol. 28, nos. 5 and 6, May 1 and June 1, 1926, pp. 107-111 and 137-138, 14 figs. Application of small-size engines for driving small radio transmitter stations, machine tools, etc.; types built by Siemens & Halske, Bergmann, etc., from 1¼ hp. upwards.

Supercompression. Supercompression in Explosion Engines (La surcompression dans les moteurs à explosion), M. Dumanois. Technique Moderne, vol. 18, no. 9, May 1, 1926, pp. 257-261, 2 figs. Discusses effect of increased compression on combustion, and efficiency; spontaneous ignition, detonation; their causes and effects.

Tests. Industrial Tests of Internal Combustion Engine, W. A. Tookey. Diesel Engine Users' Assn., no. S70, for mtg. Apr. 9, 1926, 40 pp., 11 figs. Tests made by manufacturers under supervision of engineer acting on behalf of purchaser; preliminary arrangements, duration and scope of trials; power output; fuel consumption; governing and speed variation; control; thermal and mechanical efficiencies.

See also Airplane Engines; Diesel Engines; Gas Engines; Oil Engines.

IRON

Electrolytic. Electrolytic Iron from Ilmenite Ores, R. H. Monk and R. J. Traill. Can. Chem. & Met., vol. 10, no. 6, June 1926, pp. 137-139. Process for production of electrolytic iron and recovery of titanium oxide for pigment purposes; production of sponge iron; commercial advantages of processes.

IRON ALLOYS.

Constitution. The Constitution of Steel and Cast Iron, F. T. Sisco. Am. Soc. for Steel Treating—Trans., vol. 9, no. 6, June 1926, pp. 938-953, 11 figs. Discusses fundamental concepts necessary to complete understanding of constitution and structural changes of alloys of iron and carbon; included in fundamentals are simple crystallization, saturation and equilibrium, crystallization of metals, orientation and cleavage, crystal structure, amorphous solids, allotropy and allotropy of iron.

IRON AND STEEL

MACROSCOPIC EXAMINATION OF. Macroscopic Examination of Iron and Steel, F. P. Gilligan and J. J. Curran. Am. Soc. for Steel Treating—Trans., vol. 10, no. 1, July 1926, pp. 9-25 and (discussion) 25-30, 21 figs. Describes deep-etch method of testing or inspecting bars, billets, or finished parts; discusses procedure in using this method of test, merits of various acid mixtures used in detecting different types of defects occurring in steels which may be revealed by this type of test; comparison between this and microscopic test is made; photographs are shown of specimens tested by this method and nature of defects as revealed by this method are described.

IRON CASTINGS

GATES AND RUNNERS. Arrangement of Gates and Runners in Gray-Iron Founding. (Anordnung der Trichter and Eingüsse bei Grauguss). Zeit. für die Gesamte Giessereipraxis, vol. 47, nos. 18 and 19, May 2 and 9, 1926, pp. 201-203 and 213-215, 33 figs. Gives illustrations showing arrangements for various classes of work.

IRON FOUNDING

RESEARCH. The Value of Research in the Production of Castings, J. G. Pearce. Mech. World, vol. 79, nos. 2041 and 2049, Feb. 12 and Apr. 9, 1926, pp. 129-130 and 289-290. Feb. 12: Shows value of research in iron founding; how every-day difficulties may be explained and corrected by metallurgical knowledge and experience; and how current research work is resulting in developments which call for serious attention of industry. Apr. 9: Deals with Emmel iron, hot-mold, Schuz and Nomag iron.

IRON ORE

CANADIAN TITANIUM-BEARING. Electrolytic Iron from Ilmenite Ores, R. H. Monk and R. J. Traill. Can. Min. Jl., vol. 47, no. 27, July 2, 1926, pp. 671-672. Practical utilization of titanium-bearing iron ores found in Canada, particularly Quebec; describes process for production of iron as electrolytic iron and of titanium as oxide for pigment and other purposes from ilmenite.

IRON, PIG

RE-MELTING. Re-Melting Pig-Iron in the Open-Hearth Process, E. Herzog. Foundry Trade Jl., vol. 33, no. 514, June 24, 1926, pp. 500-501. Describes cupolas used at Rothe Erde Works, Germany; difficulties encountered and how they were overcome.

IRRIGATION

MERCED DISTRICT, CAL. The Merced Irrigation District, E. C. Eaton. Western Constr. News, vol. 1, nos. 1, 2, 4 and 11, Jan. 10, 25, Feb. 25 and June 10, 1926, pp. 19-25, 24-33, 21-27 and 20-28, 24 figs. Jan. 10: Early irrigation history of area; reasons for organizing present quasi municipal project and steps taken leading to its construction. Jan. 25: Layout of Exchequer Dam and Power Plant, with contract prices and quantities. Feb. 25: Relocation of part of Yosemite Valley railroad. June 10: Distribution and drainage.

J

JAPANNING

OVENS. Japanning Stove Parts in a Continuous Conveyor Oven, W. E. Crum. Fuels & Furnaces, vol. 4, no. 7, July 1926, pp. 829-831, 3 figs. Oven is of double-tunnel type, each tunnel ventilated separately and provided with conveyor driven by individual motors giving independent control of conveyor speeds.

L

LIGHTING

INDUSTRIAL. Industrial Lighting (L'éclairage dans l'industrie), M. J. Wetzel. Electricité & Mécanique, no. 11, Mar.-Apr. 1926, pp. 32-46, 20 figs. Discusses relation between lighting and eyesight, quicker accommodation of eye in good lighting, increased production, reduction of accidents.

Plant Illumination, W. Harrison. Engrs. & Eng., vol. 43, no. 6, June 15, 1926, pp. 149-151, 3 figs. Author refers to practical tests which have been made in number of industries and which show that supplying more light increases production and decreases unit cost.

PRINCIPLES OF. Modern Principles of Good Lighting, R. M. Hutton. Can. Engr., vol. 51, no. 1, July 6, 1926, pp. 105-107. Good lighting necessary to secure maximum output and industrial efficiency; difference between natural and artificial lighting; main factors in good artificial lighting; avoidance of glare and location of light source.

LOCOMOTIVES

DESIGN. Report on Locomotive Design and Construction. Ry. Age, vol. 80, no. 34, June 15, 1926, pp. 1819-1829, 7 figs. Standardization of taps and dies; bolt and screw threads; designing locomotives to reduce track stresses; standardization of water columns; definition of engine failure. Report of committee before Am. Ry. Assn.

DIESEL-ELECTRIC. Diesel Locomotive with Gear Transmission, B. A. Wittkuhus. Ry. Mech. Engr., vol. 100, no. 7, July 1926, pp. 425-428, 8 figs. Describes two Diesel-electric locomotives designed for freight service, one is 2-10-2 type equipped with 1,200 b.hp. M.A.N. Diesel engine, and other is 4-10-2 type with gear-transmission system equipped with same engine.

ELECTRIC. *See Electric Locomotives.*

INTERNAL-COMBUSTION. Internal-Combustion Locomotives and Vehicles, S. M. Vauclain. Baldwin Locomotives, vol. 5, no. 1, July 1926, pp. 43-49, 8 figs. Types of railway motor cars; D locomotives, with mechanical, hydraulic and electric transmission.

MOUNTAIN TYPE. 4-8-2 Compound Locomotives of the P.L.M. Railway. (Locomotive Compound A Quatre Essieux Couplés de la Compagnie des Chemins de fer P.L.M.) Génie Civil, vol. 88, no. 24, July 12, 1926, pp. 517-519, 9 figs. Particulars on new 117-ton compound superheater locomotive for express service between Paris and Dijon.

MULTIPLE-PRESSURE. Multiple-Pressure Locomotive Developed in Germany. Boiler Maker, vol. 26, no. 6, June 1926, pp. 152-153, 3 figs. Also Ry. Age, vol. 80, no. 38, June 26, 1926, pp. 1969-1970, 3 figs. Locomotive, known as Henschel multiple-pressure compound locomotive, is of 4-6-0 type and has 3 cylinders; combined water-tube and fire-tube boiler generates steam at 800- and 200-lb. pressure.

PISTONS, STANDARDIZATION OF. Standardization and Maintenance of Steam Pistons and Piston Rings in German Locomotives (Die Normung und Unterhaltung der Dampfkolben und Kolbenringe bei den vorhandenen Reichsbahn-Lokomotiven). Glasers Annalen, vol. 98, no. 11, June 1, 1926, pp. 174-177, 5 figs. Shows that by adopting degrees of wear and fixed dimensions for shrunk rings maintenance of pistons in repair works may be facilitated and reduced in cost.

RAIL-STRESS-REDUCING. Designing Locomotives to Reduce Rail Stresses, H. H. Lanning. New England Railroad Club—Official Proc., Apr. 13, 1926, pp. 78-93 and (discussion) 93-101. How Atchison, Topeka & Santa Fe Railway Co. built heavier and more powerful locomotives without overtaxing strength of existing track and bridges; describes four standard types of steam locomotives adopted.

TENDERS. Tenders of Large Capacity for the Great Northern. Ry. Mech. Eng., vol. 100, no. 7, July 1926, pp. 429-430, 5 figs. Seventeen locomotive tenders largest that have ever been built for regular railroad service; have coal capacity of 24 tons and water capacity of 21,500 gal.; light weight is 138,100 lb. and loaded 364,550 lb., or 182 tons; have rigid anchorage between body and underframe.

THREE-CYLINDER. Three-Cylinder Locomotive Performance Record. Ry. & Locomotive Eng., vol. 39, no. 6, June 1926, pp. 153-154, 1 fig. Locomotive No. 5000 of Lehigh Valley Railroad shows low maintenance cost per locomotive mile; it is 4-8-2 type and weighs 369,000 lb.

LUBRICATING OILS

USED, TREATMENT OF. The Treatment of Used Oil (Die Aufbereitung gebrauchter Oele), v. d. Heyden and Typke. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 12, Mar. 20, 1926, pp. 401-402. Considerable savings may be effected by treating used lubricating and other oils, so as to eliminate impurities and correct changes in composition caused by service conditions; treatment with Fuller's earth removes mechanical impurities and absorbs acids and dissolved asphaltic matter; oil may either be passed through filter bed of granular Fuller's earth, or agitated with finely divided earth in stirring machine; latter method is more effective.

LUBRICATION

DIESEL ENGINES. Lubricating Oils for Heavy-Oil Engines. Marine Engr. & Motorship Bldr., vol. 49, no. 587, July 1926, p. 252. Particulars of report issued by committee of Diesel Enginer Users' Association on specification of such oils.

MATERIALS-HANDLING EQUIPMENT. Lubrication of Materials-Handling Equipment. Power Plant Eng., vol. 30, no. 12, June 15, 1926, pp. 700-702, 5 figs. Proper selection of lubricant to fit working conditions and proper application to gears, bearings and wire rope increase efficiency.

OIL FILTRATION. Lengthening the Life of Oil. Autocar, vol. 57, no. 1600, July 2, 1926, p. 33, 2 figs. Description of Hele-Shaw streamline lubricant filter, and method of applying it to automobile engines.

M

MANOMETERS

THERMOELECTRIC. Thermoelectric Manometers for Small Pressures (Ueber ein thermoelektrisches Manometer für kleine Drücke), E. Rumpf. Zeit. für Technische Physik, vol. 7, no. 5, 1926, pp. 224-226, 2 figs. Describes manometer consisting of heating filament and thermocouple which enables quick continuous measurement of pressures.

MASONRY

STRENGTH AT EARLY AGES. Strength of Masonry at Early Ages, J. S. Elwell. Can. Engr., vol. 50, no. 24, June 15, 1926, pp. 667-668. Tests of mortar made of hydrated lime and sand, and lime, putty and sand; strength of specimens increases with age. Paper presented before Building Officials' Conference.

MATERIALS HANDLING

MACHINERY, EVOLUTION OF. Material-Handling Machinery and Its Evolution, T. L. Messiter. Indus. Mgmt. (Lond.), vol. 13, no. 6, June 1926, pp. 240-242, 1 fig. Diagrammatic representation of evolution of handling machinery.

MATERIALS TESTING

FATIGUE OF METALS. The Fatigue of Metals When Stressed Beyond the Yield Point. Brown Boveri Rev., vol. 13, no. 7, July 1926, pp. 169-174, 8 figs. Investigations by Brown-Boveri materials testing department.

MERCURY-VAPOUR PROCESS

SUPERIORITY OF. The Mercury-Steam Cycle, P. M. Shen. Power, vol. 64, no. 1, July 6, 1926, pp. 8-11, 2 figs. Binary-vapour conception considered as possible means of increasing efficiency; why mercury-steam cycle is superior to other binary-vapour processes.

METAL WORKING

AUTOMOBILE FENDERS. Making Automobile Fenders with Hand Tools, E. Heller. Machy. (N.Y.), vol. 32, no. 11, July 1926, pp. 871-874, 9 figs. Methods employed in making set of fenders for first car of new model.

METALLOGRAPHY

STUDY OF. The Engineer and the Study of Metals, W. R. Needham. World Power, vol. 5, nos. 30 and 31, June and July 1926, pp. 303-309 and 29-32. June: Discusses facilities available for study of metal, such as X-ray examination of metals; recording internal forging or ingot flaws; magnetic analysis, micro-stress recorder, photoelastic method of determining stresses, etc. July: X-ray examination of materials; clink detector for recording internal forging or ingot flaws; quest for flaws by magnetic analysis; trepanning tool for removing central cores; drop-of-potential method for detecting flaws; micro-stress recorder; photoelastic stress analysis; commercial application of light alloys for forgings; castings, etc.

METALLURGY

GRAPHITIZATION. Graphitization at Constant Temperature, H. A. Schwartz. Am. Soc. for Steel Treating—Trans., vol. 9, no. 6, June 1926, pp. 883-906, 5 figs. Mathematical analysis of data of graphitization; means for laboratory determination of graphitizing rate as physical constant for any given hard iron outlined; mathematical deviations in appendix, July issue p. 53.

METALS

ELASTICITY AND MELTING POINT. Elasticity and Melting Point (Elastizität und Schmelzpunkt), J. P. Andrews. Physikalische Zeit., vol. 27, no. 7, Apr. 1, 1926, pp. 210-211. Widder's linear relation in elasticity-temperature curve of metals requires line when produced to zero elasticity to cut temperature axis at melting point; expression leads to erroneous melting-point values. See also brief abstract in Brit. Chem. Abstracts, May 1926, p. 462.

FATIGUE. Stress-Strain-Cycle Relationship and Corrosion-Fatigue of Metals, D. J. McAdam, Jr. Am. Soc. for Testing Matls.—Preprint, no. 33, for mtg., June 21, 1926, 31 pp., 12 figs. Material and methods of investigation; stress-cycle graph extended to nominal stresses well above tensile strength of material and over range from less than 1,000 to more than 100,000,000 cycles; interrelationship between stress-cycle, stress-deflection and deflection-cycle graphs; effect of cycle repetition on deflection and hysteresis; evidence is presented that very slight corrosion when simultaneous with fatigue causes low resistance to fatigue; damaging effect is greater the harder the steel; advantage of heat treatment may thus be practically neutralized; ratios of corrosion-fatigue limits to endurance limit are compared with other physical properties of steel.

HEAT CONDUCTIVITY. Thermal Conductivity of Certain Metals and Alloys (Conductibilité thermique de certains métaux et alliages), M. Jakob. Chaleur & Industrie, vol. 7, no. 74, June 1926, pp. 301-306, 1 fig. Data on conductivity of certain bronzes, aluminum, aluminum alloys and precious metals.

STRESS-STRAIN CURVES. Stress-Strain Curves and Physical Properties of Metal with Particular Reference to Hardness, H. P. Hollnagel. Am. Soc. for Steel Treating—Trans., vol. 10, no. 1, July 1926, pp. 87-108, 10 figs. Physical properties of metals as associated with stress-strain curve interpreted in terms of atomic forces of restitution, slip of atomic nature and in mass; interfering material set forth as amorphous phase; hardness defined; dimensions of hardness.

PLASTICITY. On the Plasticity of Metals, H. Shoji. Inst. of Physical & Chem. Research—Sci. Papers, vol. 4, nos. 57-58, Apr. 1926, pp. 189-201, 26 figs. Definition; description of apparatus for experiments made; plasticity of metals; change of plasticity with straining time.

MILLING MACHINES

OIL-GROOVE. Lehmann Oil-Groove Milling Machine. Machy. (N.Y.), vol. 32, no. 11, July 1926, p. 913, 1 fig. Machine designed primarily for use in railroad shops for milling oil-grooves in locomotive crown brasses, but which may also readily be adapted to other work.

MINES

VENTILATION. Permissible Limits of Toxic and Noxious Gases in Mine and Tunnel Ventilation, R. R. Sayers. Am. Inst. of Min. & Met. Engrs.—Advance Paper, no. 1580-A-F, July 1926, 14 pp., 3 figs. Carbon dioxide limit; oxygen required; excess oxygen; limits of other gases; sources and effects of carbon monoxide; prevention of poisoning from gases; treatment for persons poisoned.

MOLDING MACHINES

INCREASING PRODUCTION. Increasing Output with Molding Machines, R. Micks. Can. Foundryman, vol. 17, no. 6, June 1926, pp. 17-19, 2 figs. Points out that rapid development of molding-machine practice in past few years has made it possible to produce molds by machinery for almost any casting that can be made in 2-part flask; types of molding machines.

MOTOR TRUCKS

CRUDE-OIL. Crude-Oil Automotive Engine Installed in Four-Ton Truck, L. M. Fanning. Oil & Gas Jl., vol. 24, no. 51, May 13, 1926, pp. 92 and 94. Motor truck of 4-ton capacity operating in New York City traffic on 24 deg. Baumé fuel oil; equipped with French Peugeot crude-oil engine, which can work on any kind of oil, including heaviest; it is an explosion engine in which fuel is injected and is of constant volume combustion type. See also description in Oil Engine Power, vol. 4, no. 7, July 1926, pp. 403-405, 4 figs.

OPERATION COSTS. How to Find Unit Costs in Motor Truck Operation, A. J. Peel. Indus. Mgmt. (N.Y.), vol. 71, no. 6, June 1926, pp. 346-349, 3 figs. Outlines of simple methods of finding unit costs which, put into operation, shows way to substantial savings.

ROLLED STEEL WHEELS. Rolled Steel Truck Wheels. Iron Age, vol. 118, no. 1, July 1, 1926, pp. 9-11, 7 figs. Describes manufacture of rolled steel truck wheels by Bethlehem Steel Co. and laboratory tests made by Bureau of Standards.

N

NICKEL ALLOYS

NICKEL-CHROMIUM. Heat-Resisting Nickel Chrome Alloys. Foundry Trade Jl., vol. 33, no. 512, June 10, 1926, pp. 411-412, 1 fig. Research has shown that several combinations of these two elements can be effected which will withstand most arduous conditions of industrial service.

NON-FERROUS METALS

GERMAN DEVELOPMENTS. Recent Development of Non-Ferrous Metals, H. Groeck. Eng. Progress, vol. 7, no. 6, June 1926, pp. 158-159. Discusses German supply of non-ferrous metals, and endeavours since war to find substitutes for those no longer available; characteristics of some non-ferrous metals, including copper and brass, and aluminum and its light alloys.

O

OIL ENGINES

COOLING-WATER RE-CIRCULATION. Re-Circulating Oil Engine Cooling Water, A. B. Newell. Marine Eng. & Shipping Age, vol. 31, no. 7, July 1926, pp. 397-398. System of oil-engine cooling designed to maintain constant temperatures under all conditions of sea-water temperature.

LUBRICATION. The Choice of a Lubricating Oil, A. J. Wilson. Gas & Oil Power, vol. 21, no. 250, July 1, 1926, pp. 213-214. Physical tests to be considered when making choice of lubricating oil for use in gas or oil engine; specifications for oil for use on heavy-oil engines.

SKETCHES AND WORKING. Sketches and Working of Oil Engines. Motorship, vol. 11, no. 7, July 1926, pp. 532-536 and 544, 14 figs. Circle diagrams aid study of reversing systems; analysis of mechanisms found in practice.

WASTE-HEAT UTILIZATION. Reclaiming Waste Heat from Modern Oil Engines, A. B. Newell. Nat. Engr., vol. 30, no. 7, July 1926, pp. 301-302. Approximately one-eighth of original heat in fuel used in oil engine is available for heating purposes after having passed through engine; factors to be considered when installing equipment of this kind.

OIL FIELDS

ALBERTA, CANADA. Petroleum and Natural Gas Development in Alberta. Petroleum World, vol. 23, no. 310, July 1926, pp. 245-248. Developments in or near Alberta on basis of information concerning sub-surface conditions and actual results obtained from drilling in its various phases.

OIL FUEL

BURNERS. Test Data on Oil Burner. Elec. World, vol. 88, no. 1, July 3, 1926, pp. 7-8. Results of tests conducted by Phila. Elec. Co. giving data on boiler efficiency and costs of oil burner for use with house furnace; burner makes desirable load for central stations.

The Development of Atomization Methods for Oil Burners, S. D. Rickard. Heat. & Vent. Mag., vol. 23, no. 6, June 1926, pp. 76-78, 3 figs. Considerations affecting flame characteristics and economies derived from experiences of past.

HANDLING EQUIPMENT. Fuel Oil-Handling Equipment, C. C. Hermann. Machy. (N.Y.), vol. 32, no. 11, July 1926, pp. 883-885, 4 figs. In planning fuel-oil system for forge-shop use, special attention should be given to certain parts of equipment; strainer for oil-pipe line; hose for tank connection; unloading station plans; oil-pump installation.

OIL SHALES

DUST, EXPLOSION OF. Explosibility of Oil-Shale Dust, V. C. Allison and A. D. Bauer. U. S. Bur. of Mines—Reports of Investigations, no. 2758, June 1926, 8 pp., 1 fig. Investigation shows that oil-shale dusts are explosive and that their explosiveness increases with their combustible content; formation of dust during mining and handling of oil-shale is almost unavoidable, and same precautions against explosions should be taken as in coal mines.

EXTRACTION. A Problem in Oil-Shale Extraction, T. M. Bains. Eng. & Min. Jl.—Press, vol. 121, no. 25, June 19, 1926, pp. 1009-1013, 4 figs. Procedure to be followed in attempting to solve mining-research problem; basic principles involved; investigation of all known methods which might be applied to problem; applying new methods; problem of loading deep and almost flat holes; fire risk involved.

OPEN-HEARTH FURNACES

REGENERATIVE. Regenerative Pusher Type Furnace for Heating Blooms. Fuels & Furnaces, vol. 4, no. 7, July 1926, p. 807, 2 figs. Describes regenerative continuous furnace of pusher type built in Germany for heating blooms 6¼ in. x 6¼ in. cross-section and 86 in. long, weighing 880 lb.

ORE DRESSING

MOUNTING FRAGMENTAL MILL PRODUCTS. A New Method of Mounting Polished Sections of Mill Products, E. Thomson. Can. Inst. Min. & Met.—Bul., no. 170, June 1926, pp. 706-711, 6 figs. Method of mounting and polishing fragmental mill products in easiest and most efficient way, so that minerals present may be readily determined.

OXY-ACETYLENE CUTTING

SHIP SCRAPPING. The Ship Scrapping Industry. Welding Engr., vol. 11, no. 6, June 1926, pp. 41-42, 4 figs. Contractors find various ways to reduce costs of cutting up steel ships and similar structures with oxy-acetylene cutting torch.

OXY-ACETYLENE WELDING

ALUMINUM. Oxy-Acetylene Welding Sheet Aluminum, J. W. Meadowcroft. Am. Welding Soc.—Jl., vol. 5, no. 6, June 1926, pp. 47-49, 4 figs. Sheet aluminum can be welded with same thoroughness and at much greater speed than sheet metal; rod or strip completely covered with flux or filler body must be used.

PIPE JOINTS. Design of Oxwelded Equipment, E. E. Thum. Am. Welding Soc.—Jl., vol. 5, no. 5, May 1926, pp. 42-56, 14 figs. Points out that large savings in material can be made when pipe systems are designed for oxy-acetylene welded joints; principles which should control design of all oxy-acetylene joints.

PRECAUTIONS AND METHODS. Do's and Dont's for Oxy-Acetylene Welding, A. Eyles. Machy. (N.Y.), vol. 32, no. 11, July 1926, pp. 892-894, 1 fig. Requirement for welding; precautions in handling welding equipment; welding sheet metal; flux for aluminum welding; welding galvanized and other coated metals.

P

PAPER MILLS

SHAWINIGAN FALLS, QUE. Mill Extension at Shawinigan Falls, Que. J. W. H. Ford. Can. Engr., vol. 51, no. 1, July 6, 1926, pp. 101-102, 4 figs. Capacity of Belgo-Canadian Pulp & Paper Co.'s mill will be increased to 600 tons of paper per day; two 100-ton machines to be installed; interesting problems solved in building foundations; Raymond concrete piles employed.

PAVEMENT, ASPHALT

MIXTURES. Researches on Asphalt Paving Mixtures, P. Hubbard and F. C. Field. Asphalt Assn.—Circular, no. 34, pp. 1-6 and (discussion) 6-19, 20 figs. Reviews various tests to determine stability of asphalt paving mixtures, comparing different methods developed. Paper presented before Am. Soc. for Mun. Developments, Oct. 27, 1925.

PEGMATITES

CANADA. Pegmatites of South Eastern Manitoba, J. S. Delury. Can. Min. Jl., vol. 47, no. 28, July 9, 1926, pp. 695-697. Pegmatite dikes yielding lithium, cassiterite, spodumeme, lithium phosphate, sulphides, etc.

PIGMENTS

HIDING POWER. Hiding Power of Pigments, R. L. Hallett. Am. Soc. for Testing Matls.—Preprint no. 52, for mtg. June 21, 1926, 6 pp., 1 fig. Pigment characteristics which influence hiding power; relation between tinting power and hiding power of pigment in square feet per pound may be calculated if tinting power has been determined.

PIPE, CAST-IRON

STRENGTH. Strength of Iron Pipe Cast by Various Methods, A. N. Talbot. Can. Engr., vols. 50 and 51, nos. 26 and 1, June 29, and July 6, 1926, pp. 699-704 and 713; and 109-115, 11 figs. (Also Contract Rec., vol. 40, no. 36, June 30, 1926, pp. 631-632.) Results of tests by flexure, impact, and internal pressure on 6-in. pipe cast vertically and cast by two different centrifugal processes.

PIPE LINES

WELDED. Long Welded Water Pipe Line. Eng. World, vol. 29, no. 1, July 1926, pp. 5-6, 7 figs. Description of 22-mile welded pipe line of 22- and 24-in. diameter, used for water supply for city of Vallejo, Cal.

PIPE, STEEL

ELECTRICALLY WELDED. The Mokelumne River Water Supply Project for East Bay Municipal Utility District. West. Constr. News, vol. 1, no. 12, June 25, 1926, pp. 29-35, 15 figs. Successful shop and field tests prove 65- and 63-in. electrically welded steel pipe, ½, 7-16, ⅝ in. thick, entirely practicable; details of manufacture and testing.

PIPING

MANUFACTURE AND LAYOUT. Pipework: Its Manufacture and Layout, G. H. Willett. Jr. Instn. of Engrs.—Jl. & Rec. of Trans., vol. 36, part 9, June 1926, pp. 380-412, 27 figs. Ferrous pipes; riveted pipes; welded pipes; weldless tubes; fittings; non-ferrous pipes; joints; design of layout; velocities; expansion; drainage; steam traps; valves; supports; insulation; corrosion. See also Mech. World, vol. 80, no. 2062, July 9, 1926, pp. 32-33.

POWER FACTOR

CORRECTION. Power-Factor Correction in Steel Mills, E. F. Rhodes. Elec. Jl., vol. 23, no. 6, June 1926, pp. 287-288, 8 figs. Advantage of high power-factor maintenance in steel plant; power factor may be raised by substitution of synchronous and static condensers.

Power-Factor Correction by Synchronous Motors, A. S. Rufsvold. Power Plant Eng., vol. 30, no. 13, July 1, 1926, pp. 751-754, 7 figs. Principles involved in correcting power factor; methods of calculation and solution of problems by means of vector diagrams.

IMPROVEMENT. The Improvement of Power Factor, E. W. Dorey. Instn. Elec. Engrs.—Jl., vol. 64, no. 354, June 1926, pp. 633-640 and (discussion) 640-654, 7 figs. Summarized principal types of apparatus employed for improvement of power factor, and describes modern static condenser and types of power-factor-rectifying plant that have been developed during past three years; outlines various forms of power-factor tariff in force in Great Britain; systems of metering employed in conjunction with power-factor tariffs.

PRESSWORK

POWER. Power Press Work, W. A. Lynch. Machy. (Lond.), vol. 28, no. 712, June 3, 1926, pp. 236-240. Deals with cold sheet-metal work; blanking and piercing; tool clearance, shaving, drawing, forming, stripping, etc.; notes on tool design and press production.

PULLEYS

LOOSE, BALL-BEARING. Ball-Bearing Loose Pulleys Lower Production Costs. Belting, vol. 28, no. 6, June 1926, pp. 46 and 48. Use of such pulleys in industrial plant in Chicago made it possible to dispense with service of four maintenance men; design of loose pulleys.

WROUGHT-IRON. Wrought-Iron Pulleys, H. Bentley. Mech. World, vol. 80, no. 2061, July 2, 1926, pp. 6-7, 20 figs. Summarizes advantages claimed for wrought-iron pulleys and discusses some of their features.

PULVERIZED COAL

BOILER FIRING. Experiences in Pulverized-Coal Firing (Betriebserfahrungen mit Kohlenstaubfeuerungen), E. Schulz and F. Gropp. Archiv für Wärmewirtschaft, vol. 7, no. 5, May 1926, pp. 121-129, 28 figs. Use of pulverized-coal boilers for peak loads, damages of brickwork in combustion chamber, ash removal, pulverizing plants, evaporating efficiency.

Pulverized-Coal Firing and the Hygroscopic Properties of Lignite. (Kohlenstaubfeuerung and hygroskopische Eigenschaften der Braunkohle), E. Rammler. Archiv für Wärmewirtschaft, vol. 7, no. 6, June 1926, pp. 159-166, 8 figs. Significance of moisture in powdered-coal firing; handling and grinding hygroscopic coals; handling and bunkering of hygroscopic pulverized coal. See also Braunkohle, vol. 25, no. 6, May 8, 1926, pp. 120-131, 8 figs.

COMBUSTION. On Pulverized Combustible (Sur les combustibles pulvérisés), D. W. Lulofs. Chaleur & Industrie, vol. 7, no. 72, Apr. 1926, pp. 177-182, 3 figs. Notes on calculation of cooling effect of furnace walls; data on experiments with furnace having water-cooled top, bottom and side walls.

MAINTENANCE IN SUSPENSION. Power for Maintaining Coal in Suspension, J. G. Coutant. Combustion, vol. 14, no. 6, June 1926, pp. 378-379, 4 figs. Coal pulverized to sufficient fineness will remain in suspension in moving air; this fact forms basis for design of pulverized-coal burners; fuel-transport lines and pneumatic conveying systems; in order to maintain coal in suspension while burning, total air pressure of 1.68 oz. per sq. in. at burner should be provided for.

PUMPING STATIONS

CHICAGO. Factors Considered in Designing Largest Pumping Station, L. D. Gayton. Eng. News-Rec., vol. 96, no. 21, May 27, 1926, pp. 838-843, 5 figs. Reasons given as to necessity, capacity, type of unit and choice of equipment on new Western Avenue 300-m.g.d. installation in Chicago.

PUMPS

CYLINDERS. Laying Out and Machining Large Pump Cylinders, W. Wheatley. Machy. (N.Y.), vol. 32, no. 11, July 1926, pp. 908-909, 3 figs. Account of author's experience obtained while operating boring mill in copper-mining centre.

POWER EQUIPMENT. Power-Drive Equipment for Industrial Pumps, G. Fox. Indus. Engr., vol. 84, no. 7, July 1926, pp. 316-321, 11 figs. Selection of motors, control and drive equipment for different types of pumps.

PUMPS, CENTRIFUGAL

AUTOMATIC CONTROL. Controlling Centrifugal Pumps Automatically, A. H. Hubbell. Eng. & Min. Jl.-Press, vol. 121, no. 25, June 19, 1926, pp. 997-1001, 9 figs. Manual attendance largely eliminated; labor cost lessened; system is dependable and applicable to practically every condition of mine drainage where water is handled by units of this type.

R

RADIO COMMUNICATION

POLARIZATION OF WAVES. Polarization of Radio Waves, E. F. W. Alexanderson. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 7, July 1926, pp. 636-640, 4 figs. Recent investigations of phenomena of radio wave propagation; observations on short waves; theory of wave motion; mechanical model for studying wave polarization, irregularities of direction finders.

RADIOTELEGRAPHY

SHORT WAVE TRANSMISSION. Refraction of Short Radio Waves, W. G. Baker and C. W. Rice. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 6, June 1926, pp. 535-539, 1 fig. Shows that short-wave radio transmission (below 60 meters) can be quantitatively accounted for on simple electron refraction theory in which effect of earth's magnetic field and electron collisions may be neglected as first approximation.

RADIOTELEPHONY

DEVELOPMENTS. Notes on Wireless Matters, L. B. Turner. Elecn., vol. 96, no. 2506, June 11, 1926, pp. 596-597, 2 figs. Reception in wireless telephony; analysis of carrier wave; low frequency amplification; resistance and choke amplifiers.

HARMONICS. Harmonics and Their Effects on Wave Form, J. F. Herd. Experimental Wireless, vol. 3, no. 34, July 1926, pp. 407-410, 17 figs. Typical cases of effect of harmonics illustrated by drawing one complete cycle of fundamental, together with harmonic or harmonics stated in each case, and obtaining resultant wave form by algebraic addition.

RAILS

BREAKING OF. Accidental Breaking of Rails (Les ruptures accidentelles des rails), M. Merklen. Revue Génerale des Chemins de Fer, vol. 45, no. 5, May 1926, pp. 346-387, 66 figs. Defects in rails and their remedies; brittleness, cracks and fissures and their spread in rails; pipe, segregation, premature wear, corrosion, and wear.

RAILWAY MANAGEMENT

STORES CONTROL. Standardization and Simplification of Stores Stock. Ry. Age, vol. 80, no. 30, June 11, 1926, pp. 1635-1638. Report of committee before Am. Ry. Assn.

RAILWAY MOTOR CARS

BENZOL. New Benzol Car of the Town of Spremberg [Ein neuer Benzoltriebwagen der Stadt Spremberg (Lausitz)], Fratschner. Verkehrstechnik, vol. 39, no. 18, Apr. 30, 1926, pp. 288-291, 3 figs. Design and operation of A.E.G.-car replacing steam service and considerably reducing operating costs.

GASOLINE. C. B. & Q. Acquires Gasoline Car with Independent Power Units. Ry. Age, vol. 81, no. 1, July 3, 1926, pp. 19-20, 3 figs. New car having seating capacity for 42 passengers and containing baggage and mail compartments; entire floor space of 65 ft. available for revenue purposes; trucks provided with 100-hp. motors.

RAILWAY OPERATION

TRAIN CONTROL. New York Central Equips Engines for Train Stop. Ry. Signaling, vol. 19, no. 7, July 1926, pp. 264-266, 9 figs. Locomotive taken from service for 33 hours is equipped in average of 93.7 man-hours; installation of wayside inductors.

TRAIN DESPATCHING. Time Schedules and Dispatching Methods, J. A. Droege. Ry. Rev., vol. 79, no. 1, July 3, 1926, pp. 17-18. Positive meet system possesses advantage of simplicity over superiority by direction.

RAILWAY SHOPS

MATERIALS HANDLING. Handling Material in Railway Shops. Ry. Mech. Engr., vol. 100, no. 7, July 1926, pp. 447-454, 25 figs. Developments in equipment have facilitated work of routing material; efficient operation depends on prompt deliveries.

RAILWAY SIGNALLING

MAINTENANCE. Signal Maintenance on the Erie. Ry. Signaling, vol. 19, no. 7, July 1926, pp. 257-263, 17 figs. Performance in terms of train interruption improved 76 per cent and expenditure for battery reduced 43 per cent during last seven years.

RAILWAY SWITCHES

RENEWAL. How to Renew Slip Switches, J. Wilson. Ry. Rev., vol. 79, no. 2, July 10, 1926, pp. 45-46, 2 figs. Two methods for renewing slip switches; compares their advantages and stresses importance of good maintenance.

RAILWAY TRACK

CURVES. Influence of Gyroscopic Action on the Necessary Superelevation to be Provided on Curves, F. Corini. Int. Ry. Congress—Bul., vol. 8, no. 6, June 1926, pp. 491-501, 7 figs. Gyroscopic action as affecting railway rolling stock and passing round curve; superelevation of outer rail; superelevation of outer rail to gyroscopic moment, etc.

DRAINAGE. Illinois Central Installs Large Mileage of Track Drainage, P. T. Savage. Ry. Eng. & Maintenance, vol. 22, no. 7, July 1926, pp. 260-262, 3 figs. Improper drainage of subgrade, permitting formation of soft spots and water pockets in roadbed, has given maintenance force constant trouble; combination vitrified pipe and field tile drain proves efficient and economical.

TRACK STRESSES. Report of the Bridge Sub-Committee on Track Stresses, 1925. India Govt. Publication—Tech. Paper, no. 245, 1926, 54 pp., 83 figs. Sources of information; note on elastic theory; general conclusions regarding locomotive, cars, particular types of locomotives, curved track, effect of sleeper spacing, etc.

RECTIFIERS

VOLTAGE CONTROL. Rectifier Voltage Control, D. C. Prince. Am. Inst. Elec. Engrs. —Jl., vol. 45, no. 7, July 1926, pp. 630-636, 20 figs. Method of voltage control for rectifiers based on use of saturated core interphase transformer; theory of operation and curves showing results of observations.

REFRACTORIES

FOUNDRY. Refractories in the Foundry, H. V. Grundy and A. Phillips. Foundry Trade Jl., vol. 33, nos. 511 and 513, June 3 and 17, 1926, pp. 387-391 and 445-448, 15 figs. Chemical and physical properties of molding sands; test for cohesiveness; durability sand; ground coke, ground gas carbon and ground charcoal. June 17: Refractories for cupola; lining corrosion; refractory coatings.

ELECTRICAL RESISTANCE. The Electrical Resistance of Refractory Materials, J. B. Ferguson. Can. Chem. & Met., vol. 10, no. 6, June 1926, pp. 131-136, 14 figs. Summary of work on glasses and crystals illustrating many of characteristics which may be shown by commercial refractories under like conditions; porcelain and pure refractory materials.

OF OPEN-HEARTH PROCESS, EFFECT ON. Progress Report on the Effect of the Open-Hearth Process on Refractories, F. W. Schroeder and B. M. Larsen. Am. Inst. of Min. & Met. Engrs.—Advance Paper, no. 1579-C, July 1926, 19 pp., 8 figs. Economies of refractories on open hearths; dusts in open-hearth atmosphere; effects of oxide dusts on silica-brick walls; fusion, spalling, and hole formation in roof arch; dust deposits in checker chambers and tunnels.

HIGH TEMPERATURES AND. Refractories and High Temperatures. Eng. & Boiler House Rev., vol. 39, no. 11, May 1926, pp. 515-516, 1 fig. Discusses complicated problems with high-grade firebricks.

SPECIFIC-HEAT DETERMINATION. The Role of Specific-Heat in the Selection of Refractories, A. E. MacGee. Am. Ceramic Soc.—Jl., vol. 9, no. 6, June 1926, pp. 374-379. Discussion of specific heats in which particular emphasis is placed upon its determination at high temperatures; methods used in past for its determination and application of values in selection of refractories; points out need for determining physical properties of brick which have been in service.

STEEL AND METAL INDUSTRIES. Refractory Materials for Steel and Metalworking Industry (Feuerfeste Stoffe für die Eisen und Metall erzeugende Industrie), E. H. Schulz. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 12, Mar. 20, 1926, pp. 408-410. Methods of investigating, testing and standardization of refractories for metallurgical industry; main types of refractory brick and their properties; difficulties of selection and testing.

REFRIGERATING MACHINES

DOMESTIC. Self-Contained Unit or Separate Systems, O. T. Knight. Am. Gas Jl., vol. 125, no. 2, July 10, 1926, pp. 32 and 38. Factors to be considered in choosing refrigerating system for domestic purpose; objections to self-contained unit; brine-circulating systems and basement installation.

RESERVOIRS

RIVER REGULATING. Operation of River-Regulating Reservoirs, M. D. Casler. Eng. News-Rec., vol. 96, no. 20, May 20, 1926, pp. 812-816, 7 figs. Possibilities of storage reservoirs studied by use of mass diagrams made from flow records; regulation adjusted to meet local requirements.

RETAINING WALLS

GEOSTATIC THEORIES. Retaining Walls and Geostatic Theories, F. W. Woods. Engineer, vol. 141, no. 3674, June 11, 1926, pp. 604-605, 8 figs. Factor of soil cohesion should be recognized as having bearing on theories of soil movement, similar to that which viscosity has on theories of hydraulics, and it ought to be allowed for in some way, that is, by application of suitable coefficients of correction, introduced into theoretical formulas from empirical considerations.

ROAD CONSTRUCTION

GRADE CROSSINGS, ELIMINATION OF. Crossing Elimination and Road Relocation in California. Eng. News-Rec., vol. 96, no. 25, June 24, 1926, pp. 1025-1029, 8 figs. Information concerning elimination of grade crossings obtained from State Highway Commission of California; examples of elimination of both by separating grades and by relocating roads to avoid crossings.

MACHINERY. Machine for Digging Trench for Road Side Forms. Contract Rec., vol. 40, no. 26, June 30, 1926, p. 641, 2 figs. Describes machine which in two or three hours will dig enough form trench for day's run of mixer, and grade will be so exact that no trimming or filling and tamping need be done by form setters.

ROADS

SILICATED. Silicated Roads (Le Silicatage des Routes), L. Greschwind. Génie Civil, vol. 88, no. 24, June 12, 1926, pp. 519-523. Results obtained in Switzerland with limestone macadam roads in which water glass is used as binder.

ROLLING MILLS

Blooming Mills. Comparative Investigations of Power Requirements and Rolling Efficiency of Blooming Mills (Vergleichende Untersuchungen auf Kraftbedarf und Walzleistung an Blockstrassen), C. Schmitz. Stahl u. Eisen, vol. 46, no. 23, June 10, 1926, pp. 769-776, 12 figs. Investigations, carried out with aid of operating data and time studies, show what conditions influence power consumption and efficiency; calculation also provides operator with adequate means of supervising blooming mill.

Electric Drive. Converting Existing Rolling Mills from Steam-Engine to Electric-Motor Drive, D. M. Petty. Elec. Jl., vol. 23, no. 6, June 1926, pp. 276-278, 4 figs. Cites instances in which number of causes led to replacement of steam engine by motor; one of principal advantages of electric power over steam is difference between no-load losses; other advantages.

Hot-Strip Mills. New Hot-Strip Mill in Operation, R. A. Fiske. Iron Age, vol. 118, no. 2, July 8, 1926, pp. 78-81, 6 figs. New 14-stand hot-strip mill of Acme Steel Co., Riverdale, Ill.; stands are driven by 9 motors; 101 motors on runout table and hot bed; producer gas used.

Plate Mills. Steel Works Modernization. Elec. Rev., vol. 98, no. 2534, June 18, 1926, pp. 902-905, 7 figs. Electrical equipment of new plate mill of Consett Iron Co., Ltd., England.

S

SAND BLAST

Air Ratio. Compressed Air and Sand Blast Operation (Die Pressluftverhältnisse beim Betrieb von Sandstrahlgebläsen), R. Karg. Zeit. für komprimierte und flüssige Gase, vol. 25, nos. 2 and 3, Feb. and Mar. 1926, pp. 17-20 and 30-33, 5 figs. Discusses quantity of air required and its calculation from number and diameter of nozzles, operating pressure, temperature and type of compression.

SAND MOLDING

Gas Permeability and Cohesion. The Practical Utilization of Apparatus for Measuring the Permeability and Cohesion of Moulding Sands, R. Lemoine. Foundry Trade Jl., vol. 33, no. 513, June 17, 1926, pp. 449-452, 3 figs. Apparatus for measuring permeability and cohesion in cold state, when employed according to certain methods, may be of great service in foundry; controlling mixtures, raw materials, and prepared sand.

SCREW THREADS

Calipers. Screw Thread Micrometer Calipers, H. Bentley. Indus. Mgmt. (Lond.), vol. 13, no. 6, June 1926, pp. 261-262, 2 figs. Application of micrometer calipers to measuring V-type screw threads.

Generating Machine. Thread Generating and Forming Machine. Machy. (Lond.), vol. 28, no. 716, June 30, 1926, pp. 373-374, 3 figs. Cornelis machine, which is semi-automatic in operation and consists of lathe-type bed with fast headstock at one end and saddle which is guided along bed by two cylindrical steel bars supported between headstock and bracket, at left-hand end of bed.

SEWAGE DISPOSAL

Activated Sludge. Activated-Sludge Plant for Three Small California Cities, F. M. Veatch. Eng. News-Rec., vol. 97, no. 1, July 1, 1926, pp. 10-13, 4 figs. Excess sludge returned to Imhoff tanks, residue to drying beds; effluent not sent to old sewage farm is chlorinated; design features of comprehensive plant.

Plants. Sewage Treatment in Chicago. Pub. Works, vol. 57, no. 6, July 1926, pp. 218-221, 5 figs. $10,000,000 worth of work under contract and $70,000,000 more to be spent, in addition to millions already spent for sewage treatment plants, make this most extensive programme ever undertaken by any municipality.

Sludge Digestion. Experiences with Separate Sludge Digestion, L. R. Howson. Am. City, vol. 35, no. 1, July 1926, pp. 47-50. Experience at three or four different sewage treatment plants where separate sludge digestion tanks have demonstrated their ability to accomplish efficient clarification and sludge reduction and to produce good sludge which can be readily dried.

SEWER CONSTRUCTION

Relief Sewer. Construction Methods on $3,450,000 Relief Sewer, F. W. Skinner. Gen. Contracting, vol. 65, no. 6, June 16, 1926, pp. 247-254, 8 figs. Methods employed in constructing one of largest sewers in world by Brooklyn Bureau of Sewers; 14,800 ft. of lower end of sewer terminating at receiving chamber near shore of Jamaica Bay to which effluent is discharged, has overall width of 14 ft. 10 in. to 47 ft. and depth of 12 ft. 4 in. to 13 ft. and is calculated to carry maximum flow of 2,460 cu. ft. per second of storm water from large residential area; special drainage features of deep trench in wet sand.

SMOKE

Abatement. Smoke Elimination. Clay-Worker, vol. 85, no. 6, June 1926, pp. 463-465, 5 figs. Process developed by W. C. Mitchell, of Superior Press Brick Co., St. Louis, by which smoke menace is eliminated in plant manufacturing brick and tile.

The Black Smoke Problem: The New Smoke Abatement Bill, J. B. C. Kershaw. World Power, vol. 5, no. 30, June 1926, pp. 310-314. Present law relating to smoke emission; report of Committee on Smoke Abatement; set up in 1914; Government bills of 1923 and 1925; probable effects of new legislation.

SPRINGS

Laminated. Experiments on Laminated Springs, H. S. Rowell. Automobile Engr., vol. 16, no. 216, June 1926, pp. 229-236, 44 figs. Experimental determination of spring stresses and observations on spring friction.

Standardization. Standardization of Springs from the Standpoint of Construction (Ueber die Normung von Federn vom Standpunkt der Konstruktion), R. Geyer. Maschinenbau, vol. 5, no. 10, May 20, 1926, pp. 450-451, 8 figs. Discusses possibility of standardizing pressure and expansion springs and proposes standard dimensions based on calculations.

STANDARDIZATION

Developments. Engineering and Industrial Standardization. Mech. Eng., vol. 48, no. 7, July 1926, pp. 763-764. Proposals for standardized Woodruff keys; T-slot and parts; standards for gear-tooth form and nomenclature; for plain taper and gib-head taper keys; bolt, nut and rivet proportions; standardization of machine tapers; lathe and planer tool holders; standards for plain and lock washers.

STANDARDS

German N. D. I. Reports. Report of German Industrial Standards Committee (N.D.I.-Mitteilungen), W. Reichardt. Maschinenbau, vol. 5, no. 10, May 20, 1926, pp. 481-483. Proposed standards for square nuts and holes; bronzes and red brass; terminology, castings, etc.; diameters for woodworking machines; milling cutters and arbors.

Report of German Industrial Standards Committee (N.D.I.-Mitteilungen). Maschinenbau, vol. 5, no. 11, June 3, 1926, pp. 533-544, 18 figs. Proposed standards for headless screws with square shoulder; gears, definitions, designations and graphic symbols; welding, definitions and graphic symbols.

STEAM

High-Pressure. Industrial Production of High-Pressure Steam (La production industrielle de la vapeur d'eau à haute pression), M. C. Roszak and M. Veron. Société des Ingenieurs Civils de France, no. 8, Apr. 30, 1926, pp. 159-168. Discusses influence of high pressure on utilization and production of steam, concludes that high-pressure steam leads to important improvements in efficiency of central stations; pressures of 50 kg. per sq. cm. and of 80 kg. per sq. cm. will have to be considered.

Pressure Regulation. A New Pressure-Reducing Apparatus (Ein nieuw system reduceerapparaat), A. Bargeboer. Ingenieur, vol. 41, no. 17, Apr. 24, 1926, pp. 333-337, 4 figs. Dikkers-Bargeboer system of pressure regulation, calculation and applications.

Tables. New Tables of the Properties of Steam (Nouvelles Tables des Propriétés de la Vapeur d'eau), R. Martin. Chaleur & Industrie, vol. 7, no. 73, May 1926, pp. 269-271. Extensive metric tables and charts of properties up to a pressure of 60 atmospheres, values below 30 atmospheres corresponding to those established by Knoblauch, Raisch and Hausen, and those above to values of Dr. R. Mollier.

STEAM ENGINES

M. E. P. Indicator. The Direct Indication of Mean Effective Pressure—The Pî Meter [as direkte Anzeigen des mittleren indizierten Kolbendruckes (das Pî-Meter)], J. Geiger. Wärms, vol. 49, no. 19, May 7, 1926, pp. 331-333, 10 figs. Describes apparatus combining pressure-volume and pressure-time measurements and giving direct reading or recording of mean effective pressure.

Uniflow. An Auxiliary Steam Engine Development. Mar. Engr. & Motorship Bldr., vol. 49, no. 586, June 1926, pp. 216-219, 8 figs. Economy to be derived from use of uniflow principles for marine auxiliary-engine purposes.

Record-Breaking Uniflow Engine in Steel Mill. Power Plant Eng., vol. 30, no. 13, July 1, 1926, pp. 746-750, 7 figs. Largest uniflow in America, incorporating many unusual features of design and construction, is pioneer unit for reversing blooming-mill service at Steubenville plant of Wheeling Steel Corp.

STEAM PIPES

High-Pressure. High-Pressure Pipe Lines for Highly Superheated Steam of 40 Atmos. (Hochruck-Rohrleitungen für hoch überhitzten Dampf von 40 atü), H. Menk, Archiv. für Wärmewirtschaft, vol. 7, no. 5, May 1926, pp. 133-138, 22 figs. Discusses question of materials, calculation of thickness of pipe, fixing of flanges by DIN standards, expansion pipes and their tests, valves and fittings, draining of pipes, etc.

Power-Plant. How to Lay Out Power-Plant Piping, S. Crocker. Power, vol. 63, nos. 20, 23 and 25, May 18, June 8 and 22, 1926, pp. 769-770, 890-891 and 962-965, 8 figs. May 18: Preparation of preliminary plans. June 8: How to select pipe sizes. June 22: Influence of high temperatures on choice of materials; development of dimensional standards.

STEAM POWER PLANTS

Cold Circulating Water. The Value of Cold Circulating Water. Power Engr., vol. 21, no. 243, June 1926, pp. 220-221. Investigation into reduction of operating costs of steam power plants possible by use of lower-temperature circulating water.

Control Apparatus. Modern Devices for Power Plant Control. Chem. Age, vol. 14, no. 365, June 26, 1926, pp. 567-569, 2 figs. Notes on various types of apparatus applicable to conservation of power in works and for obtaining accurate data for costing.

STEAM TURBINES

Automatic Regulation. Automatic Regulation Maintains Exhaust and Bleeder Pressures. Power, vol. 63, no. 26, June 29, 1926, pp. 1005-1007, 4 figs. Describes 500-kw. Moore turbine at power plant of Lever Bros. Co. at Cambridge, Mass.; although there are three governing devices, operation is simpler than for condensing unit; thermal efficiency exceeds that of best condensing station.

Brush-Ljungstrom. Notes on the Brush-Ljungström Turbine, J. R. Cowell. S. African Instn. Engrs.—Jl., vol. 24, no. 10, May 1926, pp. 218-230, 17 figs. Machine is of pure reaction outward radial-flow double-rotation type; advantages of system.

High-Pressure. High-Pressure Prime Movers in Industrial Plants, F. Hodgkinson. Engrs. & Eng., vol. 43, no. 6, June 15, 1926, pp. 151-157 and (discussion) 157-160, 1 fig. General thermal advantages of high pressures; increasing pressure vs. increasing superheat; small-capacity turbines; industrial applications.

Reactions. The Limiting Efficiency of the Reaction Steam Turbine. Engineering, vol. 122, no. 3155, July 2, 1926, p. 1. Points out that graphic method of determining diagrammatic efficiencies as commonly applied in design of impulse turbines is but ill-fitted for discussing efficiency of group of reaction blading.

STEEL

Dentritic Structure and Crystal Formation. A Study of Dentritic Structure and Crystal Formation, B. Stoughton and F. J. G. Duck. Am. Soc. for Steel Treating—Trans., vol. 10, no. 1, July 1926, pp. 31-41 and (discussion) 42-52, 21 figs. Formation of dentritic crystals in overheated high-carbon steel; comparison of structure and hardness with normal file steel of approximately same composition; evidence is offered that amorphous-metal hypothesis does not hold when crystals are large and there are correspondingly large surfaces of cement; it is thought possible that intercrystalline rupture of metals at high temperatures is due to large size of crystals at those temperatures, as contrasted with their small size at normal temperature.

Rivet. Effect of Sulphur on Rivet Steel—Summary of Findings. Eng. News-Rec., vol. 97, no. 1, July 1, 1926, p. 26, 1 fig. Committee on investigation of effect of phosphorus and sulphur in steel reports that sulphur, up to 0.06 per cent is harmless; larger amounts reduce ductility, toughness and strength of riveted joints.

Spheroidization. Spheroidization and How It Occurs, A. Allison. Iron Age, vol. 118, no. 2, July 8, 1926, pp. 73-76, 14 figs. Damascus metal remarkable example of spheroidization; relation to grain growth and grain boundaries; explanation of Stead's brittleness.

STEEL CASTINGS

Defects. Defects Hiding in Steel Castings, F. J. Stanley. Iron Age, vol. 118, no. 1, July 1, 1926, pp. 12-13 and 60-62, 3 figs. Lists and gives causes of such defects as porosity, blowholes, shifts, cracks, etc.

STEEL, HEAT TREATMENT OF

Annealing and Quenching. Changing the Size of Steel Fittings, C. Jones. Forging—Stamping—Heat Treating, vol. 12, no. 6, June 1926, pp. 206-207, 1 fig. Method of changing size of piece of steel; results obtained by annealing carbon and low-tungsten bars.

Some Characteristics of Quenching Curves, H. J. French and O. Z. Klopsch. Am. Soc. for Steel Treating—Trans., vol. 9, no. 6, June 1926, pp. 857-882 and 906, 10 figs. Discusses time-temperature cooling curves at centre of steel samples of various sizes and shapes quenched into ordinary coolants such as water, commercial quenching oil and air; based on described experiments, method is outlined by which cooling curves for various sizes and shapes quenched from various temperatures can be derived.

STEEL, HIGH-SPEED

Hardening and Tempering. The Hardening and Tempering of High-Speed Steel, A. R. Page. Engineering, vol. 121, no. 3153, June 18, 1926, pp. 738-739. Experiments with two steels, composition of which varies only in carbon content, to determine effect of hardening and tempering on microstructure and effect of time and temperature of hardening and tempering on hardness.

STEEL MANUFACTURE

High-Grade Steel. Making High-Grade Steel, J. A. Coyle. Iron Trade Rev., vol. 79, no. 1, July 1, 1926, pp. 5-7, 3 figs. Surface finish of cold strip steel undergoes improvement due to development of rolling and supplementary equipment.

STEEL WORKS

Production at Low Cost. Steel-Plant Operating Costs from an Engineering Point of View, L. C. Edgar. Engrs'. Soc. of West. Pa.—Proc., vol. 42, no. 3, Apr. 1926, pp. 165-180 and (discussion) 180-184. Fundamental principles governing engineering in its relation to production of iron and steel of good quality at low cost.

STRUCTURES

Wind Pressures. Wind Pressures on Structures, H. L. Dryden and G. C. Hill. U. S. Bur. of Standards—Sci. Papers, no. 523, Apr. 3, 1926, pp. 697-732, 23 figs. Results of experiments on model in 10-ft. wind tunnel of Bur. of Standards; effects of uniform and steady wind, and allowances to be made for gustiness of wind; typical values of coefficient of wind pressure for various types of models; conclusions are reached that greatest average pressure against building occurs when wind blows normal to face and is equal to 1.5 times velocity pressure; average decrease in pressure over roof is about 0.84 times velocity pressure.

SUB-STATIONS

Equipment of. Alternating Current Sub-Stations and Their Equipment for Urban Areas, A. T. Rodwell. Engr., vol. 16, no. 97, May 1926, pp. 24-33 and (discussion) 33-37, 4 figs. Factors affecting design; load; primary voltages and method of protection; state regulations regarding design and layout of electrical apparatus.

Remote-Controlled. Remote-Controlled Sub-stations, W. C. Blackwood. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 6, June 1926, pp. 531-534, 11 figs. Unit type of distribution sub-station designed for Metropolitan District; although of much lower capacity than other stations on same system its cost per kva. is approximately same as larger stations.

Supervisory Control. Supervisory Control, J. L. McCoy and W. R. Swoish. Elec. Jl., vol. 23, no. 6, June 1926, pp. 311-319, 10 figs. Increasing interest in application of supervisory control for power apparatus shows that operating companies are realizing saving in operating expense that can be effected.

SUPERHEATERS

Radiant-Heat. The Radiant-Heat Superheater. Eng. & Boiler House Rev., vol. 39, no. 11, May 1926, pp. 519-520, 1 fig. Radiant-heat superheater actually forms part of furnace walls, and so replaces equivalent area of firebrick; details of Foster superheater and its application.

SURVEYING

Geodetic and Topographic. The Geodetic and Topographic Survey of Pittsburgh and Allegheny County, U. N. Arthur and R. H. Randall. Engrs'. Soc. of West Pa.—Proc., vol. 42, no. 3, Apr. 1926, pp. 119-154 and (discussion) 154-164, 11 figs. Survey in Pittsburgh and Allegheny Counties, Pa., and progress attained; triangulation; precise levels; publication of reports.

SWIMMING POOLS

Design. Swimming Pool Design, Construction and Operation. Mun. & County Eng., vol. 70, no. 6, June 1926, pp. 358-369. Principles of sanitation; location and layout of pools; design and construction features; inlets and outlets; recirculation and filtration systems, etc.; report of Joint Committee on Bathing Places to State Sanitary Engrs.

SWITCHBOARDS

Truck-Type. Truck-Type Switching Equipment, M. H. Hobbs. Elec. Jl., vol. 23, no. 6, June 1926, pp. 319-321, 6 figs. Advantages for use of truck-type equipment; installation costs; safety features.

T

TANKS

Welded. How to Investigate Tanks, H. L. Whittemore. Am. Welding Soc.—Jl., vol. 5, no. 5, May 1926, pp. 23-27, 3 figs. Outline plans to be followed in investigating welded tanks.

TELEPHONY

Automatic. The Rotary Machine Switching System, F. A. Hubbard. Univ. Engr., vol. 43, no. 6, June 1926, pp. 26-31, 7 figs. Brief account of rotary system.

Transatlantic. Transatlantic Telephony, A. A. Oswald and B. M. Deloraine. Elecn., vol. 96, nos. 2505 and 2508, June 4 and 25, 1926, pp. 572-573 and 666-668, 6 figs. Single side-band equipment and power amplifier at Post Office Rugby Radio station. June 25: Speech-current apparatus; complete protective and testing measures; shielding arrangements; control system.

TERMINALS, LOCOMOTIVE

East Altoona, Pa. Pennsylvania East Altoona Engine Terminal. Ry. Mech. Engr., vol. 100, no. 7, July 1926, pp. 441-445, 7 figs. Gives method of handling work on sidings and in house of Pa. East Altoona engine terminal which turns out 200 freight locomotives daily.

TESTS AND TESTING

Materials. Materials Testing at the Works of Sulzer Brothers, Winterthur, Switzerland. Mech. World, vol. 79, no. 2058, June 11, 1926, pp. 443-445, 6 figs. Details of materials-testing department; parts cast in Sulzer works, in iron, steel, or any of many different alloys, are constantly kept under observation by casting test pieces or by taking samples of charges; iron and steel foundries have their own testing laboratories; principally used for testing strength of new varieties of materials before large castings are made; methods of determining tensile strength; presses for Brinnell test; hardness determination, etc.

TEXTILES

Kemp. Kemp Textile Inst., vol. 17, no. 6, June 1926, pp. T264-T304, 46 figs. Contains following articles: Introduction—Flat Kemp, H. J. W. Bliss; Kemp Fibres in the Merino, J. E. Duerden; Kemp in the Fleece of the Welsh Mountain Sheep, J. A. F. Roberts; Kemp Fibres in Fleeces of British Breeds of Sheep, J. S. S. Blyth; Some Characteristics of Mohair Kemp, H. R. Hirst and A. T. King.

Yarn. A Gravimetric Method for Investigation of the Variation and Levelness of Yarn, S. G. Barker. Textile Inst., vol. 17, no. 6, June 1926, pp. T259-T263. Describes method for determination of local variation or irregularity in count of yarns by weighing successive short lengths on special balance.

TRANSFORMERS

Auto. General Theory of the Auto-Transformer, W. L. Upson. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 7, July 1926, pp. 661-665, 2 figs. Method of complex quantities which lends itself admirably to development of general theory of auto-transformer; examples of calculations by this method; compares these transformers with calculated performance of two-circuit transformer; applies theory to transformers without iron and gives interesting conclusions.

Frequency Change, Effect of. The Effect of Frequency Change Upon Transformer Operation, H. M. Lacey. Elec. Times, vol. 70, no. 1810, July 1, 1926, pp. 3-6, 5 figs. Investigation of operating characteristics at frequency of 50 cycles per second of transformers designed for other frequencies, assuming in general that ratio is unchanged; principal features considered are output, iron loss, magnetizing current, copper loss, impedance, temperature rise and immunity from dielectric failure.

TUBES

Steel. Production of Steel Tubes and Cylinders (La fabrication des tubes et corps cylindriques en acier), M. Blutel. Technique Moderne, vol. 18, no. 8, Apr. 15, 1926, pp. 231-238, 21 figs. Methods of producing tubes without welding, such as Mannesmann, Ehrard and Stiefel methods; describes Mannesmann plant at Rath.

TURBO-GENERATORS

Efficiency Meter for. Efficiency Meter for Turbo-Generators. Engineering, vol. 121, no. 3152, June 11, 1926, pp. 710-711, 5 figs. Instrument showing at glance extent by which steam consumption of turbo-generator differs from guarantee, as well as actual consumption in pounds per kw.hr.; consists of indicating wattmeter in conjunction with Venturi or other type of water meter.

Special Design. Turbine Designed for Special Conditions. Power Plant Eng., vol. 30, no. 13, July 1, 1926, p. 734. Details of 3,600-r.p.m., 1,875-kva., 480-volt, 3-phase, 60-cycle turbo-generator set to meet requirements of Am. Trona Corp., whose plant is located near large dry salt lake in Mohave Desert of California.

V

VISCOSITY

Estimation. Viscosity and Its Estimation, W. M. Seaber. Indus. Chemist, vol. 2, no. 17, June 1926, pp. 243-248, 9 figs. Measurement of viscosity in various branches of technical chemistry; measurement methods; effect of temperature upon viscosity; standardization of viscometers.

VOLTAGES

Variation, Effect of. Voltage Variation as Affecting the Quality of Electrical Service, J. W. Peart. Elec. News, vol. 35, no. 13, July 1, 1926, pp. 37-38. When voltage drops, appliances are slowed up, motors do less than their rated work, illumination is poor and lamps inefficient. Paper read before Assn. Mun. Elec. Utilities.

W

WATER MAINS

Depth of Cover. What Should be the Depth of Cover Over Water Supply Pipes? S. G. Highland. Contract Rec., vol. 40, no. 26, June 30, 1926, pp. 635-637. Information concerning proper depth for placing water mains obtained from study of year-around soil temperatures.

WATER POWER

Low Head. Technical and Economic Aspects of Small Water Powers (Technisches und Wirtschaftliches von Kleinwasserkräften), F. Kammerer. Zeit. des Bayerischen Revisions-Vereins, vol. 30, nos. 8 and 9, Apr. 30 and May 15, 1926, pp. 104-107 and 113-115, 8 figs. Discusses development of water power of low heads for industrial purposes (up to about 1,500 kw.); including flour mills, saw mills, etc.; electric plants; storage of water; management of turbines, weirs, automatic regulation, etc.

WATER PURIFICATION

New Features of. New Features of Water Purification, F. H. Waring. Contract Rec., vol. 40, no. 27, July 7, 1926, pp. 659-662. Application of new devices and methods to treatment of water supplies; research work carried out in Ohio; prechlorination; double coagulation; excess lime treatment; combination of excess lime, double coagulation and adjustment of raw water pH value, lime soda, municipal zeolite softeners; natural recarbonation; coagulant feed devices; mixing devices; clarifiers; CO_2 application equipment.

Testing Apparatus. Recording "Dionic" Water-Testing Apparatus. Engineering, vol. 121, no. 3154, June 25, 1926, pp. 773-774, 4 figs. Determination of quantity of dissolved material in water by conductivity measurements; describes instrument put on market in 1910 by means of which conductivity of water and other liquids may be simply and rapidly measured.

WATER TREATMENT

Developments. The Past, Present and Future of Water Treatment. Ry. Age, vol. 80, no. 31, June 12, 1926, pp. 1667-1672, 1 fig. Abstract of papers read before Am. Water Works Assn. as follows: Review of Development to Date, S. C. Johnson; Statement of Problems Now Confronting Water Service Engineer, R. E. Coughlan; Forecast of Probable Future Development of Railway Water Treatment, C. R. Knowles.

Raw-Water Ice Plant. Water Treatment for Raw-Water Ice Plants, W. N. Waterman. Power Plant Eng., vol. 30, no. 13, July 1, 1926, pp. 758-760. Removal of various compounds of calcium and magnesium, together with iron and organic matter, allows clear ice to be made with less power.

WATER WORKS

Cofferdam Constructed for Intake. Building Cellular Wall Cofferdam, St. Louis Intake, J. C. Pritchard. Eng. News-Rec., vol. 96, no. 21, May 27, 1926, pp. 862-865, 3 figs. Thirty cells of steel sheet piling with clear wall height of 44 ft. built to inclose intake emplacement.

Hamilton, Ont. Water Works Extension, Hamilton, Ont., W. L. McFaul. Can. Engr., vol. 50, no. 25, June 22, 1926, pp. 677-683. Abstract of report prepared by city and consulting engineers, recommending extension of intakes, distribution system, reservoir capacity and pumping stations.

Toronto, Ont. Report on $14,000,000 Water Works for City of Toronto. Contract Rec., vol. 40, no. 23, June 9, 1926, pp. 564-568, 4 figs. Scheme involves intake tunnel at Victoria Park, 10 ft. in diameter, constructed in shale and extending distance of 3,300 ft. into 30-ft. depth of water and terminating in submerged tunnel shaft; low-lift pumping station, coagulating basins, filters, reservoirs, etc., with provision for treating initially 100,000,000 gals. water per day.

WELDING

Electric. *See Electric Welding, Arc.*

Oxy-Acetylene. *See Oxy-Acetylene Welding.*

Structural Steel. Welding in the Structural Field, J. H. Edwards. Am. Welding Soc.—Jl., vol. 5, no. 5, May 1926, pp. 19-23. Structural steel material used; welding operation; shop fabrication, such as handling and assembling; cost.

WOOD PRESERVATION

Creosote-Coal Tar Solution. A Plea for More General Use of a Creosote-Coal Tar Solution, S. R. Church. Ry. Eng. & Maintenance, vol. 22, no. 7, July 1926, pp. 282-283, 2 figs. Analyzes underlying economic basis of creosote production and discusses economic merits of creosote-coal tar solution for wood preservation.

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A

AIR

Pollution. Air-Pollution, J. B. C. Kershaw. Combustion, vol. 15, no. 2, Aug. 1926, pp. 103-105. Notes upon recent progress in Great Britain in relation to air situation.

AIR COMPRESSORS

Intake-Valve Control. Compressor for Air Brake System Has Intake-Valve Control, W. L. Carver. Automotive Industries, vol. 55, no. 2, July 8, 1926, pp. 52-54, 4 figs. Valve held in locked position when desired predetermined pressure has been built up; prevents noise of fluttering; other interesting features found in Christensen system.

AIRPLANE ENGINES

Air-Cooled vs. Water-Cooled. Financial Comparison of Air-Cooled and Water-Cooled Airplane Engines (Moteurs d'avions à réfroidissement par l'air ou par l'eau), J. A. Lefranc. Nature (Paris), no. 2727, July 10, 1926, pp. 20-24, 4 figs. Operating expenses of both types are practically same, but in case of 400-hp. engines the air-cooled one is 200 kg. lighter and will carry that extra weight of freight 160,000 km. in 1,000 hr. of flight.

American Development. Modern American Aircraft Engine Development, C. L. Lawrence. Roy. Aeronautical Soc.—Jl., vol. 30, no. 187, July 1926, pp. 405-424 and (discussion) 425-433, 20 figs. Calls attention to interesting and unusual features of American engines and discusses considerations which have led to designs in question.

AIRPLANE PROPELLERS

Tip Speeds. Airscrew Tip Speeds, R. K. Pierson. Flight, vol. 18, no. 30, July 29, 1926, pp. 464c-464e, 1 fig. Table showing relation between air-screw diameter, efficiency, tip speed and forward speed for various engines, and curves showing decrease of efficiency with increase of tip speed.

AIRPLANES

Airfoils. On the Drag of an Aerofoil for Two-Dimensional Flow, H. Lamb. Roy. Soc.—Proc., vol. 3, no. A 759, July 2, 1926, pp. 592-603, 8 figs. Profile drag of airfoil of infinite span.

Gliders. The Sixth Rhoen Glider Competition, 1925 (Der 6. Rhönsegelflug, 1925), R. Eisenlohr. Zeit. für Flugtechnik u. Motorluftschiffahrt, vol. 17, no. 2, Jan. 28, 1926, pp. 28-34, 14 figs. Illustrated decriptions of the various gliders entered.

Speed. The Cost of Speed in Airplane Transportation (Le prix de la vitesse dans les avions de transport), P. Grimault. Aéronautique, vol. 8, no. 86, July 1926, pp. 233-236, 1 fig. Starts from quantity of gasoline used per unit of weight per unit of distance and develops formulas for calculating most economic weight, speed, power, dimensions, etc.; shows that speed is not incompatible with economy.

Wings. On the Slotter Wing Again. Aeroplane, vol. 31, no. 4, July 28, 1926, pp. 117-118 and 120, 7 figs. In author's belief, with proper development of slot idea, airplane of normal type can be made to do anything which is done by Hill tailless machine and Autogiro, while retaining speed and climb and weight-lifting ability of normal airplane.

AIRSHIPS

Pressure Distribution. Pressure Distribution on the C-7 Airship, J. W. Crowley, Jr., and S. J. DeFrance. Nat. Advisory Committee for Aeronautics—Report, no. 223, 1926, pp. 3-41, 39 figs. Investigation to determine aerodynamic pressure distributed encountered on "C"-class airship in flight; method of testing consisted of measuring pressures by means of orifices located at desired points connected to tubes of multiple liquid manometer; it is concluded that pressures set up by bump are larger than those obtained in manoeuvring.

ALLOY STEEL

Silicon. Silicon as an Alloy in Steel, H. W. Gillett. Iron Age, vol. 118, no. 8, Aug. 19, 1926, pp. 481-482. German "Freund" steel compared with other steels of similar composition; effect of silicon, manganese and nickel; use for structural purposes.

Selection. Application of the Mathematics of Probability to Experimental Data as a Basis for Appropriate Choice of Ferrous Materials, B. D. Saklatwalla and H. T. Chandler. Am. Soc. Steel Treating—Trans., vol. 10, no. 2, Aug. 1926, pp. 195-205 and (discussion) 205-213, 12 figs. Authors suggest method of reasoning which should be of practical value in solving problem of selecting most suitable alloy steel; law of error and law of frequency are considered; probability curves are given in which Brinell hardnesses are plotted against frequency number of castings in foundry practice.

ALLOYS

Boron. Analysis of Boron Alloys, N. Tschischewski. Indus. & Eng. Chem., vol. 18, no. 6, June 1926, pp. 607-608, 2 figs. When alloys of boron with iron or other metals are dissolved in acids, boron is converted into boric acid; describes method of determination of this boric acid which gives exact results and is rapid.

ALUMINUM ALLOYS

Boron in. Boron in Aluminum and Aluminum Alloys (Le bore dans l'aluminium et les alliages d'aluminium), P. Haenni. Revue de Metallurgie, vol. 23, no. 4, June 1926, pp. 342-352, 9 figs. Preparation of a boron-aluminum alloy; study of the aluminum-boron diagram; micrography of aluminum-boron alloys; study of mechanical properties; corrosion of light alloys of boron.

Sand-Cast. Some Sand-Cast Alloys of Aluminum Containing Cobalt, S. Daniels. Indus. & Eng. Chem., vol. 18, no. 7, July 1926, pp. 686-691, 10 figs. There is no useful casting alloy in binary series containing up to 10 per cent of cobalt; addition of more than 0.5 per cent of this element increases solidification shrinkage greatly, and more than 1 per cent imparts crystalline fracture, whose coarseness is more pronounced as pouring temperature becomes necessarily high; corrosion testing indicated that alloys are superior to those in aluminum-copper series; cobalt carries over its peculiarities into ternary and more complex alloys.

APPRENTICES, TRAINING OF

Building Contractors. The Building Contractor and Apprenticeship. Am. Contractor, vol. 47, no. 30, July 24, 1926, pp. 18-19. Responsibility of promoting apprenticeship lies jointly with vocation school and building industry.

AUTOMOBILE ENGINES

Overhauling. Engine Overhauling in Fleet Maintenance, W. S. Penfield. Soc. Automotive Engrs.—Jl., vol. 19, no. 2, Aug. 1926, pp. 183-185. Author lists operations in their sequence as dismantling, cleaning, inspection, estimating, assembling, running-in, testing, and final inspection.

Power Losses. Engine Power Losses. Autocar, vol. 57, no. 1602, July 16, 1926, pp. 89-90, 2 figs. Ingenious testing plant designed to show how much engine power is absorbed internally by drawing moving parts.

AUTOMOBILE FUELS

Coal from. The Production of Gasoline Substitutes and Solvents, R. T. Elworthy. Gas Age-Rec., vol. 58, no. 5, July 31, 1926, pp. 137-138 and 146. Discusses three main groups of processes for obtaining substitute motor fuels from coal, namely: recovery of benzol, ethyl alcohol and light oils in either high- or low-temperature carbonization processes; conversion of certain types of coals into oils by hydrogenation at high pressures by Bergius process; gasification of coal and subsequent conversion of gases to liquids by Badische, Fisher, or Patart process.

Volatility. Volatility Tests for Automobile Fuels, T. S. Sligh, Jr. Soc. Automotive Engrs.—Jl., vol. 19, no. 2, Aug. 1926, pp. 151-161, 11 figs. Review of previous methods of arriving at fuel volatility; new method is equilibrium distillation of fuel in presence of known weight of air; fuel is supplied at predetermined rate by displacement from reservoir by fall of clock-controlled cylinder, and flows into long metal helix immersed in bath at temperature of test; data for five fuels of varied characteristics.

AUTOMOBILES

Brakes. The B.K. Vacuum Brake. Motor Transport, vol. 43, no. 1, 113, July 12, 1926, pp. 61-62, 2 figs. Description of B.K. booster brake; quick action is obtained by destroying instead of creating vacuum in operating cylinder.

Front Axles. Designing Front Axle Ends to Support Braking Stresses, P. M. Heldt. Automotive Industries, vol. 55, no. 6, Aug. 5, 1926, pp. 212-216, 7 figs. Ordinary front axle has not sufficient torsional rigidity to resist stresses imposed by application of front-wheel brakes and solid section is advocated instead of I-section.

Steering Mechanisms. Duplicate Steering. Autocar, vol. 57, no. 1602, July 16, 1926, pp. 108-109, 2 figs. Novel layout which is claimed to prevent "shimmy" being set up by wheel wobble.

AVIATION

Aerial Navigation. Aerial Navigation, B. Jones. Soc. Automotive Engrs.—Jl., vol. 19, no. 2, Aug. 1926, pp. 162-164. Points out that navigation is of prime importance in aircraft operation, as it implies flying most direct course and selecting altitude that has most favourable meteorological conditions; points out some peculiarities of navigation on polar flights in spring of 1926; how ship and airplane drift differs.

B

BEARINGS

High-Speed. Design of High-Speed Bearings, C. R. Alden. Abrasive Industries, vol. 7, no. 8, Aug. 1926, pp. 251-253, 6 figs. Internal grinding spindles, operated at high rotative speeds, call for extremely accurate anti-friction bearings.

BEARINGS, BALL

SINGLE-ROW. The Design of Single-Row Ball Bearings, A. Palmgren. Engineering, vol. 122, no. 3159, July 30, 1926, pp. 127-129, p figs. Discusses two types of groove bearings, both developed from Stribeck type, but which present different features; one is provided with filling slot in order to facilitate fitting of largest possible number of balls, whereas other has no filling slot and thus operates with reduced number of balls; results of calculations show clearly that bearing without filling slot (and which, on account of this fact, operates with reduced number of balls) is in no way inferior, but in several respects superior to bearing type with largest number of balls and filling slot.

BELTING

CONVEYOR. Conveyor Belting in Production of Silica Sand, R. A. Goodwin. Belting, vol. 29, no. 1, July 1926, pp. 19-21, 3 figs. Rubber belting with heavy cover is found most economical for handling materials of this kind.

SELECTION. The Choice of Belting. Power Engr., vol. 21, no. 245, Aug. 1926, pp. 296-297. Survey of belting characteristics and requirements; author concludes that leather is most satisfactory belting.

VELOCITY, STUDY OF. Experimental Methods for Investigating the Working of Belts (Sur une méthode expérimentale d'étude du fonctionnement des courroies). R. Swyngedauw. Académie des Sciences—Comptes Rendus, vol. 182, no. 7, Feb. 15, 1926, pp. 441-443. Each element of a belt when running is subjected to variations of length which are related to acting tensions; author describes two stroboscopic methods for study of belt velocity at any particular point: (1) Based on comparison of speed of point of belt with that of pulley; (2) by direct measurement of difference of speeds at extremities of given arc on belt.

BOILER FEEDWATER

TREATMENT. Feed Water Treatment and Continuous Sludge Removal. Eng. & Boiler House Rev., vol. 40, no. 2, Aug. 1926, pp. 76-80, 4 figs. Details of continuous sludge and return device.

The Prevention of Boiler Corrosion. Eng. & Boiler House Rev., vol. 40, no. 2, Aug. 1926, pp. 70-75, 3 figs. Considers problems involved in preparing feedwater for boiler after it has been freed from its solid content; experience of G. & J. Weir, who have made special study of this aspect of feedwater problem.

BOILER FURNACES

ADDITIONAL DIRECT-HEATING SURFACE. Does Additional Direct-Heating Surface Pay? J. G. Coutant. Combustion, vol. 15, no. 2, Aug. 1926, pp. 106-107, 2 figs. Demonstrates economical features of additional direct-heating surface.

TRAVELLING-GRATE STOKERS FOR. Furnace Design for Travelling-Grate Stokers, H. S. Colby. Power Plant Eng., vol. 30, nos. 5, 6 and 7, Mar. 1, 15 and Apr. 1, 1926, pp. 313-316, 365-366 and 412-415, 9 figs. Present application of arches is due to forced draft, increasing demands for higher ratings and use of special fuel sizes. Points out that when burning fine sizes of anthracite or coke breeze, length and slope of rear arch are of prime importance.

WATER-WALL AND WELL TYPE. Water-Wall and Well Type Furnaces. A. A. Fette. Nat. Engr., vol. 30, no. 8, Aug. 1926, pp. 351-355, 3 figs. Design details, principles of operation and applications of water-wall furnaces; performance records and test results in actual practice; principle of operation of well-type furnaces and performance records in recent installations.

BOILER PLATE

CRACKS IN SEAMS. Intercrystalline Cracks in Rivetted Seams, H. Kriegsheim. Power, vol. 64, no. 7, Aug. 17, 1926, p. 261. Author maintains that intercrystalline cracks in boiler seams are fully explained by action of prolonged high total stresses, and that high internal stress, when present, is due to unsuitable mechanical or thermal treatment of material during manufacture or operation.

BOILERS

CORROSION. The Problem of Steam Boiler Corrosion, F. N. Speller. Am. Water Works Assn.—Jl., vol. 16, no. 1, July 1926, pp. 72-95, 2 figs. Mechanism of corrosion; important factors in boiler corrosion; feedwater in general; dissolved oxygen; carbon dioxide; influence of scale; organic matter; influence of composition of materials of construction; preventive measures.

ELECTRICALLY HEATED. Modern Designs of Electrode Steam Boilers, Zeulmann. Eng. Progress, vol. 7, no. 7, July 1926, pp. 174-176, 9 figs. Principal characteristics of individual types.

FRENCH CODE. Regulations for Steam Boilers Other Than Those Used Aboard Ship (Règlement sur les appareils à vapeur autres que ceux placés à bord des bateaux), Monzie. Assns. Françaises de Propriétaires d'Appareils à Vapeur—Bul., no. 24, Apr. 1926, pp. 81-84. Text of new law of April 2nd, 1926, regulating use, construction and test of steam boilers used on land; also explanatory report to French President.

SCALE PREVENTION. Preventing Hard Scale and Corrosion in Boilers, E. C. Chamberlain. Combustion, vol. 15, no. 2, Aug. 1926, pp. 101-103. Ferro-Chem process, which has been in successful use on small scale for 15 years in California, has been improved and developed and is now applied commercially in boiler room.

BOLTS

HEAT-TREATED. Heat-Treated Bolts, O. D. North. Automobile Engr., vol. 15, no. 217, July 1926, pp. 252-253. Factors influencing application; manufacture; material.

STANDARD. Basis for Determining the Proportions of Standard T-Slots and Bolts, L. D. Burlingame. Mech. Eng., vol. 48, no. 8, Aug. 1926, pp. 838-842, 7 figs. Tests conducted to ascertain comparative strength of bolts and slots in order that proportions submitted might be suited to practical needs.

BONUS SYSTEMS.

MAINTENANCE WORK. Applying a Bonus Plan to Maintenance Work, R. M. Hidey and H. Hylkema. Indus. Engr., vol. 84, no. 8, Aug. 1926, pp. 345-349, 6 figs. System employed by White Motor Co., Cleveland, Ohio.

BORING MACHINES

SCREW-CUTTING. Screw-Cutting on the Horizontal Boring Machine, H. C. Town. Machy. (Lond.), vol. 28, no. 721, Aug. 5, 1926, pp. 521-522, 5 figs. Describes three screw-cutting attachments.

BRAKES

ELECTRIC TRACK. Electric Track Brake for Gravity Switching in France. Eng. News-Rec., vol. 97, no. 6, Aug. 5, 1926, pp. 226-227, 3 figs. Sliding skates placed on rails by power devices check freight cars entering classification tracks.

MAGNETIC. Emergency Stopping Distance Decreased 22.5 to 46 Per Cent. Elec. Ry. Jl., vol. 68, no. 3, July 17, 1926, pp. 96-100, 6 figs. By using magnetic track brakes to supplement air brakes on its interurban cars, the Buffalo & Erie Railway increases retardation materially, makes braking effective regardless of rail conditions, permits higher maximum speed and reduces front-end accidents.

BRASS FOUNDRIES

CONVEYOR SYSTEM. Brass Shop Uses Conveyors, E. C. Barringer. Foundry, vol. 54, no. 13, July 1, 1926, pp. 517-519, 4 figs. Details of conveyor and sand-handling equipment.

BRIDGE ERECTION

MATERIALS HANDLING. Burlington Systematizes Handling of Its Bridge Materials. Ry. Eng. & Maintenance, vol. 22, no. 8, Aug. 1926, pp. 308-311, 4 figs. More careful programming insures better use of equipment and reduces cost.

BRIDGES, CONCRETE

GIRDER. Concrete Girder Bridge Has Steel Pin Bearings. Eng. News-Rec., vol. 97, no. 4, July 22, 1926, p. 135, 2 figs. Pin bearings were provided under concrete girders of Mitchell Ave. bridge, in Cincinnati, Ohio, to insure uniform bearing of spans in event of slight settlement of substructure.

BRIDGES, HIGHWAY

LOADS. Loads on Highway Bridges. Can. Engr., vol. 51, no. 5, Aug. 3, 1926, p. 189. Abstract of revised report of official joint committee of three engineering institutes in London.

BRIDGES, MOVABLE

ELECTRICALLY-OPERATED. Electrically-Operated Movable Railroad and Highway Bridges, H. Johnston. Elec. Jl., vol. 23, no. 7, July 1926, pp. 385-389, 7 figs. Main motors; brakes; bridge lock-motor; control, control operation; types of movable bridges.

BRONZES

STATUARY AND ART. Statuary and Art Bronzes. Metal Industry (N.Y.), vol. 24, no. 8, Aug. 1926, pp. 315-317, 9 figs. Describes work of bronze foundries of J. Williams, Inc., New York; main business of company is casting and finishing of bronze statuary, architectural work and tablets; plant includes foundry, molding, melting, pattern, chasing fitting, finishing, brazing, colouring and lacquering departments.

BUILDING CONSTRUCTION

REINFORCED CONCRETE. Van Gilder Form System Used on Plant. Am. Contractor, vol. 47, no. 30, July 24, 1926, pp. 15, 2 figs. Method can be used on double wall structures when openings between walls are only two inches in width.

BUILDINGS

STEEL-FRAME. Steel-Frame Office Building with 555½-ft. Tower. Eng. News-Rec., vol. 97, no. 8, Aug. 19, 1926, pp. 286-290, 7 figs. Girder framing and novel wind bracing connections in 20-storey structure at Columbus, Ohio, with 47-storey tower; spandrel girders; portal bracing at high entrance archways.

C

CABLES, ELECTRIC

PAPER-INSULATED. Accuracy Required in the Measurement, C. F. Hanson. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 8, Aug. 1926, pp. 719-725, 6 figs. Deals with effect of errors in measurement of power factor upon usefulness of impregnated paper-insulated cables.

CARBON MONOXIDE

COMBUSTION OF. The Combustion of Carbonic Oxide. Gas World, vol. 85, no. 2188, July 10, 1926, pp. 34-38, 7 figs. Spectrographic investigations; effect of progressive drying; theroics proved by experiment; explosion of rigidly dried mixtures of carbon monoxide and oxygen; experiments showing influence of pressure.

CAST IRON

CARBON IN. Determining Carbon in Cast Iron, J. T. MacKenzie. Iron Age, vol. 118, no. 7, Aug. 12, 1926, pp. 415-416, 1 fig. Simplified combustion train found satisfactory for routine analyses in laboratory of large cast-iron pipe foundry.

HIGH-STRENGTH. Production of High-Strength Cast Iron, Gilles. Foundry Trade Jl., vol. 34, no. 518, July 22, 1926, pp. 70-73 and (discussion) 73-75, 1 fig. Melting facilities, electric-furnace iron; pearlitic iron; Emmel's results; Wuest cupola and high tensiles; value of superheating; producing low carbon; treating coke for retarding combustion. Translated from Giesserei-Zeitung.

METALLURGY. Improving Cast Iron as Shown by Tests, J. R. Hyde. Foundry Trade Jl., vol. 34, no. 517, July 15, 1926, pp. 53-56. Experiments made during fairly extensive period in endeavour to produce improved and regular commercial cast iron.

PEARLITIC. Grey Iron Castings for Special Needs, H. J. Young. Foundry Trade Jl., vol. 34, no. 520, Aug. 5, 1926, pp. 117-121, 9 figs. Latest practice in cast iron and summary of present position; it has been demonstrated to satisfaction of author that Perlit procedure is applicable to all classes of foundry practice, and that success depends upon skill of moulder and metallurgist in same degree as it attends manufacture of castings of all other alloys and of steel. (Abstract.) Paper presented before West of Scotland Iron & Steel Inst.

SHRINKAGE. Metal Shrinkage, J. H. List. Foundry Trade Jl., vol. 34, no. 519, July 29, 1926, p. 100, 3 figs. Discusses methods employed to overcome fluid shrinkage, and tests made with object of preventing this shrinkage in large shaft couplings by means of chills and densers; describes one method whereby good castings, despite this shrinkage trouble, can be produced.

CASTINGS

HYDRAULIC RUNNERS. Canadian Foundry Makes Large Hydraulic Runner. Foundry, vol. 54, no. 15, Aug. 1, 1926, pp. 601 and 610, 3 figs. Methods employed at plant of National Bronze Co., Montreal, in casting hydraulic runner 4 ft. in diameter and 3 ft. high; it has 19 blades and weighs 4,500 lb.; casting is made of special manganese bronze.

TESTING. The Testing of Castings. Metallurgist (Supp. to Engineer, vol. 142, no. 3681), July 30, 1926, pp. 98-99. Discusses difficulties which surround satisfactory testing, and therefore drafting of sound specifications; production and use of test bars; if test bar is cooled at rate that differs widely from that occurring in casting itself, then sound test bar affords no guarantee of an equally sound casting.

CEMENT, PORTLAND

SODIUM AND MAGNESIUM SULPHATES, EFFECT OF. Action of Sodium and Magnesium Sulphates on Portland Cement, G. R. Shelton. Indus & Eng. Chem., vol. 18, no. 8, Aug. 1926, pp. 854-856, 2 figs. Investigation to determine difference in sulphate action on Portland cement clinker and on its compounds taken separately.

SULPHUR, EFFECT OF. Portland Cement, High Sulphur Content, F. C. Lea. Can. Engr., vol. 51, no. 2, July 13, 1926, pp. 133-134. Experiments on effect of sulphur on Portland cement; results tabulated from experiments of five types of specimens.

CENTRAL STATIONS

CLEVELAND, OHIO. Features of Avon Station. Elec. World, vol. 88, no. 6, Aug. 7, 1926, pp. 260-272, 20 figs. New plant of Cleveland Elec. Illuminating Co. operates on regenerative cycle, using pulverized fuel exclusively; reliability, simplicity and safety predominate in electrical and mechanical design.

DIESEL-ENGINED. Diesel Makes Ideal Steam Plant Standby, C. C. Hermann. Power Plant Eng., vol. 30, no. 16, Aug. 15, 1926, p. 900, 1 fig. Even with heating load thermal efficiency will often outweight other disadvantages; details of 750-hp. McIntosh & Seymour Diesel in municipal plant of Cedar Falls, Iowa.

INTERCONNECTION. Economies of System Interconnection, H. V. Bozell. Elec. World, vol. 88, no. 6, Aug. 7, 1926, pp. 273-275. A few examples of interconnection in electric light and power industry reduced to dollars-and-cents results.

CHAIN DRIVE

SPROCKETS. The Manufacture of Sprockets for Chains (La fabrication des pignons pour chaines). Pratique des Industries Mécaniques, vol. 9, no. 4, July 1926, pp. 140-144, 14 figs. Methods of designing sprockets for use with roller and silent chain, and of cutting teeth on same.

CHROMIUM

ALLOY. Chromium Alloys Resist Chemicals, C. E. MacQuigg. Iron Age, vol. 118, no. 7, Aug. 12, 1926, pp. 416-418, 1 fig. Use in chemical apparatus; how chromium acts in creating resistivity; proper precautions in welding. Paper read before Am. Inst. Chem. Engrs.

CIRCUIT-BREAKERS

AIR. Rupturing Circuits with Air Breakers. Elec. News, vol. 35, no. 15, Aug. 1, 1926, pp. 31-32, 2 figs. Recent tests show good performance at 250 and 500 volts; effect of short-circuits on breakers; conclusions favourable to ratings; ultimate safe ratings determined.

COAL

CARBONIZATION. The Carbonization of Coal, J. Roberts. Combustion, vol. 15, no. 2, Aug. 1926, pp. 98-100. Combustion of anthracite and of coke; coal by-products; waste of volatile products; natural fuels.

Carbonization of Coal in Continuous Vertical Retorts. Colliery Guardian, vol. 132, no. 3420, July 16, 1926, pp. 131-132. Report of Fuel Research Board.

The Low-Temperature Carbonization of Coal, A. C. Fieldner. Fuel, vol. 5, no. 6, June 1926, pp. 265-271, 10 figs.

Some Problems in the Carbonization Industries, H. M. Spiers and T. C. Finlayson. Indus. Chemist, vol. 2, no. 18, July 1926, pp. 315-318, 2 figs.

Vertical Retort for Low-Temperature Carbonization. Fuels & Furnaces, vol. 4, no. 8, Aug. 1926, pp. 915-916, 3 figs. Experimental plant for low-temperature carbonization of lignite developed by Coal Improvement Co., Germany; new carbonizing furnace is rotating vertical retort.

CONSTITUTION. The Constitution of Coal, S. W. Parr. Indus. Eng. & Chem., vol. 18, no. 6, June 1926, pp. 640-648, 23 figs. With special reference to problems or carbonization.

EVALUATION. Evaluation and Metallurgical Coals, R. H. Sweetser. Min. & Met., vol. 7, no. 236, Aug. 1926, pp. 337-339. Author seeks to find acceptable, workable method for accurately determining value of metallurgical coals containing varying percentages of ash, moisture, sulphur and carbon.

FUSION. The Transient Fusion of Coal, E. Audibert. Fuel, vol. 5, no. 6, June 1926, pp. 229-244, 18 figs. To be suitable for use in blast furnace, coke must possess mechanical strength, which necessitates: (1) that all its component parts are sufficiently strong, (2) that structure is compact and not too spongy, (3) that mass does not have too many fissures; researches show nature and mode of action of factors determining inherent strength of coke. Translated from Revue de l'Industrie Minérale.

COAL DEPOSITS

NOVA SCOTIA. The Characteristics and Utilization of Nova Scotia Coals, W. S. Wilson and M. W. Booth. Eng. Jl., vol. 9, no. 8, Aug. 1926, pp. 373-385, 8 figs. Extent of coal fields, outstanding characteristics of coals, and discussion of their utilization.

COAL HANDLING

EQUIPMENT. Economic Fuel Handling and Storage, W. T. Conlon. Mfg. Industries, vol. 12, no. 2, Aug. 1926, pp. 97-100, 5 figs. Equipment and methods that have saved money and prevented low grading and fires.

PLANTS. New Coal-Handling Plant at Beckton. Engineer, vol. 142, no. 3679, July 1926, pp. 69-71, 4 figs. Combined equipment of cranes and conveyors, which will be capable of dealing with 2,000 tons of coal per hour, is claimed to be largest installation of its kind in Europe. See also Engineering, vol. 122, no. 3158, July 23, 1926, pp. 103-105, 4 figs.

COAL MINES

ROOF CONTROL. Recent Developments in Roof Control, W. C. Stratton. Min. Congress Jl., vol. 12, no. 8, Aug. 1926, pp. 584 and 599. Author is led to believe that ultimate safety and economy will be obtained by roof-control instrument, sufficiently rugged in construction that it will be capable of use over comparatively long period, and will be designed for advance by mechanical power.

COAL STORAGE

SPONTANEOUS COMBUSTION. Does Carbon Dioxide Set Fire to Coal Storage Piles? H. G. Turner and E. Sinkinson. Coal Age, vol. 30, no. 5, July 29, 1926, pp. 139-140, 3 figs.

COKE

POWDERED SEMI-COKE. Some Tests on Powdered Semi-Coke for Boiler Firing. Eng. & Boiler House Rev., vol. 40, no. 2, Aug. 1926, pp. 65-66, 2 figs. Results of tests carried out on water-tube boiler fired with semi-coke in powdered form.

Coke Quenching and Handling, C. F. Ellwood. Iron & Coal Trades Rev., vol. 113, no. 3044, July 2, 1926, pp. 14-15, 7 figs. Methods of quenching; inclined bench; inclined bench and conveyor.

COKE OVENS

GAS REGULATION. Gas is Regulated Automatically, E. X. Schmidt. Iron Trade Rev., vol. 79, no. 8, Aug. 19, 1926, pp. 441-444, 4 figs. Calorimeter of recent design affords continuous record of heating value and reduces labour of maintaining desirable flow of potential heat in by-product oven practice; manipulation is described.

MULTI-FLAME. The "Still" Multi-Flame Coke Oven, H. Kuhn. Iron & Coal Trades Rev., vol. 113, no. 3045, July 9, 1926, pp. 50-53, 7 figs.

COLD STORAGE

EUROPEAN PLANTS. European Cold Stores at North Sea Ports. Cold Storage, vol. 29, no. 340, July 15, 1926, pp. 298-300, 5 figs. Plants at Hook of Holland and at Bremerhaven.

COMPRESSED AIR

SHIPYARDS. Shipyard Pneumatic Plant, J. A. Cromar. Shipbldg. & Shipg. Rec., vol. 28, no. 3, July 15, 1926, p. 67, 1 fig. Suggested method of control to minimize waste of air.

CONCRETE

PROPORTIONING. Concrete Strength Made Uniform by Careful Proportioning, Z. Witkin. Eng. News-Rec., vol. 97, no. 7, Aug. 12, 1926, pp. 258-259, 1 fig. Comparisons in California building between ordinary volumetric measurement, weight measurement and inundation method.

WATER-CEMENT RATIO. Proportioning Concrete by Water-Cement Ratio, W. C. Mabee. Mun. & County Eng., vol. 71, no. 1, July 1926, pp. 32-35. Outline of method of calculating ideal proportions for any job, which has been simplified until it calls for only little study and very little arithmetic. Paper presented to Am. Water Works Assn.

CONDENSERS, ELECTRIC

SPHERICAL. The Problem of the Spherical Condenser, A. Russell. Instn. Elec. Engrs.—Jl., vol. 64, no. 355, July 1926, pp. 727-736, 6 figs. Methods given of computing to any desired accuracy capacity of spherical condenser when bounding spherical surfaces are not concentric.

CONDUITS

UNDERGROUND. Underground Conduit and Manhole Construction. Elec. News, vol. 35, no. 15, Aug. 1, 1926, pp. 29-30 and 33, 1 fig. Higher voltages and concentration of larger amounts of power in single cable; wider separation at duct entrances; round manhole covers favoured.

CONVERTERS

FREQUENCY. A 49,000-Kva. Frequency Converter Set, A. McCarty. Elec. Jl., vol. 23, no. 7, July 1926, pp. 338-341, 6 figs. Development of growth in size; description of machine.

CUPOLAS

CHEMISTRY. Some Notes on Chemistry of the Cupola, F. C. Thompson and M. L. Becker. Metal Industry (Lond.), vol. 29, nos. 3, 4 and 5, July 16, 23 and 30, 1926, pp. 65-66, 86-87 and 111-112, 4 figs. Points out that only possible sources of economy lie in heat actual or potential lost in gases, about one-half of all heat which could be generated by coke, and slight gain by use of burnt lime; reactivity of coke; addition of further air through auxiliary tuyeres.

CORES

MAKING. Produce Cores by Thousands with Watch-Making Accuracy, P. Dwyer. Foundry, vol. 54, no. 16, Aug. 15, 1926, pp. 638-642, 7 figs. Coremaking facilities and equipment installed in Central Foundry of Saginaw Products Co., Saginaw, Mich.

COST ACCOUNTING

FORGE SHOP. Forge Shop Production; Cost Accounting, F. S. Hatch. Forging—Stamping—Heat Treating, vol. 12, no. 7, July 1926, pp. 235-238. Enthusiastic organization with confidence in management is essential to high production; carefully-planned cost system is invaluable.

CUPOLAS

OPERATION. Operating the Cupola Efficiently, R. Micks. Can. Foundryman, vol. 17, no. 7, July 1926, pp. 7-9. Lining cupola; charging; location of slag hole; melting losses of metal; mixing of iron a factor in production.

SHAKING HEARTH. Jigger Hearth for Cast Iron, C. Irresberger. Foundry Trade Jl., vol. 34, no. 518, July 22, 1926, pp. 64-65, 1 fig. Describes hearth developed by J. Dechesne; efforts to desulphurize cast iron suggested idea of trying to effect this by jigging and shaking freshly tapped metal; characteristic of effects of jigging is possibility of very liberal steel additions without endangering casting capabilities owing to viscousness, without risk of piping and without tendency to white solidification. Translated from Stahl u. Eisen, June 30, 1926. See also Iron Age, vol. 118, no. 7, Aug. 12, 1926, pp. 413-414, 2 figs.

CUTTING METALS

ART OF. Advantages of Improving the Metal and Shape of Cutting Edge of Tools (Die Vorteile der Verbesserung des Stoffes und der Scheidenform beim Werkzeug), W. Hippler. Maschinenbau, special no., 1926, pp. 7-12, 11 figs. Examines question as to whether it is more advantageous to improve quality of metal of tool or shape of cutting edge and concludes that in neither direction is there much room for improvement.

Effect of Shape of Chip-Profile on Generation of Heat and Wear of Cutting Edge (Einfluss der Gestalt des Spanquerschnittes auf die Wärmeentwicklung und die Schneidhaltigkeit), G. Engel. Maschinenbau, special no., 1926, pp. 32-42, 27 figs. Discusses Freidrich equation and its deviation for practical cutting speeds; formulates heat generated, etc., shape of chip and heat generation, effect of size of chip profile on wear of cutting edge, determination of economic cutting speeds.

TURNING. Maximum Efficiency in Lathe Work (Höchstleistung beim Drehen), E. Baltz. Maschinenbau, special no., 1926, pp. 12-20, 12 figs. Shows that by cooling tool greater efficiency and cutting speed result, compared with dry cutting; use of lathes with gear cases and normal feeds and special drive with motor regulatable in ratio of 1:25.

Research and Practice with Cutting Tools (Forschung und Praxis in der Zerspanung), K. Hegner. Maschinenbau, special no., 1926, pp. 1-3, 1 fig. Discusses formulation of fundamental laws and their application in practice; gives AWF table enabling calculation of load for tool steel of given quality, hardness and shape, and details of lathe.

D

DIESEL ENGINES

AIRLESS-INJECTION. New Airless-Injection Diesel with Displacer Piston. Oil Engine Power, vol. 5, no. 8, Aug. 1926, pp. 486-487, 3 figs. 4-cycle machine of small bore and high speed.

EXHAUST GASES. Diesel Exhaust Gives Valuable Information. Power Plant Eng., vol. 30, no. 16, Aug. 15, 1926, p. 901, 2 figs. Conclusions regarding influence of load, speed, fuel, cooling-water temperature and irregularities in engine operation upon temperature and CO_2 content of exhaust, based on tests of horizontal, two-cylinder, four-cycle, belt-drive, Koerting solid-injection engine. Translated from Wärmewirtschaft, Mar. 1926.

FOOS. Higher Speed Range for New Engine Model. Oil Engine Power, vol. 5, no. 8, Aug. 1926, pp. 472-476, 5 figs. Engine develops 50 hp. per cylinder and runs up to 900 r.p.m.; complete enclosure without exterior moving parts.

HEAVY-OIL-BURNING. Burning Heavy Fuel Oil in Diesel Engines, R. Hilderbrand. South. Power Jl., vol. 44, no. 7, July 1926, pp. 56-56, 3 figs. Showing how heating system assisted in solving problem when used in connection with small engine.

LUBRICATION. Some Notes on Marine Lubrication, R. S. Robinson. Mar. Engr. & Motorship Bldr., vol. 49, no. 588, Aug. 1926, pp. 285-286, 1 fig. With particular reference to Diesel-engine lubricants and their purification.

TWO-CYCLE VS. FOUR-CYCLE. Two- and Four-Cycle Engines Compared. Motorship, vol. 11, no. 8, Aug. 1926, pp. 592-593. Comparison of year's operation of Japanese trans-Pacific motorships Atago Maru and Asuka Maru.

DRAINAGE

BELOW-SEWER LEVEL. Disposal of Below-Sewer-Level Drainage, R. M. Starbuck, Jr. Domestic Eng. (N.Y.), vol. 116, no. 5, July 31, 1926, pp. 24-26, 45 and 48, 14 figs. Discusses problem of taking care of sub-soil drainage and of large volumes of sewage produced in use of plumbing fixtures at this low level.

ROADBED. Increasing the Efficiency of Roadbed Drainage. Good Roads, vol. 69, no. 7, July 1926, pp. 261-264, 12 figs. New method of subdrainage with perforated iron pipe; its advantages and applications to highway and municipal work.

DREDGES

DIESEL-ELECTRIC. Electrical Equipment for a 30-inch Diesel-Electric Pipe-Line Dredge, R. W. McNeill. Elec. Jl., vol. 23, no. 8, Aug. 1926, pp. 403-407, 8 figs. Details of Clackamas, constructed by Port of Portland, known as 30-inch dredge, this being diameter of discharge pipe line.

DRILLING MACHINES

HOEFER. Repetition Drilling of Pistons. Automobile Engr., vol. 16, no. 217, July 1926, pp. 258-259, 3 figs. Description of three drilling machines made by Hoefer Mfg. Co., Freeport, Ill.

INVERTED-SPINDLE. Inverted-Spindle Drilling Machine. Machy. (Lond.), vol. 28, no. 720, July 29, 1926, pp. 490-491, 3 figs. Five-spindle machine developed by Selson Eng. Co., Coventry, for work requiring drilling of blind holes, such as float-chamber aperture in carburetor bodies.

MULTI-SPINDLE. Multi-Spindle Drilling. Brit. Machine Tool Eng., vol. 4, no. 40, July-Aug. 1926, pp. 453-458, 8 figs. Reviews contemporary practice in various machining operations, giving representative examples of drilling machines and attachments that have effected economies in production.

RADIAL. All-Geared Radial Drilling Machine. Engineer, vol. 142, no. 3681, July 30, 1926, pp. 122-123, 4 figs. Machine made by Midgley & Sutcliffe, Bradford, Eng.; features of particular interest are pillar about which radial arm rotates, eight-speed gear box and enclosed spindle head.

TYPES. Drilling and Honing Machines. West. Machy. World, vol. 17, no. 7, July 1926, pp. 305-308, 11 figs. Descriptions of various types.

DRILLS

TWIST. Making Milled Twist Drills, A. E. Granville. Can. Machy., vol. 36, no. 6, Aug. 5, 1926, pp. 19-21, 9 figs. Describes how either tool-steel or high-speed drills are made from round bar stock when flues are milled.

E

EDUCATION, ENGINEERING

AID TO INDUSTRY. Can the University Aid Industry? B. F. Bailey. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 8, Aug. 1926, pp. 742-745. Author believes there is growing spirit of co-operation between industry and university, and it is believed that this tendency to co-operate will continue and will be of great advantage to both parties.

EUROPE. The Engineering Scene, W. E. Wickenden. Mech. Eng., vol. 48, no. 8, Aug. 1926, pp. 794-796. Critical glance at technical education in Europe and how America may profit by it.

ELECTRIC CONDUCTORS

SHORT-CIRCUIT STRESSES IN SUPPORTS. Practical Calculation of Short-Circuit Stresses in Supports for Straight, Parallel Bar Conductors, O. R. Schurig, C. W. Frick and M. F. Sayre. Gen. Elec. Rev., vol. 29, no. 8, Aug. 1926, pp. 534-544, 8 figs. Formulas and curves for determining stresses; two-wire, three-phase line-to-neutral short circuits; also direct current; vibratory characteristics of busbars.

ELECTRIC CURRENTS

TRANSFORMATION. The Taylor Connection for Three-Phase to Two-Phase Transformation, J. B. Gibbs. Elec. Jl., vol. 23, no. 7, July 1926, pp. 341-343, 6 figs. Explanation of Taylor connection; calculation of currents.

ELECTRIC FIELD

MECHANICS OF. The Mechanics of the Electric Field, J. J. Thomson. Instn. Elec. Engrs.—Jl., vol. 64, no. 355, July 1926, pp. 721-726. Discusses whether equations of electrodynamics express statistical or particle dynamics.

ELECTRIC FURNACES

ANNEALING. Electric Annealing at Walworth Plant, J. L. Faden and J. D. McManus. Elec. World, vol. 88, no. 5, July 31, 1926, pp. 215-218, 7 figs. Wrench forgings treated in electric furnace at saving of $3 per ton; oil-fired equipment displaced; heating cycle cut down and improved; quality gains.

AUXILIARY EQUIPMENT. Auxiliary Equipment for Electric Furnaces, J. D. Keller. Fuels & Furnaces, vol. 4, nos. 1, 5, 6, 7 and 8, Jan., May, June, July and Aug. 1926, pp. 49-56, 541-548 and 566, 661-672, 789-794 and 832; 895-900 and 930, 68 figs. Jan.: Wiring diagrams, control and safety switches, relays and fuses, for resistor-type furnaces. May: Pyrometers and temperature records. June: Automatic temperature regulators. July: Control panels, meters and transformers. Aug.: Equipment for melting furnaces at resistance and arc types.

IRON-MELTING. Electric Furnace Melting of Grey Iron. Metallurgist (Supp. to Engineer, vol. 142, no. 3681), July 30, 1926, pp. 101-102. Review of article by E. Richards, in Stahl u. Eisen, Feb. 25, 1926, in which author deals with problem of high cost of production by electrical means, and goes into detail regarding desirable electric-furnace practice for this purpose.

RESISTANCE. Electric Resistance Furnaces, W. Y. Anderson. Elec. Rev., vol. 99, no. 2540, July 30, 1926, pp. 178-179, 2 figs. Tests of installation at Summer Lane, Birmingham, Eng., consisting of 60-kw. furnace, manufactured under Wild-Barfield patents.

ELECTRIC GENERATORS

COOLING. Systems for Cooling Electric Generators. Power Plant Eng., vol. 30, no. 16, Aug. 15, 1926, pp. 905-907, 1 fig. Among various systems developed and suggested, proposed use of hydrogen as cooling medium is most novel.

LOCATING FAULTS. Locating Faults in Direct-Current Machines, C. O. Mills. Power, vol. 64, no. 6, Aug. 10, 1926, pp. 195-197, 6 figs. Tells how wrong brush position causes sparking at commutator.

ELECTRIC GENERATORS, D.C.

PARALLEL OPERATION. Some Problems of Parallel Operation of Direct-Current Generators, I. C. Smith. Elec. Jl., vol. 23, no. 8, Aug. 1926, pp. 407-412, 18 figs. Describes situation when generators are connected in parallel at negative terminal when voltage characteristics, as measured between this point and positive terminal, are rising; remedy is to connect generators at point where voltage has drooping characteristic when load is taken from machines at that point.

THREE-WIRE. Control and Protection of Three-Wire Direct-Current Generators, W. A. Holland. Gen. Elec. Rev., vol. 29, no. 8, Aug. 1926, pp. 531-533, 3 figs. Overspeed protection; locations of devices and instruments in circuits; two types of control equipment; analysis of operation.

ELECTRIC MOTORS

MOUNTING AND INSTALLING. Mounting and Installing Industrial-Type Motors, G. Fox. Indus. Engr., vol. 84, no. 8, Aug. 1926, pp. 357-360 and 363, 16 figs. Methods of installation so as to secure accessibility, reduce vibration, and lower maintenance and repair costs; describes several types of supports and relative merits, etc.

RATING. Rating of Industrial Motors, C. L. Collens. Elec. World, vol. 88, no. 7, Aug. 14, 1926, pp. 317-318. Cannot be divorced from service conditions; industry requires infinite variety of duty cycles and affords multitude of service conditions; usual service conditions normal basic rating.

TRACTION. Characteristics of Generators and Motors for Gas-Electric Traction, C. A. Atwell. Elec. Jl., vol. 23, no. 7, July 1926, pp. 363-366, 9 figs. Use of electric transmission to eliminate gear reductions; principles of electric transmission.

ELECTRIC MOTORS, A.C.

CROSS-FIELD THEORY. The Cross-Field Theory of Alternating-Current Machines, H. R. West. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 2, Feb. 1926, pp. 160-165, 5 figs. Shows how analysis by cross-field theory may be used to obtain accurate, purely numerical methods of calculating performance characteristics of a.c. machines; methods of calculation are derived and sample calculations are given for single-phase induction motor and repulsion motor.

INDUCTION. Design Problems in Flat-Front Induction Motors, A. W. Forbes. Elec. World, vol. 88, no. 6, Aug. 7, 1926, pp. 278-279, 7 figs. Deals with induction motors with shaft close to one side of frame; problem is to secure uniformly rotating field with irregularly distributed windings.

Characteristics of Induction Motors on A.C. Networks, R. G. Warner. Elec. World, vol. 88, no. 7, Aug. 14, 1926, pp. 324-325, 5 figs. Curves showing changes in characteristics when 220-volt motors are operated at network voltages; heating limitation not so serious as decreased starting and breakdown torque.

The Effect of the Number of Poles on the Power-Factor of Induction Motors, F. L. Moon. Elec. Jl., vol. 23, no. 8, Aug. 1926, pp. 428-431, 15 figs. Induction motor having small number of poles has relatively high power-factor, while one with many poles has relatively low power-factor; author discusses underlying reasons for this condition.

SQUIRREL-CAGE. Starting Characteristics and Control of Polyphase Squirrel-Cage Induction Motors, H. M. Norman. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 2, Feb. 1926, pp. 153-159, 7 figs. Considers part that primary and secondary resistance and total reactance play in determination and manipulation of starting losses, and to value of secondary resistance that will give minimum starting time for given field strength; shows how proceeding short-cut method can for most cases be made more simple without sacrificing accuracy of result to any appreciable extent.

ELECTRIC TRANSMISSION LINES

CALCULATION. Simplification of Line Calculations, C. Morrison. Elec. World, vol. 88, no. 2, July 10, 1926, pp. 72-73, 3 figs. Extended Mershon chart used to arrive at power loss values; methods for short-cutting calculations.

INTERCONNECTION. Some Economic and Social Aspects of Interconnection, W. E. Creed. Nat. Elec. Light Assn.—Bul., vol. 13, no. 7, July 1926, pp. 409-413. United States far in lead; California proving ground; centralization checked; industry profits by change; city comforts in country; farm motors never idle.

SAFETY AND CONSTRUCTION STANDARDS. Safety and Construction Standards for Transmission Lines, J. S. Martin. Engrs'. Soc. of West Pa.—Proc., vol. 42, no. 4, May 1926, pp. 185-195, 2 figs. Sizes and type of wire; proper spacing; critical span; clearances; clamps; splices; clevices; insulators; foundations.

SYSTEM STABILITY. Practical Aspects of System Stability, R. Wilkins. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 2, Feb. 1926, pp. 142-151, 21 figs. Results of field tests of 220-kv. system establishing following facts: system stability as problem is inextricably entangled with operating economics, and cannot be handled solely as problem in design, except for very simple cases; proper relay equipment and action is vital; oil-switch operation is important factor; operating distribution of excitation current is one of major problems.

TOWERS. Safety in Tower-Line Construction, H. S. Brubaker. Nat. Elec. Light Assn.—Bul., vol. 13, no. 7, July 1926, pp. 459-461, 8 figs. Digging holes; careful selection of men.

UNDERGROUND. Underground Electric Transmission. Power Plant Eng., vol. 30, no. 15, Aug. 1, 1926, pp. 848-850, 3 figs. Internal ionization theory points way to design of high-voltage underground cable.

ELECTRIC WELDING

ARC STABILITY. Factors Affecting Arc Stability, J. B. Green. Welding Engr., vol. 11, no. 7, July 1926, pp. 25-27 and 35, 3 figs. Study of metallic electric arc, indicating importance of electrode material as affecting welding operation.

PIPE. Making Electrically-Welded Pipe for East Bay Conduit. Eng. News-Rec., vol. 97, no. 4, July 22, 1926, pp. 128-131, 7 figs. Shop methods worked out successfully for making up and testing 65-in. pipe, using steel plates ½-in. thick; welding, testing, dipping and wrapping operations.

ELECTRIC WELDING, ARC

COMMERCIAL APPLICATION. Commercial Arc Welding Applications, W. L. Warner. Iron Age, vol. 118, no. 7, Aug. 12, 1926, pp. 421-422, 6 figs. Application to gas-holders, piping in large sizes, purifiers for gas, details of construction, doors and blast gates handled.

ELECTRICAL APPARATUS

SUPERVISORY CONTROL. Supervisory Systems for Electric Power Apparatus, C. Lichtenberg. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 2, Feb. 1926, pp. 116-123, 12 figs. Survey of various types of supervisory systems for control and indication of remotely-located electrical apparatus; describes selector, distributor, audible, code-visual, synchronous-relay-visual and carrier-current systems, with principles and features of each; deals also with telemetering.

ELECTRICAL EQUIPMENT

INVISIBLE HAZARDS. Guarding Against the Invisible Hazards of Electrical Installations, W. Greenwood. Iron & Steel Engr., vol. 3, no. 7, July 1926, pp. 336-338. Points out that hazard connected with operating electrical equipment by persons not authorized, even though they may be qualified, should not be underestimated; hazard connected with grounding in disconnecting wires from electrically-saturated equipment, etc.

ELECTRICAL MACHINERY

PHASE ADVANCERS. A New Phase Advancer. Engineer, vol. 142, no. 3679, July 16, 1926, p. 71, 1 fig. Machine made by Metropolitan Vickers Electrical Co. is claimed to combine many operating characteristics unobtainable with other types of phase advancers, whereas simplicity results in low initial cost and minimum maintenance expenses.

RATINGS. The Ratings of Electrical Machines as Affected by Altitude, C. J. Fechheimer. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 2, Feb. 1926, pp. 124-130, 6 figs. Presents equations applicable to machines cooled by forced air connection currents; considers effect of altitude from two standpoints, namely, change in temperature rise, rating remaining the same, or change in rating, temperature rise at given altitude equalling that of sea-level. See discussion in no. 8, Aug. 1926, pp. 763-766, 2 figs.

ELECTROMAGNETIC FIELDS

MAPPING. Mapping Magnetic and Electrostatic Fields, A. D. Moore. Elec. Jl., vol. 23, no. 7, July 1926, pp. 355-362, 24 figs. Rectilinear fields; two-dimensional fields; curvilinear squares; corner-flux principles; special problems; division of m.m.f.; calculations on two dimensional field maps.

ELEVATORS

SAFETY DEVICES. Safety Devices of Elevators and Lifts (Dispositifs de Securité dans les ascenseurs et monte-charges), G. Baignères. Société des Ingénieurs Civils de France Mémoires et Compte Rendu des Travaux, vol. 79, no. 3-4, 1926, pp. 71-110, 37 figs.

EXPLOSIVES

SAFETY IN HANDLING. Safety and Economy in Handling Explosives, J. E. Tiffany. Min. Congress Jl., vol. 12, no. 8, Aug. 1926, pp. 593-597, 5 figs. Bureau of Mines recommends that coal be mined exclusively with permissible explosives, fired electrically, and that as aid to blasting, all coal which it is feasible to cut should be cut or sheared.

F

FILTRATION

HYDRAULIC JUMP AS MIXING DEVICE. The Hydraulic Jump as a Mixing Device, A. G. Levy and J. W. Ellms. Water Wks., vol. 65, no. 7, July 1926, pp. 323-331, 4 figs. Investigations at Cleveland of hydraulic jump as chemical mixing device in filtration.

FILTRATION PLANTS

LIVERPOOL, ENG. The Oswestry Filter Beds of the City of Liverpool Waterworks. Engineering, vol. 122, no. 3159, July 30, 1926, pp. 123-125, 17 figs. Growing demand for water has rendered it necessary to increase area of slow sand filter beds, and three new beds were completed; construction presents novel features.

WASHINGTON, D.C. Universal Metering of Water Supplies, J. Ericson. Water Wks., vol. 65, no. 7, July 1926, pp. 307-309. Design and constructional features; foundation; control chambers; coagulating basins; filters; pumping station; filtered water reservoir; multi-ducts; wash water reservoir; alum manufacture; power plant.

FIREBRICK

SPALLING. The Mechanism of Spalling, F. H. Norton. Am. Ceramic Soc.—Jl., vol. 9, no. 7, July 1926, pp. 446-461, 20 figs. Study of stresses and fractures developed in solid when rapidly heated or cooled.

FIRE PREVENTION

WASHINGTON, D.C. Report of Committee on Fire Prevention and Engineering Standards on the City of Washington, D.C. Nat. Board of Fire Underwriters—Committee Report, no. 275, June 1926, 36 pp., 2 figs. Fire-fighting facilities; fire department; fire alarm system; fire department and auxiliaries; structural conditions and hazards; recommendations.

FLOW OF GASES

POPPET-VALVES. A Study of the Potential Flow of Gas Through the Poppet Valves, K. Tanaka. Soc. of Mech. Engrs. (Japan)—Jl., vol. 29, no. 3, July 1926, pp. 397-408, 8 figs. Seeks to solve case of tulip-type valve with conical seat in its increased lift, and compares results with those derived by Eck, in other words, with those of plane seated and ordinary conical-seated valve. (In English.)

FLOW OF WATER

PIPES. Theoretical Energy Losses in Intersecting Pipes, J. C. Stevens. Eng. News-Rec., vol. 97, no. 4, July 22, 1926, pp. 140-141, 2 figs. Confined to impact and eddies; general formula deduced, with application to number of particular cases.

FLYING BOATS

DURALUMIN HULLS, REPAIRING. Repairing Duralumin Hulls and Pontoons. Aviation, vol. 21, no. 6, Aug. 9, 1926, pp. 242-243, 5 figs. Fractures and punctures in duralumin may be repaired effectively and with great facility.

FORGING

SUPERHEATER PARTS. Forged Return Bends for Superheater Units. Machy. (Lond.), vol. 28, no. 718, July 15, 1926, pp. 423-424, 2 figs. Operation in forging superheater return bends on upsetting type of forging machine.

FORGINGS

DEFECTS IN. Defects in Carbon-Vanadium Forgings, O. B. Schultz. Forging—Stamping—Heat Treating, vol. 12, no. 7, July 1926, pp. 230-234, 9 figs. Defects which have been found in large carbon-vanadium locomotive forgings, and means for their prevention.

PICKLING. The Elements of Good Pickling Practice, R. L. Rolf. Forging—Stamping—Heat Treating, vol. 12, no. 7, July 1926, pp. 248-249 and 254. Various factors which enter into practice of pickling are briefly discussed; pickling of forgings; unlike tumbling or sand blasting; reveals defects.

FOUNDRIES

FUEL ECONOMY. Fuel Economy in the Foundry, A. Campion. Metal Industry (Lond.), vol. 29, no. 3, July 16, 1926, pp. 63-65. Fuel consumption in foundry practice; heat generation; temperature of gaseous current; heating in reverberatory furnaces; annealing operations; drying of molds.

SAFETY IN. Safety in Foundries. Nat. Safety News, vol. 14, nos. 1 and 2, July and Aug. 1926, pp. 43-53 and 42-54, 54 figs. No. 73 of series of safe-practices pamphlets. July: Training new man; handling raw material; sand mills, cutters and sifters; moulding and core-making; flasks; ovens; foundry floor; cupolas and furnaces; crucible furnaces. Aug.: Open-hearth furnaces, ladles; handling molten metal; shaking out castings; cranes, hoists and accessories; wheelbarrows and trucks; sand buckets; protective clothing; ventilation; heating and lighting.

STATISTICAL DATA, UNITED STATES. Consummated Deflation Shown in Foundry Count. Foundry, vol. 54, no. 16, Aug. 15, 1926, pp. 627-632, 8 figs., 6 tables. Compilation of statistics shows increase in all classes of castings plants except those specializing in gray iron.

FOUNDRY EQUIPMENT

HEAT-TREATING. Heat Treatment and Foundry Plant. Machy. (Lond.), vol. 28, no. 719, July 22, 1926, pp. 459-460, 4 figs. Details of coke-fired muffle furnace, No. 2 Simpson intensive sand mixer and core stove, constructed by August's Muffle Furnaces, Halifax.

MAGNETIC-SEPARATOR PULLEYS. Magnetic Separator Pulleys in Foundries, C. H. S. Tupholme. Foundry Trade Jl., vol. 34, no. 518, July 22, 1926, pp. 76-77, 3 figs. Principles and characteristics.

PARTING MATERIALS. Composition of Foundry Parting Material. Foundry, vol. 54, no. 13, July 1, 1926, p. 509. Although composition of powder designed to serve as parting medium, placed on market by manufacturers of foundry supplies, is guarded as trade secret, it is generally understood that lycopodium and tripoli form base.

FUELS

CARBON MONOXIDE AND HYDROGEN FROM. Synthetic Fuel from Carbon Monoxide and Hydrogen, O. C. Elvins and A. W. Nash. Fuel, vol. 5, no. 6, June 1926, pp. 263-265. Methods available for transformation of CO and H into compounds containing carbon and hydrogen are divided into four groups, all requiring use of catalyst and increased temperature.

LOW-GRADE. Using Low-Grade Fuel (L'utilisation des combustibles minéraux de qualité inférieure), M. Berthelot. Société des Ingénieurs Civils de France—Mémoires et Compte Rendu des Travaux, vol. 79, no. 5-6, May-June, 1926, pp. 318-369, 9 figs.

FURNACES, ANNEALING

LINING. New Furnace Lining, R. Walker. Iron Age, vol. 118, no. 7, Aug. 12, 1926, p. 420, 2 figs. Monolithic structure replaces brickwork; method of using.

FURNACES, GAS

ANNEALING. Bright Annealing by Gas Furnaces, J. B. Nealey. Iron Age, vol. 118, no. 7, Aug. 12, 1926, pp. 422-423, 3 figs. Making percolator parts in plant of Manning, Bowman & Co., Meriden, Conn.; air-gas ratio regulated to prevent scale formation.

COMBUSTION-SPACE REQUIREMENTS. Combustion-Space Requirements, O. L. Kowalke and A. W. Carlson. Gas Age-Rec., vol. 58, no. 4, July 24, 1926, pp. 107-109, 5 figs. Behaviour of burners attached to furnaces; maximum amount of gas which can be completely burned per unit volume of combustion space.

FURNACES, HEATING

RE-HEATING. A Direct Method of Calculating the Size of Continuous Re-Heating Furnaces, C. Gerrard. Iron & Coal Trades Rev., vol. 113, no. 3044, July 2, 1926, p. 3. Input to furnace; output; method of calculating furnace size.

G

GAS HOLDERS

CORROSION. Corrosion of Gas Holders. Gas Jl., vol. 175, no. 3296, July 21, 1926, pp. 141-142. Review of report of committee of Société Technique de l'Industrie du Gaz; influence of gas composition and of tank water; exterior influences; constitution of metal employed; protective measures.

TANKLESS. Explosion in a Tankless Holder. Gas Jl., vol. 175, no. 3296, July 21, 1926, pp. 135-138, 5 figs. Translated report to conference of German engineers on explosion of gas holder in Posen, Poland, having capacity of 1¾ million cu. ft., diameter of 112 ft. and height of 190 ft.; cause of accident appears to have been tilting of disk or piston, which, by displacing tar seal, allowed gas to pass into enclosed space between top of disk and roof; explosive mixture thus formed was apparently ignited by friction, and blew roof distance of 40 yds.

GAS TURBINES

STEELS FOR. Internal Combustion Turbines, W. H. Johnson. Autocar, vol. 57, no. 1604, July 30, 1926, pp. 165-166. Points out that solution of problem lies in discovery of suitable steels to withstand very high temperatures generated; recent development of new high-temperature steel by Hadfield concern may be of far-reaching importance to automobile industry by bringing gas turbine within bounds of practicable possibility.

GEARS

AUTOMOBILE. The Institution of Automobile Engineers, H. E. Merritt. Automobile Engr., vol. 16, no. 217, July 1926, pp. 266-274, 15 figs. Camshaft drives; pump gears; gear box; calculations of velocities of sliding and rolling; influence of rolling and sliding on lubrication; final drive; worm drive. Paper awarded Daimler premium for 1924-25.

HELICAL. Solving a Helical Gear Problem by Unconventional Methods, E. Buckingham. Am. Mach., vol. 65, no. 8, Aug. 19, 1926, pp. 327-328. Selection of change gears without use of continuous fractions; calculation of theoretical pitch radius for hob and root radius of gear.

INSTRUMENT. Die and Assembling Fixture for Instrument Gears. Machy. (Lond.), vol. 28, no. 719, July 22, 1926, pp. 456-458, 6 figs. In manufacture of certain delicate recording instruments, it is necessary to employ gears of exceedingly fine pitch in trains having high gear ratios; friction is minimized partly by use of small delicate bearings and correspondingly small arbours for gears.

GIRDERS

CONTINUOUS. A Simple Method of Dealing with Continuous Girders, A. W. Loveridge. Engineering, vol. 122, no. 3157, July 16, 1926, p. 63, 6 figs. Shows that much use may be made of principle of reciprocal deflections in forming deflection equations.

TRUSSED. Trussed Girders, N. Tate. Mech. World, vol. 80, no. 2066, Aug. 6, 1926, pp. 99-100, 8 figs. Strength of trussed girders depends largely on depth of trussing, which, in turn, is often regulated by headroom available.

GOLD DEPOSITS

NOVA SCOTIA. The Gold Deposits of Nova Scotia, S. Brunton. Can. Inst. of Min. & Met.—Bul., no. 171, July 1926, pp. 781-847, 29 figs. Analysis of history and present status, and hypothesis concerning structural features of Province in relation to deposits of gold.

ONTARIO. District of Patricia Red Lake and Adjacent Areas, W. R. Rogers. Ont. Dept. of Mines—Bul., no. 56, 1926, 11 pp., 3 figs. Summary of reports and maps published by Geological Survey of Canada and Ontario Department of Mines.

GRINDING

CAMS. Automobile Camshaft Grinding and Checking, E. W. Hancock. Machy. (Lond.), vol. 28, no. 720, July 29, 1926, pp. 493-497, 7 figs. Method of accurate cam grinding suitable to policy which has moderate output and variety of designs.

INTERNAL. Internal Grinding, H. Darbyshire. Automobile Engr., vol. 16, no. 217, July 1926, pp. 254-255, 3 figs. Measures to be observed in securing accurate work and high output.

H

HARDNESS

ROCKWELL TEST. Rockwell Hardness-Test Approved. Soc. Automotive Engrs.—Jl., vol. 19, no. 2, Aug. 1926, pp. 125-126. Principle of test recommended by sub-division of Soc. of Automotive Engrs. Standards Committee.

HEATING, GAS

HOUSES, WIND EFFECT. The Effect of Wind on Gas Fires (Das Haus im Windstrom), Kobbert. Gas- u. Wasserfach, vol. 69, no. 20, May 15, 1926, pp. 404-412, 33 figs; also translated abstract in Gas World, vol. 85, no. 2190, July 24, 1926, p. 83, 1 fig.

RADIATING HEAT. The Role of Radiating Heat in the Heating Effect of Gas Heaters (Ueber den Anteil der strahlenden Wärme an der Wärmewirkung von Gasheizungen), F. Hurdelbrink and R. Polenske. Gas- u. Wasserfach, vol. 69, no. 2., May 22, 1926, pp. 421-430, 9 figs. Method of determining heat radiated from given source to given distance and surface, and its experimental test with heating lamp, gas heater filled with refractories, and cast-iron stove.

HEATING, HOT-AIR

FLUE-GAS SAMPLING. Principles of Design in Furnace Heating, A. M. Daniels. Sheet Metal Worker, vol. 17, no. 12, July 16, 1926, pp. 452-454, 10 figs. Combustion of coal; products of combustion; flue-gas analysis.

HEAT LOSSES. Cooling of Water in Pipes of Heating Plant (Il raffreddamento dell'acqua nelle tubazioni degli impianti a termosifone), A. Gini. Ingegneria, vol. 5, no. 5, Mar. 1926, pp. 164-168, 1 fig. Discusses piping for heating plants with little change in level, with distribution from lower level; calculation of area of radiators for each; heat losses in lower-level plants, etc.

HEATING, STEAM

CENTRAL. Fundamental Factors in District Steam Distribution. Heat. & Vent. Mag., vol. 23, no. 8, Aug. 1926, pp. 73-76, 3 figs. How to predetermine initial pressures, transmission-line location and other elements to secure best results.

HIGHWAYS

RESEARCH. Results of Highway Research in Iowa, R. W. Crum. Mun. & County Eng., vol. 71, no. 1, July 1926, pp. 58-61. Results obtained from work completed on 15 research projects active during year 1925, under direction of research organization of Iowa State Highway Commission and from work accomplished on three research projects in which this organization co-operated with other agencies.

TRACTIVE RESISTANCE OF. An Experiment in Tractive Resistance on Various Types of Highways, H. B. Shaw. Good Roads, vol. 69, no. 6, June 1926, pp. 225-226. Purpose of tests; apparatus used.

HOUSES

MINERS. Miners' Dwelling Houses, H. E. Mitton. Colliery Guardian, vol. 182, no. 3419, July 9, 1926, pp. 75-77, 12 figs. Site; streets; houses; lighting; hot water; furnace.

HOUSING

LABOR. Housing. Monthly Labor Rev., vol. 23, no. 1, July 1926, pp. 71-76, 1 fig. Volume of building construction, 1919 to 1925, New York housing law; housing situation in Germany, 1925.

HYDRAULIC TURBINES

DEVELOPMENTS. Present State and Tendencies in Hydraulic-Turbine Construction (Les progrès, l'état actuel et les tendances de la construction des turbines hydrauliques), P. Cayère. Arts & Métiers, vols. 78 and 79, nos. 58, 59, 64 and 65, July and Aug. 1925 and Jan. and Feb. 1926, pp. 269-286, 318-327, 11-24 and 63-67, 57 figs.

DRAUGHT TUBES. Draught Tube Lined with Cast Iron at Big Creek No. 8 Plant. Eng. News-Rec., vol. 97, no. 5, July 29, 1926, pp. 182-183, 2 figs. Lining of steel plates, loosened by vibration, is replaced by heavier construction in California hydro plant.

GOVERNORS. Hydraulic-Turbine Governor Pressure Fluids, M. B. Thurston. Power, vol. 64, no. 7, Aug. 17, 1926, p. 248. Discusses what appears to be best for oil-pressure governor; author's preference is fairly light oil of good flash test; strength of film and stability.

RUNNERS, PITTING OF. Pitting of Hydraulic Turbine Runners. Elec. News, vol. 35, no. 15, Aug. 1, 1926, p. 40. Causes of this form of corrosion and methods for its prevention.

HYDRO-ELECTRIC DEVELOPMENTS

NEWFOUNDLAND. The Humber Development of Newfoundland Power and Paper Company, Limited, H. C. Brown. Eng. Jl., vol. 9, no. 8, Aug. 1926, pp. 359-372, 22 figs. Power equipment and development and its installation in paper mill in Newfoundland; investigation of precipitation and flood conditions; canal and canal intake works; pipe line, power house and transmission lines, substation, switchboard room, conduit system, wire and cable.

HYDRO-ELECTRIC PLANTS

MECHANICAL EQUIPMENT. Equipping the Water Power Plant, F. Johnstone-Taylor. Power House, vol. 19, nos. 4, 5 and 8, Feb. 20, Mar. 5 and Apr. 20, 1926, pp. 19-23, 19-21 and 29-31, 31 figs. Feb. 20: Sluices and other control apparatus. Mar. 5: Pipes and pipe line. Apr. 20: Valves and protective devices.

QUEBEC. Rapid Work on Gatineau Power Plants. Contract Rec., vol. 40, no. 31, Aug. 4, 1926, pp. 736-738, 11 figs. Details of storage dam at Lake Bascatong power houses at Farmers' Rapids and Chelsea Falls, and pulp and paper mill at East Templeton.

SAFETY IN. Developing the Safety Habit in a Hydro-Electric Station, R. D. Shaub. Nat. Safety News, vol. 14, no. 2, Aug. 1926, pp. 11-13 and 18, 6 figs. Methods and precautions employed at Holtwood hydro-electric station, Pa.

I

INDICATORS

MEAN-PRESSURE. Mean-Pressure Indicator, J. Geiger. Eng. Progress, vol. 7, no. 7, July 1926, pp. 181-183, 8 figs. In all reciprocating engines there exists simple relation between mean-pressure referred to stroke and mean-pressure referred to time; describes measuring instrument indicating both pressures directly.

INDUSTRIAL MANAGEMENT

CATALOGS. Catalogs (Die Stückliste), W. Heinze. Maschinenbau, vol. 5, no. 14, July 15, 1926, pp. 649-653, 6 figs. Discusses use of list of goods manufactured at given shop, in which for each item details of all its parts are given, and for each part all specifications, etc., for production, recommending this list as sole reference for producers and buyers, its information being complete to satisfy all demands; examples of sheets with tabulation; for parts and for finished goods.

PRODUCTION LOTS, DETERMINING PROPER SIZE OF. Method of Finding Minimum-Cost Quantity in Manufacturing, R. C. Davis. Mfg. Industries, vol. 12, no. 2, Aug. 1926, pp. 129-131, 1 fig. Formulas for size of production lots. Continuation of article in Apr. 1925, issue of same journal. See reference in Eng. Index 1925, p. 400.

INDUSTRIAL PLANTS

POWER AND HEAT SUPPLY. Selecting a Power and Heat Supply for Industrial Plants. Mech. Eng., vol. 48, no. 8, Aug. 1926, pp. 806-807. Discussion of paper by M. K. Bryan, published in June, 1926, issue of journal.

INDUSTRIAL RELATIONS

SMALL PLANTS. Plans for Industrial Relations Work in Small Plants, R. W. Kelly. Mfg. Industries, vol. 12, no. 2, Aug. 1926, p. 132. In Associated Oil Co. scattered divisions in producing fields have successfully developed plan of using so-called employment foremen.

INSULATION, HEAT

INDUSTRIAL APPLICATIONS. Heat Insulation in Industrial Plants, L. B. McMillan. Engrs. and Eng., vol. 43, no. 7, July 15, 1926, pp. 191-194, 5 figs. Observed conditions; useful curves; effect of circulating air; maintaining temperature head.

INSULATING MATERIALS, ELECTRIC

PORCELAIN. Selection of Porcelain for Electrical Purposes, M. Kraner. Elec. Jl., vol. 23, no. 7, July 1926, pp. 344-348, 14 figs. Composition of porcelain; action of heat; superiority of American clays; dry process porcelain; high-strength insulation; glazes.

INTERNAL-COMBUSTION ENGINES.

FRICTION LOSSES. Research on Friction Losses in Explosion Engines (Recherches sur les pertes par frottement dans les moteurs à explosions), A. Planiol. Technique Automobile et Aérienne, vol. 17, nos. 133 and 134, 1926, pp. 33-42 and 81-90, 18 figs. Experiments carried out to determine any connections between phenomena of internal friction in explosion engines, whether losses increase with power and velocity; study and operation of Watt indicators; variation of losses with charge; tests at variable speed and temperature.

See also Airplane Engines; Automobile Engines; Diesel Engines; Oil Engines.

IRON ALLOYS

IRON-CARBON. The Carbon Content of Pearlite in Iron-Carbin Alloys Containing One Per Cent Silicon, A. Hayes and H. U. Wakefield. Am. Soc. Steel Treating—Trans., vol. 10, no. 2, Aug. 1926, pp. 214-221 and (discussion) 221-232, 7 figs. Review of modification of diagram for pure iron-carbon alloys which was constructed to conform to experimental data for malleable white-iron composition.

IRON DEPOSITS

CANADA. Mississagi Reserve and Goulais River Iron Ranges, District of Algoma, E. S. Moore. Ontario Dept. of Mines, vol. 34, 1926, pp. 1-33, 21 figs. Topography; economic and general geology of iron districts.

IRON ORE

FUTURE PRODUCTION. Factors Affecting Probable Future Iron Ore Production, W. G. Swart. Min. & Met., vol. 7, no. 236, Aug. 1926, pp. 334-336, 4 figs. Factors which will affect future production; increased cost of mining; competition of foreign ores; changes in furnace location and practice; unequal ownership.

J

JOINTS

WELDED, X-RAY EXAMINATION. Welded Joints Searched by X-Rays, J. T. Norton. Iron Age, vol. 118, no. 7, Aug. 12, 1926, pp. 409-412, 9 figs. Defects which can be detected and some which cannot; methods of making and testing welds; typical radiographs.

L

LABOUR

PRODUCTIVITY INDEXES. Index of Productivity of Labour in the Steel, Automobile, Shoe and Paper Industries. Monthly Labour Rev., vol. 23, no. 1, July 1926, pp. 1-19. First of series of studies of labour-productivity indexes in American industry now being carried on by U. S. Bur. of Labour Statistics.

WAGES AND HOURS. Wages and Hours of Labour. Monthly Labour Rev., vol. 23, no. 1, July 1926, pp. 38-40. Wages and labour conditions in Louisiana; English views of American wage policies; wage fixing and wage rates in New South Wales; wages and prices in Cuba; average daily wages and output in French coal mines, 1920-1925; wages and cost of living in Nagarit, Mexico.

LABORATORIES

HYDRAULIC. New Hydraulic Laboratory for Worcester Polytechnic. Eng. News-Rec., vol. 97, no. 3, July 15, 1926, pp. 96-97, 3 figs. Small laboratory built in 1894 replaced by much larger one; provisions made for many kinds of tests.

LADDERS

IRON. Iron Ladders: Some Notes on Design and Construction, H. Atkin. Mech. World, vol. 80, no. 2063, July 16, 1926, p. 48, 4 figs. Supports for wall ladders; sections to employ; ladder rungs; assembly; finish.

LAPPING

MACHINES FOR. New Machine Eliminates Hand-Lapping of Crankshafts. Automotive Industries, vol. 55, no. 2, July 8, 1926, pp. 48-49, 2 figs. Does work of two to six men with greater precision; all line and rod bearings lapped simultaneously; single operator able to handle machines due to automatic timing feature.

LIGHTING

ARTIFICIAL SKYLIGHT. Artificial Skylight Illumination, D. H. Tuck. Elec. World, vol. 88, no. 6, Aug. 7, 1926, pp. 281-282, 2 figs. Success of Cleveland auditorium lighting scheme duplicated in Milwaukee; concentration of prismatic reflectors over skylights used.

RESIDENCE. Commercial Possibilities of Home Lighting, M. Luckiesh. Nat. Elec. Light Assn.—Bul., vol. 13, no. 7, July 1926, pp. 427-431. Shaded lights; commercial possibilities of better lighting; average annual consumption per home; active and average sockets; kitchen lighting; portable lamps; utilitarian brackets; utility equipment; future prospects.

STREET. Modern Tendencies in Ornamental Street Lighting, C. J. Stahl. Elec. News, vol. 35, no. 14, July 15, 1926, pp. 37-42, 12 figs. Progress of improvement, design; rating and costs; overcoming glare; cost of asymmetric distribution.

Essentials of Modern Street Lighting, C. J. Stahl. Elec. World, vol. 88, no. 2, July 10, 1926, pp. 65-67, 2 figs. Safety of first importance, ornamentation and advertising value also desirable; strong silhouette effect with feeble vertical illumination not sufficient; how desired effects can be produced.

LIQUIDS

ELECTRIC HEATING. Electric Heating of Liquids and Compounds, L. P. Hynes. Indus. Engr., vol. 84, no. 8, Aug. 1926, pp. 361-363, 4 figs. Analysis of problems involved, and describes equipment available for this purpose.

LOCOMOTIVE BOILERS

FEEDWATER PREHEATING. Experiments with Preheating Locomotive Feedwater (Esperimenti con preriscaldatori d'acqua per locomotive), Rivista Tecnica delle Ferrovie Italiane, vol. 29, no. 15, Mar. 15, 1926, pp. 181-213, 10 figs. Tests carried out by Italian State Railways with various types of preheaters, including those by Weir, Worthington, Knorr, Davies & Metcalfe, A. C. F. I. and Friedmann; their fuel consumption, efficiency, etc.

LOCOMOTIVES

DIESEL-ELECTRIC. Diesel-Electric Locomotive Built in Russia. Ry. Age, vol. 81, no. 5, July 31, 1926, pp. 208-209. Locomotive weighing 198 tons, including fuel and water, driven by 1,000-hp. engine.

1,000-H.P. Diesel-Electric Locomotive. Engineering, vol. 122, no. 3159, July 30, 1926, pp. 150-152, 6 figs. Locomotive built by Baldwin Locomotive Works, Philadelphia; results of tests.

OIL-ELECTRIC. Russian Oil-Electric Locomotive of 1,000-Hp. Oil Engine Power, vol. 5, no. 8, Aug. 1926, pp. 490 and 495-497, 3 figs. Has 10-cylinder airless injection engine; motors with thermocouples and ball-bearing axles.

VALVE DIAGRAMS FOR. Valve Diagrams for Locomotives. Ry. Engr., vol. 47, no. 559, Aug. 1926, pp. 290-291, 3 figs. Points out that use of Zeuner, or other valve diagram, for purpose of design is not so usual, due perhaps to fact that certain amount of rather troublesome "trial and error" work is usually involved; author seeks to find more direct way of working.

LUBRICATING OILS

DISTILLATION. The Distillation of Lubricating Oils Under High Vacuum, B. T. Brooks. Ind. & Eng. Chem., vol. 18, no. 8, Aug. 1926, pp. 789-793, 4 figs.

FIRE-POINT CARBON TEST. Fire-Point Carbon Test, R. M. Byrd and F. C. Vilbrandt. Ind. & Eng. Chem., vol. 18, no. 7, July 1926, pp. 699-701. This test, which consists of determining amount of residue formed upon heating oil to its fire point and diluting heated oil with gasoline, measures tendency toward oxidation of lubricating oils; no special or elaborate equipment is needed and its execution is simple and rapid.

MID-CONTINENT. The Composition of Mid-Continent Petroleum, C. F. Mabery. Ind. & Eng. Chem., vol. 18, no. 8, Aug. 1926, pp. 814-819. Explains improvements in solvent fractionation; most of lubricants undergo vacuum distillation without great decomposition; behaviour of petroleum lubricants on standardized frictional testing machine shows comparative strength of individual molecules to resist breaking stress as indicated by appearance of smoke and final rupture.

PROPERTIES. Lubricating Oils (Généralités sur les huiles de graissage), R. Fillon. Bul. Technique du Bureau Veritas, vol. 5, nos. 5 and 6, May and June 1926, pp. 83-85 and 104-106. Examines mineral, vegetable and animal oils and greases; origin, manufacture, properties, flash point, freezing, emulsions, impurities, acidity, etc.

LUBRICATION

HIGH-SPEED JOURNALS. Lubrication of High-Speed Journals and the Properties of the Oil in Its Use, T. Hayashida. Soc. Mech. Engrs. (Japan)—Jl., vol. 29, no. 110, June 1926, pp. 319-373, 23 figs. Results of experiments on lubrication and lubricants. (In Japanese.)

REFRIGERATING MACHINERY. Cold Storage and Refrigeration-Machinery Lubrication. Lubrication, vol. 12, no. 7, July 1926, pp. 73-84, 21 figs. Discusses importance and systems of lubrication; selection of ammonia-compressor lubricants; control of oil supply; reclaiming of oil; lubrication of carbonic-anhydride compressors; sulphur-dioxide-machinery lubrication, etc.

STEAM CYLINDERS. Fundamental Principles of Efficient Steam Cylinder Lubrication. Nat. Engr., vol. 30, no. 8, Aug. 1926, pp. 361-363. Essential requirements for effective cylinder lubrication; oil as piston-sealing medium; lubrication without friction or wear; reduction of oil consumption; service problems and performance records.

M

MACHINE TOOLS

HISTORICAL NOTES. Pioneer Tools Serve Industry 150 Years. Can. Machy., vol. 36, no. 4, July 22, 1926, pp. 15-17, 5 figs. Machine tools at work in Soho foundry, Birmingham, Eng., after 150 years of continuous service.

NUT-DRIVING MACHINES. Nut-Driving Machine. Machy. (Lond.), vol. 28, no. 719, July 22, 1926, pp. 469-470, 3 figs. Radial air-driven type for tightening nuts on railway trucks or removing them.

MACHINING METHODS

BORING AND DRILLING. Boring and Drilling Automobile Components. Machy. (Lond.), vol. 28, no. 718, July 15, 1926, pp. 431-432, 4 figs. Boring and drilling and automobile rear axle and differential cover.

GEAR CASE. Machining a Motor Cycle Three-Speed Gear Case. Machy. (Lond.), vol. 28, no. 721, Aug. 5, 1926, pp. 517-520, 9 figs. Methods employed at works of Scott Motor Cycle Co., Saltaire, Yorks.

MAGNESIUM

CASTINGS. Casting Magnesium, Characteristics and Recent Progress (La fonderie de magnésium—ses particularités—ses récents progrés), R. de Fleury. Technique Moderne, vol. 18, no. 14, July 15, 1926, pp. 426-429. Discusses metallurgy of magnesium and its difficulties; concludes that German Griesheim Elektron Co., Italian Isotta Fraschini Co., and French Michel Co., have succeeded in industrial production of magnesium castings.

MAGNETIC FIELDS

INTENSE, GENERATION OF. The Generation of Very Intense Magnetic Fields, T. F. Wall. Instn. Elec. Engrs.—Jl., vol. 64, no. 355, July 1926, pp. 745-757, 10 figs. Method of generating magnetic fields of order of magnitude of 1 million gauss and for impressing such fields on specimen of magnetic material at regular intervals to ascertain whether any disturbance of electronic orbits can be obtained of sufficient magnitude to produce marked effect on magnetization curve of specimen.

MATERIALS HANDLING

EQUIPMENT FOR PRODUCTION PROCESSES. Fixed Equipment for Production Processes, W. T. Spivey. Factory, vol. 37, no. 2, Aug. 1926, pp. 257-259, 6 figs. Final economy of standardized type; combining cranes, monorails, hoists, conveyors; progressive assembly.

FACTORIES. Controlling Production Mechanically, W. F. Bailey. Can. Machy., vol. 36, no. 4, July 22, 1926, pp. 21-24, 9 figs. Mechanical handling methods used in Hoover Company's factory.

INDUSTRIAL PLANTS. Handling Studies Pay in the Otis Plant, R. J. Pearson. Mfg. Industries, vol. 12, no. 2, Aug. 1926, pp. 115-120, 10 figs. Cranes and motor, electric and hand-lift trucks operate under comprehensive and completely organized schedule.

WAREHOUSES. Reducing Handling Costs in the Warehouse, G. F. Zimmer. Indus. Mgmt. (Lond.), vol. 13, no. 7, July 1926, pp. 299-304, 4 figs. Explains how economies may be effected in handling of cases and packages in warehouse by employment of modern conveying appliances.

YARD HAULAGE AND HANDLING. Yard Haulage and Handling, T. F. Barbier. Factory, vol. 37, no. 2, Aug. 1926, pp. 245-247, 252 and 254, 8 figs. Deals with trailers, gas tractors, cranes, hoists, and railways.

METALS

BENDING. Tools and Machines for the Bending of Metals. Machy. (Lond.), vol. 28, no. 721, Aug. 5, 1926, pp. 509-515, 8 figs. Bending motor-armature coils; formers and formulas for former settings; bending machines for coils.

CORROSION-RESISTING. Corrosion-Resisting Materials for Chemical Plant Construction, A. Grounds. Indus. Chemist, vol. 2, no. 18, July 1926, pp. 296-300, 5 figs. Notes on corrosion-resisting irons and steels, aluminum, etc.

ENGINEERING. Present Tendencies in Engineering Materials, J. A. Mathews. Mech. Eng., vol. 48, no. 8, Aug. 1926, pp. 791-794. Specifications and what they should embody; widening expanse of engineering requirements in materials; recent demands on steel metallurgist; applications of alloy steels.

LATENT HEAT OF FUSION. Conclusions Concerning Latent Heat of Fusion and Melting Point of the Metals, H. Etherington. Chem. & Industry, vol. 45, no. 26, June 25, 1926, pp. 430-431, 1 fig.

PROPERTIES. Metals and Their Properties, T. Newton. Sheet Metal Worker, vol. 17, no. 14, Aug. 13, 1926, pp. 535 and 537. Conductivity; expansion and contraction; table of coefficients of linear expansion; surface expansion; expansion of volume; examples of expansion.

PROTECTIVE COATINGS. Protective Coatings for Metals, J. A. Aupperle. Blast Furnace & Steel Plant, vol. 14. nos. 6, 7 and 8, June, July and Aug., 1926, pp. 281-283, 322-325 and 341-343 and 357, 1 fig. Various methods for protecting metal surfaces against corrosion and exidation. July: Theory of sherardizing; how precipitation of vapor on metal occurs; tin plate; schoop metal-spraying process; dip process. Aug.: Nature of coating; asbestos-protected metal; red and black paint; vitreous enamelled sheets.

SURFACE FLAWS. A Method of Observing Flaws in Metal Surfaces and of Comparing the Conductivities of Metal Plates, E. W. Marchant and J. L. Miller. Instn. Elec. Engrs.—Jl., vol. 64, no. 355, July 1926, pp. 737-744, 9 figs. Principle of action of apparatus; design and method of use; experimental results.

MICROSCOPES

INDUSTRIAL USES. The Use of the Microscope in Industry, R. G. Guthrie. West. Soc. of Engrs.—Jl., vol. 31, no. 6, June 1926, pp. 215-225, 32 figs. Kinds of microscopes; application to study of treatment of metals.

MILLING

RAILWAY SHOPS. Milling Operations in Railroad Shops. West. Machy. World, vol. 17, no. 7, July 1926, pp. 285-286, 6 figs. Reduction in time due to installation in railroad shop of modern milling machines for manufacture of rolling stock and replacement parts.

MILLING MACHINES

TYPES. Milling Machines. West. Machy. World, vol. 17, no. 7, July 1926, pp. 294-296, 6 figs. Description of 6 milling machines by various manufacturers.

MOULDING METHODS

MACHINE MOULDING. Machine Moulding Boiler Section Castings, R. F. Ringle. Can. Foundryman, vol. 17, no. 7, July 1926, p. 11. When production requirements demand casting of uniform metal thickness, with all fitting parts true to pattern, Weil McLain Co. has found machine moulding casting incomparable.

MOULDS

DIE-CASTING. Some Features of Mould Design and Construction for Aluminium Die-Casting in Gravity Dies, N. V. Pearson. Machy. (Lond.), vol. 28, no. 718, July 15, 1926, pp. 425-427, 6 figs. Drawings of examples of gravity dies for die casting.

INGOT, WALL THICKNESS. The Influence of Mould Wall Thickness, F. Leitner. Forging—Stamping—Heat Treating, vol. 12, no. 7, July 1926, pp. 245-247, 11 figs. Influence of primary crystallization and time of solidification are examined in three different mould sizes with decreasing wall thickness; medium-wall moulds have advantage, giving better crystal development and are less expensive than heavy moulds. Translated from Stahl u. Eisen, May 13, 1926, p. 629.

MOTOR BUSES

ENGINE REQUIREMENTS. Engine Requirements of Interurban Motorcoach Service, L. P. Kalb. Soc. Automotive Engrs.—Jl., vol. 19, no. 2, Aug. 1926, pp. 179-182, 2 figs. Analyzes requirements of engine for 29-passenger interurban motor bus as to piston displacement, accelerative ability of vehicle, fuel consumption, number of cylinders, engine speed, and relation of horsepower available to power required to propel vehicle with various ratios.

HEATING AND VENTILATING. The Heating and Ventilating of Motorcoaches, L. C. Josephs, Jr. Soc. Automotive Engrs.—Jl., vol. 19, no. 2, Aug. 1926, pp. 173-178. Both systems should perform their functions efficiently in entirely unobtrusive manner; requirements of heating system include unobtrusiveness, protection of passengers from hot pipes and danger from fire, even distribution, and freedom from noise and fumes; sources and methods of heating.

MOTOR-GENERATOR

AUTOMATIC CONTROL. Automatic Control of Edison Lighting Motor-generator Sets, H. Bany and G. R. McDonald. Gen. Elec. Rev., vol. 29, no. 7, July 1926, pp. 482-489, 5 figs. Application of automatic control to machines feeding d.c. networks; constant voltage and continuous service prime essentials; control takes full advantage of favourable machine characteristics; protection and operation, single-unit and multiple-unit installations.

MOTOR-GENERATORS

DESIGN. Private Electric Power Stations, W. Kreul. Eng. Progress, vol. 7, no. 7, July 1926, pp. 190-191, 3 figs. Design and operation of motor-generator sets; Kreul system of semi-automatic stations, equally useful for lighting, power and water supply plants, as for cooling, ventilating and heating plants.

N

NUTS

STRENGTH TEST. Tests with Nuts 0.8 of the Bolt Diameter in Thickness (Versuche mit 0.8 d hohen Muttern), K. Schimz. Maschinenbau, vol. 5, no. 12, June 17, 1926, pp. 552-554, 8 figs. Discusses jolting and breaking tests of bolts and nuts, decreasing thickness of nut, and applies results to nuts of 0.8 of bolt diameter.

O

OILS

BIBLIOGRAPHY. Recent Articles on Petroleum and Allied Substances, H. Britton. U. S. Bur. of Mines, May 1926, 34 pp. History and geographic occurrence, geology and origin, properties, refining, production, utilization, etc.

CRACKING. The Development of a Liquid-Phase Cracking Process, S. J. M. Auld and A. E. Dunstan. Ind. & Eng. Chem., vol. 18, no. 8, Aug. 1926, pp. 803-807, 5 figs. Deals with Auld, Dunstant, and Herring cracking process; fundamental principles upon which design of plant was based; problem of maintaining liquid phase; factors which operate for and against this state; mechanism of cracking; experiments to determine relationship between oil temperature, skin temperature, and furnace temperature, so as to design heating arrangements of plant.

REFINING. Systematic Refining of Cracked Distillates, J. C. Morrell. Ind. & Eng., Chem., vol. 18, no. 7, July 1926, pp. 733-738, 2 figs. Chemical factors in refining.

OIL ENGINES

HEAT TRANSMISSION. Heat Transmission in Oil Engines, W. Nusselt. Mar. Engr. & Motorship Bldr., vol. 49, no. 588, Aug. 1926, pp. 301-303, 5 figs. Deduction of theoretical expression from actual tests.

SKETCHES AND WORKING. Sketches and Working of Oil Engines. Motorship, vol. 11, no. 8, Aug. 1926, pp. 617-619 and 620, 2 figs. Fuel-injection methods as distinguishing characteristics; effect on economic status and technical characteristics.

OIL FUEL

BURNERS. Oil-Fuel Burning Systems. Mech. World, vol. 80, no. 2066, Aug. 6, 1926, pp. 103-110, 29 figs. Types of equipment on market may be broadly classified under three systems according to method of atomizing fuel; pressure or mechanical, compressed-air, and steam-jet system; describes number of leading types of oil-fuel burning apparatus.

CHARACTERISTICS. The Liquid Fuel Question, F. Burgess. Machy. Market, no. 1341, July 16, 1926, pp. 21-22. Characteristics of fuel oil; advantages, disadvantages, and economy.

OPEN-HEARTH FURNACES

TEMPERATURE MEASUREMENT. Optical Temperature Measurement on Open-Hearth Furnace, B. M. Larsen and J. W. Campbell. Am. Inst. of Min. & Met. Engrs.—Trans., no. 1581-C, Aug. 1926, 15 pp., 6 figs. Possible errors in optical measurements; temperature gradients in walls and roof of melting chamber; differences between flame-off and flame-on optical readings; temperature distribution in melting chamber.

OXYACETYLENE WELDING

ALLOY STEEL. Gas Welding Alloy Steels, G. L. Walker. Welding Engr., vol. 11, no. 7, July 1926, pp. 28-30, 13 figs. How high-carbon steels and high-speed steels can be successfully welded; some applications of process.

PIPE. Pipe Welding for the Building Contractor, H. E. Wetzell. Acetylene Jl., vol. 28, no. 2, Aug. 1926, pp. 65-72 and 102, 18 figs. Deals with welding of water, gas and steam pipes used in building construction.

COPPER. Copper Welding, S. W. Miller. Machy. (Lond.), vol. 28, no. 720, July 29, 1926, p. 483. Results of series of tests made by author on copper welding rods containing such deoxidizers as silicon, manganese, aluminum, phosphorus, and various combinations of them.

TOOL STEEL. Welding High Carbon Tool Steel and High Speed Steel with the Oxy-acetylene Torch, G. L. Walker. Am. Welding Soc.—Jl., vol. 5, no. 7, July 1926, pp. 40-48, 13 figs. Rules to be observed.

P

PACKING

MACHINERY. Packing Machinery and Heavy Goods. Indus. Mgmt. (Lond.), vol. 13, no. 7, July 1926, pp. 318-322, 1 fig. Methods in use for packing such bulky articles as machinery, automobiles, airplanes, and power plants for home and overseas markets.

PROBLEMS. Good Packing as an Economic Factor in Production. Indus. Mgmt. (Lond.), vol. 13, no. 7, July 1926, pp. 270-274, 6 figs. Problems connected with packing of foodstuffs, articles of household use, medical and toilet preparations, and certain articles of clothing.

PAINTS

LIGHTING VALUE. Lighting Value of Paint in Industrial Plants, M. Luckiesh and E. W. Commery. Indus. Engr., vol. 84, no. 8, Aug. 1926, pp. 350-353, 4 figs. Reflection factor and other properties which affect its value, with pointers that will aid in using it most effectively.

PATTERNMAKING

PIPE WORK. Economies of Pipe Patterns, J. McLachlan. Can. Foundryman, vol. 17, no. 7, July 1926, pp. 16-17, 8 figs. Author stresses fact that work involved in patternmaking for pipe work in foundry is not as simple as patternmakers who have had no practical experience imagine; describes use of templets.

PATTERNS

CARE OF. The Care of Patterns, W. Dobbs. Foundry Trade Jl., vol. 34, no. 519, July 29, 1926, pp. 87-88, 2 figs. System adopted in small foundry, whose work was partly of outside-order type.

MOUNTING. Mounting Patterns Requires Varied Ingenuity, H. N. Tuttle. Foundry, vol. 54, nos. 11, 12 and 13, June 1, 15 and July 1, 1926. pp. 438-441, 479-482 and 521-522, 35 figs. Patterns are classified into three general types: match-plate patterns, rock-over machine patterns, and stripping-plate patterns; first is used chiefly for bench work, while rock-over and stripping-plate patterns are in general use for floor work; material for pattern plates; advantages of cast plate; gating patterns.

PLATES. Pattern Plates, E. Ronceray. Foundry Trade Jl., vol 34, no. 519, July 29, 1926, pp. 89-92, 12 figs. Methods of manufacturing pattern plates and core-boxes adopted by Etablissements Ph. Bonvillain & E. Ronceray, which include considerable number of improvements and apparatus to facilitate their use. Paper read before Czecho-Slovakian Foundrymen's Assn.

PAVEMENTS, CONCRETE

IMPACT STRESS. Impact Stress in Concrete Pavement by an Electric Strain Gage, D. D. McGuire. Eng. News Rec., vol. 97, no. 7, Aug. 12, 1926, p. 251, 2 figs. Stress-strain law assumed to apply to impact so that stresses are determined from areas under recorded curve.

OVERRUNS, COST OF. Cost of Quantity Overruns on Concrete Paving Work, J. L. Harrison. Highway Eng. and Contractor, vol. 15, no. 1, July 1926, pp. 29-32, 2 figs. Cause of overrun; short batches; cost of spillage; bulking of sand; coarse sand; coarse aggregate; calculating overrun losses.

PIPE, CAST-IRON

CENTRIFUGALLY CAST. Machine for Centrifugally Casting Iron Pipe (Note sur une machine à couler les tuyaux en moules métalliques, par centrifugation), C. Derulle. Fonderie Moderne, vol. 20, June 1926, pp. 138-140, 1 fig. Details of French machine which, it is said, will cast a length of pipe every 5 min.

SAND-SPUN CAST-IRON PIPE MANUFACTURE. Foundry Trade Jl., vol. 34, no. 517, July 15, 1926, pp. 45-52, 9 figs. Raw material; plant used; sand reclamation; facing molds; melting plant; chemical and physical control.

HORIZONTAL CASTING. Casting Standard Lengths of Pipe Horizontally, J. R. McWane. Water Wks. Eng., vol 79, no. 15, Aug. 1, 1926, pp. 983-984. Emphasizes advantages of method of making cast-iron pipe horizontally, and employing green sand moulds; new method is said to be entirely different from old. (Abstract.) Paper read befroe Am. Water Wks. Assn.

MANUFACTURE. Modern Methods of Cast Iron Manufacture, T. E. Dimbleby. Junior Instn. Engrs.—Jl. and Rec. of Trans., vol. 36, part 10, July 1926, pp. 421-450, 19 figs. Vertical moulding plant; pit with fast and stationary boxes; cores and coremaking; assembling, casting and stripping; mechanical production of moulds; moulding machines; ramming machines; making pipes in permanent iron moulds; centrifugal process.

PIPE LINES

INLET AIR VALVES. Pipe Line Inlet Air Valves, J. W. Ledoux. Water Wks., vol. 65, no. 7, July 1926, pp. 303-306. Principles for determining number of air valves required on steel pipe lines with solution of practical problems.

PISTONS

ALUMINUM AND MAGNESIUM ALLOYS OF. Pistons of Aluminum "Alpax" and Magnesium (Les pistons en aluminium, en alpax et en magnésium), R. de Fleury. Académie des Sciences—Comptes Rendus, vol. 182, no. 10, Mar. 8, 1926, pp. 628-630, 1 fig. Disadvantages of thin-walled pistons in regard to carbonization, over-heating with consequent ill-effects on scavenging and efficiency, and on necessary tolerances in diameter, of ribbed pistons in respect of high heat transfer to lubricant, and of thick pistons on account of their weight, are claimed to be overcome by design described, which is intended to be made in light metal; advantages accruing from use of aluminum and magnesium alloys are demonstrated by data on their thermal constants.

INTERNAL-COMBUSTION ENGINES. The Pistons of Internal-Combustion Engines. Engineering, vol. 122, no. 3159, July 30, 1926, p. 142. As a result of numerous experiments, it has become recognized that cooling of pistons takes place chiefly by heat conductivity through walls in contact with cylinders; theoretical shape of piston must be modified according to coefficient of heat conductivity of metal employed; enumerates advantages of proper cooling of piston heads.

POLES, CONCRETE

CHARTS FOR. Charts for Reinforced Concrete Poles, P. Gillespie and F. E. Wilson. Can. Engr., vol. 51, no. 5, Aug. 3, 1926, pp. 175-179, 8 figs. Graphical methods for readily determining flexural resistance, deflection, etc., of reinforced concrete poles of typical section; their use will minimize materially labour ordinarily required.

POWER FACTOR

CORRECTION. Savings from Power Factor Correction, R. L. Hall. Elec. World, vol. 88, no. 2, July 10, 1926, pp. 61-64, 4 figs. British Columbia Elec. Railway Co. saves approximately $120,000 annually by power factor correction; necessity for additional generator capacity obviated.

Power-Factor Correction and How It May Be Accomplished, H. W. Terry. Power, vol. 64, no. 7, Aug. 17, 1926, pp. 242-244, 4 figs. There are five ways in which power-factor may be corrected; rearrangement of induction motors, use of static condensers, installation of synchronous condensers, installation of synchronous motors, and of self-excited induction-synchronous motors; each of these methods is considered.

The Economic Limit of Power-Faction Correction, A. R. Stevenson, Jr. Gen. Elec. Rev., vol. 29, no. 8, Aug. 1926, pp. 574-579, 4 figs. Importance and economic bearing of power factor; setting conditions for problem; measuring of terms; mathematical analysis; computations.

POWER TRANSMISSION

STRESS WAVE TRANSMISSION. The Transmission of Stress Waves Through Elastic Media, D. Laugharne-Thornton. World Power, vol. 6, no. 32, Aug. 1926, pp. 81-90, 5 figs. Describes wave stress system of power transmission.

PRECIPITATION

ELECTRICAL. Electrical Precipitation as Applied to Gas Streams, H. R. Hanley. Univ. of Missouri, School of Mines and Metallurgy—Bul., vol. 9, no. 2, Feb. 1926, pp. 7-64, 31 figs. Theory of electric precipitation; research work; electrical machinery; determination of solids in gases.

PRESSWORK

RADIO AND TELEPHONE PARTS. Press Work on Radio and Telephone Parts, F. J. Oliver, Jr. Am. Mach., vol. 65, no. 8, Aug. 19, 1926, pp. 309-312, 11 figs. Tooling for rapid production of high-quality standardized parts; blanking, drawing, forming and perforating operations are involved.

PRODUCER GAS

FURNACES FOR. Furnaces for Highly-Purified Producer Gas, K. Wentzel. Eng. Progress, vol. 7, no. 7, July 1926, pp. 179-180, 6 figs. Chemical purifying and desulphurizing of producer gas hitherto gave rise to difficulties owing to its acid character and tar vapours suspended in it; these difficulties have been overcome by addition of alkali to purifying mass and corresponding heating of latter; system developed by firm of Gafag in Frankfort, Germany.

PUBLIC UTILITIES

FINANCING OF. Financing Public Utility Corporations, M. J. Insull. West. Soc. of Engrs.—Jl., vol. 31, no. 6, June 1926, pp. 235-242. Method of operation and necessity for so-called holding companies.

PULVERIZED COAL

MARINE BOILERS. Pulverized Fuel for Marine Boilers. Mar. Engr. & Motorship Bldr., vol. 49, no. 588, Aug. 1926, pp. 298-300, 1 fig. Experiments carried out with powdered coal as fuel under Scotch boiler; particulars of new British fuel; method of distillation which results in production of gas, "L. & N." oil, and "L. & N." fuel from coal; "L. & N." process is method of low-temperature distillation developed by Sensible Heat Distillation Co., London.

PREPARATION COSTS. Powdered Coal Costs in Factory Plant, F. L. Wolf. Power Plant Eng., vol. 30, no. 16, Aug. 15, 1926, pp. 894-896, 5 figs. Ohio Brass Co. keeps detail records of coal-preparation costs.

SMALL PLANTS. Is Pulverized Coal Practical in Small Plants? H. C. Shields. Pit & Quarry, vol. 12, no. 8, July 21, 1926, pp. 71-74. Special equipment needed; more than fine grinding necessary; large furnace areas not necessary; amount of oxygen important; tube mill; destructive flames eliminated.

PUMPS

BOILER-FEED. Selection and Operation of Modern Boiler-Feed Equipment, C. L. Hubbard. Nat. Engr., vol. 30, no. 8, Aug. 1926, pp. 341-344, 6 figs. Types of boiler-feed pumps and their application for different operating conditions and service requirements; advantages and disadvantages of direct-acting power-driven and centrifugal pumps for different services; characteristics of centrifugal pumps.

GEAR. Gear Pump Capacities, H. Walker. Machy. (Lond.), vol. 28, no. 719, July 22, 1926, p. 451. Presents tables showing capacity factors of gear pumps of all sizes; capacity factor represents output in gallons per minute for one revolution of pump which has gears of unit face width.

R

RADIOTELEGRAPHY

SIGNALS AND INTERFERENCE, EFFECTS OF. Behaviour of Radio Receiving Systems to Signals and to Interference, L. J. Peters. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 8, Aug. 1926, pp. 707-716, 12 figs. Develops simple but effective way of answering questions which raise in dealing with effects of both signals and interference upon radio receiving systems when steady-state properties of system are known, or of arriving at best steady-state properties of system for receiving given signal through interference.

RADIOTELEPHONY

ELECTRIC LIGHT COMPANIES, RELATION TO. Radio and the Electric Light and Power Company, D. Sarnoff. Nat. Elec. Light Assn.—Bul., vol. 13, no. 7, July 1926, pp. 421-426. Present status of radio technical developments; radio and public good will; increased consumption of power; merchandizing aspects of radio; central stations' share of radio market; radio retailing, inductive interference.

RAILS

TRANSVERSE FISSURES. How the Illinois Central Watches Its Transverse Fissures. Ry. Eng. & Maintenance, vol. 22, no. 8, Aug. 1926, pp. 302-307, 7 figs. Methods and records which make possible prompt removal of defective heats.

RAILWAY ELECTRIFICATION

GREAT NORTHERN. Great Northern Electrification Plans. Elec. World, vol. 88, no. 7, Aug. 14, 1926, pp. 321-323, 2 figs. Single-phase motor-generator-type locomotives adopted; main-line electrification over cascades to cost more than three millions; Northern Pacific studying electrification.

RECTIFIERS

Mercury-Vapour. Glass Type Mercury-Vapour Rectifiers. Power Engr., vol. 21, no. 245, Aug. 1926, pp. 298-300, 4 figs. Account of British developments in static-converting plant.

REFRIGERATING MACHINES

Gas-Fired. Gas Refrigeration, N. T. Sellman. Gas Industry, vol. 26, no. 7, July 1926, pp. A-12-A-14 and (discussion) A-14-A-15. Claims that most gas machines developed to date are less noisy, less complicated and have fewer moving parts than electric ice machines; describes machine which is a small compact gas-fired refrigerating unit of absorption type and enumerates points which test on this machine will show.

Household-Type. Design Problems of the Household-Type Refrigerating Machines, M. Lassen. Refrig. Eng., vol. 12, no. 12, June 1926, pp. 409-413 and 4 5, 1 fig. Outline of factors which must be considered in any well-organized plan for developing small automatic refrigerating machine.

Improvements. Recent Improvements in Refrigerating Apparatus, F. Ophuls and G. A. Horne. Refrig. Eng., vol. 12, no. 12, June 1926, pp. 406-408 and 414-415. Authors' comment on discussion by T. Shipley on their paper presented at Fourth International Congress of Refrigeration in London, 1924, and published in this journal in May, 1926.

Diesel and Electric Drive. Comparison of the Electric and Diesel Drives for Ice Plants, C. T. Baker. Refrig. World, vol. 61, no. 7, July 1926, pp. 14-15. Basis for comparing relative merits of two systems of drive.

REFRIGERATION

Adsorption and. Adsorption and Its Relation to Refrigeration, F. G. Keyes. Refrig. Eng., vol. 12, no. 12, June 1926, pp. 416-417. Enumerates characteristics which adsorbent useful in refrigeration art must possess; aspect of problems encountered in connection with adsorbents and absorbents.

REFUSE DISPOSAL

Recovery of Urban Wastes. The Recovery and Use of Waste Materials, I. B. C. Kershaw. Indus. Chemist, vol. 2, no. 18, July 1926, pp. 309-314, 5 figs. Methods followed in preparing refuse for destructor plants; American and continental methods of refuse disposal.

REGULATORS

Induction. Operating Induction Regulators in Series-Parallel, E. H. Coxe, Jr. Elec. World, vol. 88, no. 5, July 31, 1926, pp. 226-227, 2 figs. Regulators having combined secondary relay and limit switch and regulators having double-pole, knife-blade type limit switches operate satisfactorily with primary relay operating two secondary relays in parallel, no other changes being made.

RIVERS

Bank Protection. Behaviour of Flexible Reinforced-Concrete Mattresses as Bank Protection on Deep Rivers, B. Okazaki. Eng. News-Rec., vol. 97, no. 7, Aug. 12, 1926, pp. 248-250, 1 fig. Satisfactory results obtained in river work in Japan; method of laying mattresses and fascines in deep water; experience with steel wire for under-water work.

Circulating Water Intakes on. Circulating Water Intakes on Inland Rivers, C. E. Colborn. Power Plant Eng., vol. 30, no. 16, Aug. 15, 1926, pp. 898-899, 4 figs. In absence of specific data, stratification of water in rivers must not be assumed.

ROAD, ASPHALT

Asphalt Mixers. 14-Ton Asphalt and Tar Macadam Plant. Engineering, vol. 122, no. 3159, July 30, 1926, pp. 130-132, 2 figs. Machine is equipped with elevator gear, rotary dryer, dust collector and paddle mixer.

ROADS, CONCRETE

Repairing. Methods of Repairing Concrete Roads, A. H. Hinkle. Roads & Streets, vol. 66, no. 1, July 1926, pp. 50-55, 1 fig. Procedure of Indiana State Highway Department. Paper presented before Miss. Valley State Highway Departments.

ROADS, EARTH

Lime, Use of. Use of Lime in Earth Roads, H. W. Wood, Jr. Cement Mill & Quarry, vol. 29, no. 2, July 20, 1926, pp. 26 and 28. Test for stabilizing effect; results of tests; practical treatment with lime; maintenance; test roads.

ROADS, GRAVEL

Sand and. Gravel and Sand Roads, R. H. Picher. Can. Min. Jl., vol. 47, no. 29, July 16, 1926, pp. 716-718. Composition; grading; binder; testing; construction; maintenance.

Type of Gravel. What is the Best Type of Gravel for Road Use? R. H. Picher. Contract Rec., vol. 40, no. 30, July 28, 1926, pp. 717-719. Important points in connection with use of gravel for highway construction and maintenance, based on observations of roads in Eastern Canada.

ROADS, MACADAM

Asphalt-Macadam. Asphalt-Macadam in Northeastern States, V. L. Ostrander. Roads & Streets, vol. 66, no. 1, July 1926, pp. 5-8. Construction details of work in New York and New England. Paper presented before New Hampshire Good Roads Assn.

Bituminous Macadam. Bituminous Macadam and Surface Treatment, E. B. Lockridge. Roads & Streets, vol. 66, no. 1, July 1926, pp. 56-58. Application of bituminous material; reconstruction of 21 miles of Lincoln Highway; patching bituminous macadam; treatment of stone and gravel surfaces. Paper presented at Twelfth Annual Road School, Purdue Univ.

Improvement in Design. Suggested Improvement in Macadam Road Design, A. T. Goldbeck. Eng. News-Rec., vol. 97, no. 6, Aug. 5, 1926, pp. 221-223, 8 figs. Granular subbase, stone shoulder drains, concrete or bituminous curbs to stop spreading and give edge strength. Abstracted from Jl. of Nat. Crushed Stone Assn.

ROOFS

Steel Truss. Steel Truss Roof for Chicago Riding Club. Eng. News-Rec., vol. 97, no. 7, Aug. 12, 1926, pp. 250-251, 1 fig. Light and ventilation factors in design; upper floor hung from transverse cantilever trusses.

S

SAFETY

Electrical Hazards. Electrical Hazards and the Safe Use of Electrical Apparatus, F. A. Gaby. Elec. News, vol. 35, no. 14, July 15, 1926, pp. 32-34. Ontario Hydro Commission regulation to avoid danger from shock and fire.

SAND, MOULDING

Facing Sands. A Practical View of Facing Sands. Foundry Trade Jl., vol. 34, no. 518, July 22, 1926, p. 79. Points out importance of mixing of facing sand; sands used in facings should be properly dried and then coal dust added; gives table of mixtures for various classes of mouldings; rule of blackings in facing mould.

Permeability and Cohesion, Measurement of. Practical Use of Apparatus for Measuring Permeability and Cohesion of Moulding Sand (Utilisation pratique des Appareils de mesure de la perméabilité et de la cohésion des sables de moulage), R. Lemoine. Fonderie Moderne, vol. 20, July 1926, pp. 155-162, 3 figs. Discusses mixtures for a given product, their composition and method of preparation; control of uniformity of materials for mixtures; control of mixtures to assure regularity of operations and uniformity of properties.

SCREW THREADS

Cutting Equipment. Thread-Cutting Equipment. West. Machy. World, vol. 17, no. 7, July 1926, pp. 302-304, 4 figs. Descriptions of various threading machines, die heads and taps.

SEPARATORS

Steam. Saving Fuel by Using Dry Steam, F. Dawson. Eng. & Boiler House Rev., vol. 40, no. 2, Aug. 1926, pp. 67-70, 5 figs. Types of separators for eliminating moisture from steam.

SEWAGE DISPOSAL

Activated-Sludge. New Activated-Sludge Plant of Essen, Germany, K. Imhoff. Eng. News-Rec., vol. 97, no. 8, Aug. 19, 1926, pp. 298-299, 6 figs. Submerged paddles supplemented by compressed air from diffuser plates produce activation at 8 hp. per M.G.

SEWER CONSTRUCTION

Concrete Road Machinery for. Concrete Road Machinery Adopted for a Three and a Half Million Dollar Sewer Job, F. W. Skinner. Good Roads, vol. 69, no. 7, July 1926, pp. 256-258, 4 figs. Work accomplished in construction of very large and deep concrete sewer, for which many of principal items of plant installed were identical with those necessary for heavy road construction; thus making it easy for any contractor for road work to make advantageous bids for sewer construction in idle times or vice versa.

SEWERS

Design. Notes on the Design of a Main Sewer, F. Wilkinson and F. W. Brown. Surveyor, vol. 70, no. 1800, July 23, 1926, pp. 77-82, 8 figs. Important factors governing design, such as drainage area, depth of sewer, construction and materials necessary for tunnelling and cost.

Laying. Laying 42-in. Concrete Pipe Sewer on Ocean Bottom. Eng. News-Rec., vol. 97, no. 8, Aug. 19, 1926, pp. 292-293, 1 fig. Work damaged by earthquake restored; derrick barge lowered pipe singly to diver; jointing done under water.

SHEET IRON

Pickling. Some Factors Influencing the Rate of Pickling of Sheet Iron, J. E. Hansen and G. S. Lindsey. Am. Ceramic Soc.—Jl., vol. 9, no. 8, Aug. 1926, pp. 481-492, 13 figs. Results of experiments with regard to various factors entering into pickling of sheet iron.

SHEET METAL

Machines for Working. Equipment for Sheet Metal and Structural Fabrication. West. Machy. World, vol. 17, no. 7, July 1926, pp. 309-311, 8 figs. Description of various machines, shears, rivetters, bending rolls, flanging machines, hammers, etc.

SHOVELS

Steel. The Steel Shovel—How It Is Made, M. W. Von Bernewitz. Iron Age, vol. 118, no. 5, July 29, 1926, pp. 273-274. Features of mine and works shovel; types reduced by standardization; larger use of steel handles; proper way to shovel.

SNOW REMOVAL

Highways. Snow Removal on Mountain Pass Highways. Eng. News-Rec., vol. 97, no. 8, Aug. 19, 1926, pp. 300-304, 9 figs. Two articles, as follows: Snoqualmie Pass Highway in Washington, N. A. Bowers; Fall River Pass Highway in Colorado, C. H. Vivian.

SOLAR ENGINES

Design Principles. Solar Engines, Remshardt. Eng. Progress, vol. 7, no. 7, July 1926, pp. 185-189, 8 figs. General principles for design; explanation of refractory plant planned by Remshardt.

STACKS

Welded Steel. Welded Steel Stacks Avoid Corrosion at Joints. Power Plant Eng., vol. 30, no. 16, Aug. 15, 1926, pp. 908-909, 5 figs. Guyed stacks built at shop and erected in one piece; self-supporting stacks built in place; both types are strong jointless steel cylinders.

STEAM PIPES

Expansion. Notes on Expansion of Steam and Hot Water Pipes, A. Lewis. Heat. & Vent. Mag., vol. 23, no. 28, Aug. 1926, pp. 61-64, 5 figs. With charts covering practice on high-pressure steam mains and hot-water piping. (Abstract.) Paper read before Victorian Inst. of Engrs.

STEAM TURBINES

Efficiencies. Notes on the Comparison of Steam Turbine Efficiencies, E. L. Robinson. Gen. Elec. Rev., vol. 29, no. 7, July 1926, pp. 503-510, 15 figs. Fundamental relations between efficiencies; reheat factor; condition curves; non-thermodynamic effects; percentage of heat recovery and economy.

Extraction. Extraction Turbine Fills Many Needs, S. B. Roberts. Power Plant Eng., vol. 30, no. 16, Aug. 15, 1926, pp. 896-898, 8 figs. Installation of 1,580-kva. mixed-pressure extraction unit effects considerable savings in industrial plant.

STEEL

Heat-Resisting. Modern Heat-Resisting Steels, Mech. World, vol. 80, no. 2064, July 23, 1926, pp. 59-60, 2 figs. New "Era/HR" heat-resisting steel produced by Hadfields, Ltd., Sheffield, Eng., exceptional characteristic of which is its freedom from scaling combined with unusually great strength at high temperatures.

Hardening. The Hardening of Steel: A Review and Some Comments, W. T. Griffiths. Metallurgist (Supp. to Engineer, vol. 141, nos. 3665, 3670, 3672 and 3676), Mar. 26, Apr. 30, May 28 and June 25, 1926, pp. 34-36, 51-53, 72-74 and 89-90, 8 figs.

High-Temperature Testing. Safe Stresses at High Temperatures. Metallurgist (Supp. to Engineer, vol. 142, no. 3681), July 30, 1926, pp. 104-106, 3 figs. Particulars of rated pressure of recent boiler installations; review of high-temperature tests, especially of work by Cournot and Sasagawa in Revue de Métallurgie, Dec. 1925, giving results for creep strength or viscosity limit relating to carbon steels, high-speed steel, silicon-chromium steel and nickel-chromium alloy.

Magnet. Some Factors Affecting Coercive Force and Residual Induction of Some Magnet Steels, J. R. Adams and F. E. Goeckler. Am. Soc. Steel Treating—Trans., vol. 10, no. 2, Aug. 1926, pp. 173-190 and (discussion) 190-194, 1 fig. Coercive force and residual induction of magnet steels as applicable to commercial problems; metallurgical factors that have greatest influence on these values are composition, melting, casting, rolling or forging, and heat treatment; tables which show effects of these factors upon magnet steel are investigated.

PHOSPHORUS, EFFECT OF. Effect of Phosphorus on the Endurance Limit of Low-Carbon Steels, F. F. McIntosh. Min. & Met., vol. 7, no. 236, Aug. 1926, pp. 332-333. Phosphorus increases strength and ability to withstand fatigue within limits; should be considered alloying element, not merely impurity.

STEEL, HEAT TREATMENT OF

CARBON STEELS. Facts and Principles Concerning Steel and Heat Treatment, H. B. Knowlton. Am. Soc. Steel Treating—Trans., vol. 10, no. 2, Aug. 1926, pp. 285-298. Manufacture, properties and uses of plain carbon steels other than tool steels from standpoint of consumer; effect of different carbon contents upon properties of steel.

CHEMICAL AND PHYSICAL CONSIDERATIONS. Heat Treatment Practice. Automobile Engr., vol. 16, no. 217, July 1926, pp. 262-263. Thermal critical points of steel; annealing; hardening and tempering; alloy steels.

GAS AS FUEL FOR. Gas as a Fuel for Heat Treating Metal, I. Ginsberg. Forging—Stamping—Heat Treating, vol. 12, no. 7, July 1926, pp. 250-252, 3 figs. Scope of industry great; efficient equipment results in economy; provisions for materials handling; most fuels essentially gaseous.

STEEL, HIGH-SPEED

HEAT TREATMENT, EFFECT OF. Hardness and Toughness of High-Speed Steel, R. K. Barry. Am. Soc. Steel Treating—Trans., vol. 10, no. 2, Aug. 1926, pp. 257-266, 10 figs. Physical properties of high-speed steel can be closely controlled by manner of heating, cooling, tempering and drawing; results of tests covering heat treatment.

STEEL MANUFACTURE

CHROME STEEL. Production of High Chromium Alloy Steel, R. S. Kerns. Blast Furnace & Steel Plant, vol. 14, no. 8, Aug. 1926, pp. 334-336. Manufacture of high-chromium alloy steel in acid-lined furnace; with proper care, acid furnaces are as satisfactory as basic.

RIMMED. Rimmed Steel and How It Is Made, H. D. Hibbard. Iron Age, vol. 117, no. 25, June 24, 1926, pp. 1778-1780, and vol. 118, nos. 3 and 4, July 15 and 22, 1926, pp. 142-143 and 214-215. June 24: Products made from rimmed or effervescence steels; uses and properties; effervescence and skinholes. July 15: Melting-furnace practice; effect of manganese; intermediate and central holes. July 22: Character of slags and casting temperatures; scums and what they indicate; extent of segregation.

STOKERS

COAL PRE-DRYING. Pre-Drying of Coal in Conjunction with Mechanical Stokers. Eng. & Boiler House Rev., vol. 40, no. 2, Aug. 1926, pp. 63-65, 2 figs. Points out that whole subject of pre-drying coal in conjunction with mechanical stokers ought to be reconsidered, especially as regards water-tube boilers.

STREAM POLLUTION

INVESTIGATION. Investigations of Stream Pollution, W. H. Frost. Mun. & County Eng., vol. 71, no. 1, July 1926, pp. 15-20. Review of research work of Bur. of Public Health Service.

STRUCTURAL STEEL

MADISON SQUARE GARDEN. Steelwork Found in Excellent Condition, F. W. Skinner. Blast Furnace & Steel Plant, vol. 14, no. 8, Aug. 1926, pp. 337-341, 7 figs. Structural framework of Madison Square Garden, except for few unprotected places, found in almost perfect condition after 35 years of service.

WELDED. Welded Steel Members and Joints Tested at Pittsburgh. Eng. News-Rec., vol. 97, no. 7, Aug. 12, 1926, pp. 263-265, 2 figs. Built girders and structural connections tested to failure; welds able to develop full strength of steel.

SUBWAYS

PHILADELPHIA. Subway Construction in Philadelphia, H. E. Ehlers. Contractors & Engrs. Monthly, vol. 13, no. 1, July 1926, pp. 55-62, 12 figs. Report of discussions by H. E. Ehlers, Director, Department of City Transit, Philadelphia, Pa., and Paul J. Brown, Managing Engineer, Keyston State Construction Company.

SWITCHGEAR

METAL-CLAD. Metal-Clad Switchgear. Power Engr., vol. 21, no. 245, Aug. 1926, pp. 289-293, 6 figs. Notes on recent introductions in high-tension switchgear.

T

TAPS

MANUFACTURING. Making Fine Taps in a Modern Tool Shop. Am. Mach., vol. 65, no. 8, Aug. 19, 1926, pp. 317-318, 6 figs. All material is subjected to chemical analysis and physical tests before being racked; different methods employed to make different kinds of taps.

TELEPHONY

ENGINEERING COSTS. Engineering Costs Studies, F. L. Rhodes. Telegraph & Telephone Age, no. 15, Aug. 1, 1926, pp. 339-344. Engineering costs studies made in connection with telephone industry; transmission standards and studies; other applications; factors entering into annual costs and their evaluation.

LOADING FOR CIRCUITS. Development and Application of Loading for Telephone Circuits, T. Shaw and W. Fondiller. Elec. Communication, vol. 4, no. 4, and vol. 5, no. 5, Apr. and July 1926, pp. 258-276 and 38-52, 18 figs. Review of art of loading telephone circuits as practised in United States; phantom group loading; loading for repeatered circuits; incidental cables in open wire lines; cross talk; telegraphy over loaded telephone circuits; loading for exchange area cables; submarine cables; extent of commercial application.

TRAFFIC DISTRIBUTION. Methods of Distributing Traffic, E. L. Gaines. Telephony, vol. 91, no. 5, July 31, 1926, pp. 12-15. Partial and intermediate distributing frame and other methods of distributing telephone traffic in use at present time.

TIDAL POWER

UTILIZATION. Choice of Current for Utilization of Tidal Power (Sure une forme de courant propre à l'utilisation des marées), L. Schwob. Revue Génerale de l'Electricité, vol. 19, no. 22, May 29, 1926, pp. 859-866, 2 figs. In author's belief transformation energy from tidal waves should be effected by means of apparatus of turbine-dynamo type with direct-current and variable speed; he recommends and describes Thury distribution system.

TEMPERATURE MEASUREMENTS

SURFACE. Measurement of Surface Temperatures, M. W. Boyer and J. Buss. Ind. & Eng. Chem., vol. 18, no. 7, July 1926, pp. 728-729, 2 figs. Portable thermocouple device compensated for heat losses.

TESTING MACHINES

MEASURING DIALS AND SPRING GAUGES. Measuring Dials and Spring Gauges for Testing Machines. Eng. Progress, vol. 7, no. 7, July 1926, p. 184, 2 figs. Testing machines with measuring dials, as developed by firm of Mohr & Federhaff of Mannheim; combination of two power-measuring devices offers advantage that either sliding weight balance or hydraulic balance may be operated singly or both measuring simultaneously.

TRANSFORMERS

HARMONICS, CIRCULATION IN CIRCUITS. Circulation of Harmonics in Transformer Circuits, T. C. Lennox. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 8, Aug. 1926, pp. 755-757, 9 figs. Describes manner in which certain harmonic currents may be permitted to flow within transformer network; shows how fifth and seventh harmonics of transformer exciting current may be eliminated from transmission lines; extent to which harmonic currents generated in rectifier may be eliminated from a.c. lines by means of phase multiplication.

220,000-VOLT. 28,866-kv.-a., 220,000-volt Transformers for Pennsylvania Power and Light Company, F. F. Brand. Gen. Elec. Rev., vol. 29, no. 7, July 1926, pp. 499-502, 5 figs. Largest 220-kv. transformers in world; support and insulation of coils; ratio adjuster; dimensions.

RATIO CHANGE UNDER LOAD. 60,000-Kv.-a. Transformer Banks Equipped for Change of Ratio Under Load, W. M. Dann. Elec. Jl., vol. 23, no. 8, Aug. 1926, pp. 398-402, 10 figs. Installation at Richmond Station of Phila. Elec. Co. consists of 120,000-kva. of transformer capacity, comprising two banks of 60,000-kva. each, made up of three 20,000-kva. single-phase units; adjustment of ratio under load is accomplished by having low-voltage winding arranged in two similar paralleled parts.

TUBES

TESTING. How Metal Tubing Should Be Tested, N. S. Otey. Iron Age, vol. 118, no. 8, Aug. 19, 1926, pp. 477-480, 11 figs. Tensile properties as affected by shape of test specimens; tube diameter influential factor.

TUNNELS

NORTHWESTERN PACIFIC R. R. N.W.P. Has a Thoroughly Safe Tunnel, W. S. Wollner. Ry. Rev., vol. 79, no. 4, July 24, 1926, pp. 127-128, 1 fig. Protection includes electric lights, circuit breakers and manual switches.

RAILWAY. Progress and Methods on the New Cascade Tunnel. Eng. News-Rec., vol. 97, no. 3, July 15, 1926, pp. 100-101. Construction detailed on 7¾-mile tunnel on Great Northern Railway; power equipment, character of ground, tunnelling plant.

VEHICULAR. The Holland Tunnel (The Hudson River Vehicular Tunnel), O. Singstad. Am. Inst. of Min. & Met. Engrs.—Trans., no. 1582-A-F, Aug. 1926, 19 pp., 2 figs. Basis of ventilation; difficulty in handling air flow; composition of exhaust gases; ventilation stations and systems; fan equipment and fan capacity; characteristics of ventilation system; compressed air tunnelling; solution of foundation problems; structure of tunnel; classes of materials penetrated; working through silt; blowouts and their cause.

VENTILATION. Ventilating the Holland Vehicular Tunnel. Heat. & Vent. Mag., vol. 23, no. 8, Aug. 1926, pp. 79-80, 4 figs. There are four ventilating stations with seven sources of air supply; exhaust fans in groups of three; air flow in tunnels.

TURBO-ALTERNATORS

FLUCTUATING LOAD WITH. Stability of Alternating-Current Turbine Generators with Fluctuating Loads, J. Strasser. Elec. Jl., vol. 23, no. 8, Aug. 1926, pp. 413-420, 16 figs. Deals with stability of synchronous machines where assumption of constant magnetic reluctance in any radial direction can be made, such as turbo-generators; special attention is paid to case of leading current in generator.

U

UNEMPLOYMENT

RELATION TO PRICE CHANGES. A Statistical Relation Between Unemployment and Price Changes, I. Fisher. Int. Labour Rev., vol. 13, no. 6, June 1926, pp. 785-792, 2 figs. Author finds correlation between rate of price changes and employment, and describes methods by which results are achieved.

V

VALVE GEARS

3-CYLINDER ENGINE. Calculation of the Valve Gear for 3-Cylinder Engines, S. Taga. Soc. Mech. Engrs. (Japan)—Jl., vol. 29, no. 110, June 1926, pp. 374-386, 5 figs. Method of calculation for 3-cylinder valve gear when (1) cylinders are in same plane and cranks are at 120 deg.; (2) when middle cylinder is inclined and cranks are at 120 deg., and (3) when middle-cylinder inclines and crank angles are correspondingly changed. (In Japanese.)

VENTILATION

RATIONAL BASIS FOR. A Rational Basis for Ventilation, J. E. Rush. Am. Soc. of Heat. & Vent. Engrs.—Jl., vol. 32, no. 8, Aug. 1926, pp. 581-616. Historical review of experimental work; composition of air and changes on respiration and combustion; consideration of various constituents of air.

VOLTMETERS

WAVE-SHAPE FACTOR AND. A New Wave-Shape Factor and Meter, L. A. Doggett, J. W. Heim and M. W. White. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 2, Feb. 1926, pp. 131-136, 6 figs. Star-connected circuit consisting of two voltmeters and one variable condenser has certain properties upon which wave-shape factor may be based; from any measured ratio of voltmeter readings, purity of voltage wave may be determined; maximum possible percentage of any single harmonic present in wave can be immediately obtained; wave-shape meter is proposed for practical application which consists essentially of two voltmeters and variable condenser.

W

WAGES

BASIS OF. What Determines Wages in Industry, J. D. Cox, Jr. Open Shop Rev., June 1926, p. 255-264. Relative wages; importance of management; problem of general level of wages; wage levels depend on productive efficiency; law of general wage level; problem of price and wage cycles.

BONUS SYSTEMS. *See Bonus Systems.*

WATER GAS

MANUFACTURE. The Story of Carburetted Water Gas, T. W. Stone. Am. Gas Jl., vol. 125, nos. 2, 3 and 4, July 10, 17 and 24, 1926, pp. 30-31, 40, 49-51 and 72-74. July 10: Six periods of development outlined. July 17: Development of details; rise in back pressure; steam; oil economy; automatics, hydraulics, interlocks; regulation. July 24: Economizing processes; waste-heat boiler; automatic charger; self-cleaning grates.

WATER PIPES

LININGS AND COVERINGS. Linings and Coverings for Water Pipes, B. Talbot. Can. Engr., vol. 51, no. 3, July 20, 1926, pp. 151-152. Various methods of preserving pipes from corrosion; bitumen dipping for steel pipe; causes of corrosion: properties a preservative should possess; Talbot hydrocarbon process for protecting pipe and its principal features.

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A

ABRASIVE WHEELS

Standard Types. Standard Types of Grinding Wheels. Am. Mach., vol. 65, no. 11, Sept. 9, 1926, p. 465. Reference-book sheet. Simplified-practice standards.

ACCELEROMETERS

Types. Accelerometers, F. Paulsen. Elec. Jl., vol. 23, no. 9, Sept. 1926, pp. 475-478, 12 figs. Simple forms of accelerometers; mechanical and hydraulic types; electrical accelerometers. Bibliography.

ACCIDENT PREVENTION

Industrial. Industrial Accidents and Hygiene. Monthly Labor Rev., vol. 23, no. 2, Aug. 1926, pp. 41-46. Problem of national accident statistics; what is being done in collection of accident statistics; and to develop national accident-prevention statistics; other phases of accident-prevention problem; resolutions passed by Conference.

AERIAL PHOTOGRAPHY

Surveying. Aerial Photographic Survey of International Waters. Eng. News-Rec., vol. 97, no. 11, Sept. 9, 1926, p. 431. Advantages in time, cost, detail and accuracy in mapping Rainy lake district by amphibian plane.

AIR COMPRESSORS

Turbo. Turbo Compressors and Turbo Blowers (Turbo-Compresseurs et Turbo-Soufflantes), E. Moerlen. Société Alsacienne de Constructions Mecaniques—Bul., vol. 4, no. 15, July 1926, pp. 59-69, 13 figs. Design and construction of Société Alsacienne machines; their advantages, fields of application, control, constant and variable speed regulation.

AIR-CONDITIONING

Principles and Apparatus. Air-Conditioning and Air-Conditioning Apparatus, J. W. Cooling. Domestic Eng. (Lond.), vol. 46, nos. 7 and 8, July and Aug. 1926, pp. 140-145 and 157-163, 11 figs. Control of temperature, humidity, cleanliness and air distribution; air-conditioning apparatus; automatic controls.

Problems. Air-Conditioning, S. C. Bloom. Refrig. Eng., vol. 13, no. 1, July 1926, pp. 10-13 and (discussion) 13-15. Term includes heating, cooling, humidifying, dehumidifying, purifying and distributing air for regulation of atmospheric conditions within enclosed spaces; deals with offices and cooling problem.

AIRPLANE ENGINES

Air-Cooled. Some Problems in the Design of an Air-Cooled Radial Engine, R. W. A. Brewer. Aviation, vol. 21, no. 10, Sept. 6, 1926, pp. 410-411. Considers problems which confront designer, such as brake horse power, speed of revolution, cooling and cowling, weight, number of cylinders, disposition of accessories, lubrication and fuel arrangement, kind of fuel to be used, mounting, type and arrangement.

Compression-Ignition. The High-Duty Compression-Ignition Engine, D. R. Pye. Engineering, vol. 122, no. 3163, Aug. 27, 1926, pp. 277-279, 1 fig. Describes what has been done toward development of engine burning heavy oil for use in air; this type of engine offers great possibilities of development, both as regards fuel economy and saving of weight in material. Paper read before Sect. G, Brit. Assn.

Developments. Progress in Aircraft-Engine Design, A. Nutt. Soc. Automotive Engrs.—Jl., vol. 19, no. 3, Sept. 1926, pp. 239-247, 14 figs. Reviews marked advance made in last ten years in constructional details in airplane-engine and airplane performance; describes each type of engine produced successively by Curtiss Airplane & Motor Co., Buffalo, and tells of changes made to improve performance.

AIRPLANE PROPELLERS

Airplane Structure, and. Interaction Between Air Propellers and Airplane Structures, W. F. Durand. Nat. Advisory Committee Aeronautics—Report, no. 235, 1926, 23 pp., 36 figs. Investigation conducted at Leland Stanford Junior University to determine character and amount of interaction between air propellers as usually mounted on airplanes and adjacent parts of airplane structure.

Characteristics. Navy Propeller Section Characteristics as Used in Propeller Design, F. E. Weick. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 244, Aug. 1926, 7 pp., 10 figs.

Vibration. Airscrew Vibration and Gear Stripping, J. Morris. Roy. Aeronautical Soc.—Jl., vol. 30, no. 188, Aug. 1926, pp. 495-502, 2 figs. Author contradicts statement made by J. D. Siddeley in paper published in same journal in March 1925, in which he stated that inclusion of reduction gears has been responsible for limiting seriously degree of reliability of power unit.

AIRPLANES

Airfoils. Aerodynamic Characteristics of Airfoils. Nat. Advisory Committee for Aeronautics—Rept, no. 244, 1926, pp. 191-230, 124 figs. Collection of data on airfoils made from published reports of number of leading aerodynamic laboratories of United States and Europe.

Rotating Wings. An Airplane with Rotating Wing (Avion a voilure tournante), J. L. Breton. Académie des Sciences—Comptes Rendus, vol. 182, no. 18, May 3, 1926, pp. 1079-1082. Details of Moineau vertical type, consisting of one or more paddle wheels, whose oblique action gives lifting power similar to that of helicopter.

The Rotating Wing in Aircraft, H. E. Wimperis. Engineering, vol. 122, no. 3162, Aug. 20, 1926, pp. 246-248, 3 figs.

Three-Engined. Three-Engine Planes for Air Transport, C. G. Peterson. Aviation, vol. 21, no. 9, Aug. 30, 1926, pp. 354-357, 7 figs. Points out that reliability and punctuality are insured by three-engine principle in commercial air transportation; comparative fuel costs.

AIRSHIPS

Mooring. The Development of Airship Mooring, G. H. Scott. Roy. Aeronautical Soc.—Jl., vol. 30, no. 188, Aug. 1926, pp. 459-474 and (discussion) 474-481.

Shenandoah Disaster. Technical Aspects of the Loss of the U.S.S. Shenandoah. Am. Soc. Nav. Engrs.—Jl., vol. 38, no. 3, Aug. 1926, pp. 487-694, 29 figs. Conclusions arrived at by National Advisory Committee for Aeronautics in design of Shenandoah.

ALLOY STEEL

Chemically Resistant. Chemically Resistant Steels—With Special Reference to Very High and Very Low Temperatures, T. G. Elliot and G. B. Willey. Chem. & Industry, vol. 45, no. 31, July 30, 1926, pp. 526-534, 7 figs. Discusses properties of steels for very high and very low temperatures; newer types of nickel-chromium and other steel alloys mentioned offer great promise to chemical engineer for nitrogen fixation, synthetic ammonia, oil cracking, nitric acid, etc.

ALLOYS

Aluminum. *See Aluminum Alloys.*
Copper. *See Copper Alloys.*
Gun Metal. *See Gun Metal.*
Iron Alloys. *See Iron Alloys.*

ALUMINUM

Casting. *See Casting Aluminum.*

Castings. Aluminum Castings of High Strength, R. S. Archer and Z. Jeffries. Am. Inst. of Min. & Met. Engrs.—Trans., no. 1590-E, Sept. 1926, 26 pp., 5 figs. Describes compositions and processes which appear to authors to offer greatest promise for production on commercial scale of aluminum castings of superior mechanical properties, with special reference to heat-treated castings; tests for suitability of alloy; casting characteristics; toughness in castings; heat treatment of castings; commercial development of heat-treated castings; "Y" alloy castings; recent laboratory results.

Corrosion, Protection Against. The Protection of Aluminum and Its Alloys Against Corrosion by Anodic Oxidation, G. D. Bengough and H. Sutton. Engineering, vol. 122, no. 3163, Aug. 27, 1926, pp. 274-277, 6 figs. Authors find that film produced by anodic oxidation in bath containing chromate, bichromate or chromic acid is effective method of protecting against corrosion; details of treatment of various alloys of aluminum by this method, results of testing such treated specimens in sea water, and development of process on technical lines. Paper read before Sect. G of Brit. Assn. See also Metal Industry (Lond.), vol. 29, nos. 7 and 8, pp. 153-154 and 175.

ALUMINUM ALLOYS

Aluminum-Silicon. The Constitution and Structure of the Commercial Aluminum-Silicon Alloys, A. G. C. Gwyer. Inst. Metals—Advance Paper, no. 404, for mtg. Sept. 1-4, 1926, 43 pp., 54 figs.

AMMONIA

Heat Diagram. Ammonia Heat Diagram—How to Use It, T. M. Gunn. Refrigeration, vol. 40, no. 2, Aug. 1926, pp. 44-46, 1 fig. Examples of use of chart prepared by Bureau of Standards.

AMMONIA COMPRESSORS

Atmospheric Pressure, Effects of. Atmospheric Pressure Affects Ice Machines, W. H. Motz. Power Plant Eng., vol. 30, no. 18, Sept. 15, 1926, pp. 1019-1020. Analysis of difference in capacity and power consumption between identical machines with different barometric pressures.

Improvement. Recent Improvements in Refrigerating Compressors. Power Engr., vol. 12, no. 246, Sept. 1926, pp. 336-337, 1 fig. Effect of increased speed on methods of construction.

Leakage Reduction. How to Reduce Ammonia Compressor Leakage, F. H. Randolph. Power, vol. 64, no. 11, Sept. 14, 1926, pp. 404-405. Suggests proper precautions in plants having difficulty in getting proper results from compressor stuffing box.

APPRENTICES, TRAINING OF

Foundry. Creates Supply of Skilled Labour, R. A. Fiske. Iron Age, vol. 118, no. 12, Sept. 16, 1926, pp. 766-768 and 823, 4 figs. Chicago foundry conducts apprenticeship course in moulding, pattern-making and tool-making; both class-room instruction and shop training provided.

Training Boys for the Foundry, E. N. Simons. Foundry Trade Jl., vol. 34, no. 523, Aug. 26, 1926, pp. 175-176. In majority of foundries, system of "learnership" is in force; these usually comprise precise verbal agreement between employer and lad that latter shall have opportunity to pick up trade at former's plant, though employer is not bound to teach lad; examination of methods of training adopted.

ASBESTOS

PAINTS. Asbestos and Asbestos Paints, H. Cornell. Asbestos, vol. 8, no. 2, Aug. 1926, pp. 9-11, 13, 14, 16, 18, 20 and 23. Includes references to ancient knowledge of asbestos, general data on properties and uses, indications as to how it is ordinarily prepared for use; analyses. Translated from Farbe and Lack, Centralblatt.

AUTOMOBILE ENGINES

CRANKCASE-OIL DILUTION. Eliminating Dilution by the Application of Heat, J. C. Coulombe. Soc. Automotive Engrs.—Jl., vol. 19, no. 3, Sept. 1926, pp. 282-287, 4 figs.

FUELS. *See Automotive Fuels.*

OIL-RECTIFIERS. The Oil-Rectifier, W. G. Wall. Soc. Automotive Engrs.—Jl., vol. 19, no. 3, Sept. 1926. pp. 279-282, 3 figs. Describes rectifier designed to take out all water and to keep diluent between 4 and 5 per cent and viscosity above 250 sec. at 100 deg. Fahr., oil being forced through by pressure of oil pump at rate of about 3 gal. per hr.

PISTONS. *See Pistons.*

AUTOMOBILES

PARTS, MANUFACTURE OF. A Modern Plant for the Manufacture of Automotive Parts. West. Machy. World, vol. 17, no. 8, Aug. 1926, pp. 341-343, 8 figs. Methods and equipment of new plant of Mann Manufacturing Co., Berkeley, Cal.

SPRING-SUSPENSION. Relation of Spring-Suspension to Riding Qualities, F. C. Mock. Soc. Automotive Engrs.—Jl., vol. 19, no. 3, Sept. 1926, pp. 288-294, 9 figs.

AUTOMOTIVE FUELS

ALCOHOL. Experiences with Alcohol Motor Fuels, J. D. Ross and W. R. Ormandy. Chem. & Industry, vol. 45, no. 33, Aug. 13, 1926, pp. 273T-280T, 8 figs. Modern researches into nature and behaviour of various types of fuel in automobile cylinder.

BENZOL. *See Benzol.*

SPONTANEOUS IGNITION. Spontaneous Ignition of Carburetted Fuel Mixtures (L'Auto-inflammation des mélanges carburés), A. Pignot. Jl. des Usines à Gaz, vol. 50, no. 15, Aug. 5, 1926, pp. 293-298, 12 figs. Discusses difficulty encountered in increasing coefficient of compression in explosion engines due to premature ignition and studies flammability of carburetted fuel mixtures from this point of view.

AVIATION

LIGHTING EQUIPMENT. Lighting Equipment for Airways, Airports and Airplanes. Soc. Automotive Engrs.—Jl., vol. 19, no. 3, Sept. 1926, pp. 309-319, 22 figs. In Part I, by H. C. Ritchie, navigational aids needed to enable pilot to keep on his course are discussed. Part II, C. T. Ludington, outlines certain other phases of aeronautic lighting and particularizes on products of company represented by author.

B

BEAMS

J. & L. JUNIOR. "J. & L." Junior Beam Construction Tested, C. R. Young. Can. Engr., vol. 51, no. 9, Aug. 31, 1926, pp. 255-256, 3 figs. Test panel carries normal dead load and 4.38 times rated live load without failure; deflections for twice rated live load much less than those permissible for plastered ceilings; hanger tests satisfactory.

BENDING

TESTS. Material Bend Tests. Machy. (Lond.), vol. 28, no. 722, Aug. 12, 1926, p. 557. Admiralty bend test; machining of test pieces; grinding on test piece.

BENZOL

AUTOMOBILE FUEL, AS. Tests of Benzol as a Motor Engine Fuel. Oil Eng. & Technology, vol. 7, no. 124, Aug. 1926, pp. 355-358, 5 figs. Examination of tendency to deposit resinous compounds on automobile engine parts.

BLAST FURNACES

AIR DRYING. Drying Air for Blast Furnaces with Silica-Gel, F. Krull. Iron & Coal Trades Rev., vol. 113, no. 3049, Aug. 6, 1926, pp. 191-192, 2 figs. Air drying is understood to mean reduction of water vapour or humidity content per weight unit of air in contradistinction to change in humidity of air by increase of temperature; previous drying processes; use of silica-gel as adsorbent. Translated from Zeit. des Vereines deutscher Ingenieure.

BLASTING

SUBMARINE. Submarine Blasting, S. R. Russell. Contractors' & Engrs'. Monthly, vol. 13, no. 2, Aug. 1926, pp. 73-76, 1 fig. Discusses methods and costs. Rock removal under water is more difficult procedure than other kinds of blasting and is higher in cost; precautions that have to be taken. See also Contract Rec., vol. 40, no. 32, Aug. 11, 1926, pp. 767-769, 1 fig.

BOILER FEEDWATER

CONDITIONING. Boiler Water Conditioning with Special Reference to High Operating Pressure and Corrosion, R. E. Hall. Combustion, vol. 15, no. 3, Sept. 1926, pp. 156-159, 1 fig. Scope of boiler-water conditioning; prevention of scale formation on evaporating surfaces; relation between chemical used in treatment and operating pressure; control of non-condensable gases in steam by conditioning of boiler water.

EQUIPMENT. The Selection and Operation of Modern Boiler Feed Equipment, C. L. Hubbard. Nat. Engr., vol. 30, no. 9, Sept. 1926, pp. 401-405, 12 figs. Operating principles, construction details, and applications of automatic water-level regulators; feed-water regulation problems in practice; type of regulators and their applications; construction details of different types of regulators.

BOILER FIRING

HONEYCOMBING. Fuel Losses Resulting from Honeycombing and Excessive Clinkering, S. W. Parr. Combustion, vol. 15, no. 3, Sept. 1926, pp. 167-168. Points out that primary cause for honeycombing is presence of finely-divided particles in coal as fired; clinkering of grates.

INDUSTRIAL POWER PLANTS. How Industrial Power-Plant Boilers Are Fired. Power, vol. 64, no. 12, Sept. 21, 1926, p. 445, 1 fig. Hand-firing is still used in one-half of industrial plants; 35 per cent use automatic stokers.

BOILER PLANTS

TEXTILE MILLS. Modernized Boiler Plant and Electric Drive Nets 35 Per Cent on Investment, H. M. Wilson. Power, vol. 64, no. 12, Sept. 21, 1926, pp. 428-430, 5 figs. By replacing obsolete engine and power transmission equipment with motors using purchased energy, and by substituting stoker firing with re-designed furnaces for hand-firing, management of textile mill, with initial investment of $225,000, reduced annual operating cost from $195,000 to $115,000.

BOILERS

BARREL PLATES. Boiler Barrel Plates. Ry. Engr., vol. 47, no. 560, Sept. 1926, pp. 306-307, 1 fig. Formula and chart for calculation.

ELECTRIC. Electric Steam Generation, C. H. Tupholme. Elec. Rev., vol. 99, nos. 2543 and 2544, Aug. 20 and 27, 1926, pp. 292-293 and 331-333, 10 figs. Details of modern electric-boiler equipment.

JOINT EFFICIENCY. Joint Efficiency Easily Checked with New Tables, A. G. Peterse. Power, vol. 64, no. 9, Aug. 31, 1926, pp. 338-340. To determine safe working pressure of boiler, it is necessary to know efficiency of its rivetted joints; presents tables compiled to eliminate tedious calculations necessary to determine weakest part of joint and efficiency.

LOSS ANALYSIS. Analyzing Boiler Losses, L. J. Levit. Power, vol. 64, no. 11, Sept. 14, 1926, p. 420, 2 figs. Author points out causes of boiler losses and shows their relative importance.

LOCOMOTIVE. *See Locomotive Boilers.*

TESTS. Operating Boiler Tests Show Important Relations. Power Plant Eng., vol. 30, no. 17, Sept. 1, 1926, pp. 944-946, 6 figs. Variation of draft loss, superheat, efficiency and losses with rate of forcing and percentage of CO_2.

WATER-GAUGE GLASS. A High-Pressure Water-Gauge Glass. Engineer, vol. 142, no. 3685, Aug. 27, 1926, p. 232, 1 fig. With object of providing water-gauge glass capable of safely withstanding high boiler pressures, R. Klinger, London, has made several modifications in its original form of prismatic glass, which shows water in black, while steam space is bright; this effect is produced by refraction from ribbed inside face of glass.

BRASS

EXTRUDING. Problems in Extruding Brass, L. Kroll. Brass World, vol. 22, no. 8, Aug. 1926, pp. 253-254, 3 figs. Tested methods in obtaining good results; how to prevent cracking.

BRASS FOUNDRIES

COSTS. Brass Foundry Costs. Brass World, vol. 22, no. 8, Aug. 1926, pp. 245-246. Careful analysis of fuel expense shows cost of gas for melting metal less than cost of labour for pouring.

HEALTH HAZARDS. Health Hazards of Brass Foundries, J. A. Turner and L. R. Thompson. Metal Industry (N.Y.), vol. 24, no. 9, Sept. 1926, pp. 375-376. Results of field investigations; following conditions which have directly or indirectly detrimental influence upon health and efficiency of workers were observed to be present in foundries visited: exposure to dust; inadequate illumination and glare; inadequate ventilation; presence of fumes, gases, smoke, heat, cold, dampness.

BRIDGE DESIGN

BRACING. The Lateral and Transverse Bracing of Bridges, J. Husband. Structural Engr., vol. 4, no. 8, Aug. 1926, pp. 264-268, 5 figs. Lateral systems of deck bridges follow closely same line as for through bridges; transverse bracing comprises sway and portal bracing.

BRIDGE STRENGTHENING

RAILWAY BRIDGES. Strengthening Existing Bridges, O. Arup. Concrete & Constr. Eng., vol. 21, no. 8, Aug. 1926, pp. 544-549, 6 figs. How problem has been tackled in case of three single-track railway bridges in Sweden.

BRIDGES, CONCRETE

ARCH. Six Concrete Arch Bridges at the Twin Cities. Eng. News-Rec., vol. 97, no. 10, Sept. 2, 1926, pp. 370-371, 1 fig. Four bridges under construction in and near St. Paul and Minneapolis represent diverse features of design adapted to special conditions at respective sites.

CURVED ARCHES. Curved Arch Spans in Long Concrete Bridge, C. H. Wood. Eng. News-Rec., vol. 97, no. 9, Aug. 26, 1926. pp. 342-344, 3 figs. Sharp turn in recently-opened bridge over Mohawk, at Schenectady, is carried by two arches curved in plan.

WINTER ERECTION. Concrete Bridge Built in Winter Time. Contract Rec., vol. 40, no. 33, Aug. 18, 1926, pp. 780-781, 2 figs. New structure over mill stream, Galt, Ont., is designed as double culvert; constructed during winter to take advantage of lower costs.

BRIDGES, HIGHWAY

NEW JERSEY AND STATEN ISLAND. Highway Bridges to Connect New Jersey and Staten Island, O. H. Ammann. Eng. News-Rec., vol. 97, no. 9, Aug. 26, 1926, pp. 345-347, 2 figs. Details of two large structures being built by Port of New York Authority across Arthur Kill.

BRIDGES, RAILWAY

INTERMEDIATE SUPPORT. Hanging Girder Ends from Above Eliminates Necessity for Piers, G. A. Haggander. Ry. Age, vol. 81, no. 10, Sept. 4, 1926, pp. 411-413, 5 figs. Unusual method of supplying intermediate support for bridge spans in location that did not permit of construction of pier or bent was adopted by Chicago, Burlington & Quincy, for structure carrying wye track over tracks of three other railroads.

BRIDGES, SUSPENSION

CABLE CALCULATION. Cable Calculations for the Delaware River Bridge, G. M. Rapp. Franklin Inst.—Jl., vol. 201, no. 6, June 1926, pp. 712-734, 4 figs. Outline of composition, physical qualities and geometry of cables; calculation of cable design, tower analysis; stiffening truss analysis; erection.

DELAWARE RIVER. The Erection of the Suspended Structure of the Delaware River Bridge, R. G. Cone. Franklin Inst.—Jl., vol. 201, no. 6, June 1926, pp. 691-711, 17 figs. Erection was divided into two distinct phases: hanging steel on cables and adjusting members for rivetting; adjusting and rivetting; roadway-slab details.

BUILDING MATERIALS

UNIT STRESSES. Unit Stresses, F. E. Turneaure. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 7, Sept. 1926. Symposium of articles, as follows: Unit Stresses, F. E. Turneaure, pp. 1424-1427; Unit Working Stresses in Reinforced Concrete, A. E. Lindau, pp. 1428-1431; Unit Stresses in Structural Steel (For Buildings), D. B. Steinman, pp. 1432-1435; Unit Stresses in Timber, J. A. Newlin, pp. 1436-1443, 4 figs.

BRONZES

PROPERTIES. Physical Properties of Engineering Materials. Power Engr., vol. 21, nos. 241, 242, 244 and 245, Apr., May, July and Aug. 1926, pp. 136-138, 183-185, 264-266, 294-295, 7 figs. Apr.: Gunmetal. May: Phosphor and Aluminium bronze. July: Silver bronze, manganese bronze; miscellaneous bronzes. Aug.: Manganese.

C

CABLES, ELECTRIC

MUSCLE SHOALS INSTALLATION. Cable Installation for Muscle Shoals Power House Described, H. M. Friend. Elec. World, vol. 88, no. 11, Sept. 11, 1926, pp. 517-520, 3 figs. Specifications for cable manufacture rigidly observed, with strict inspections during course of manufacture; additional exacting tests applied in installation at plant; arrangement of circuits in power house.

Sag-Tension Curves. Sag-Tension Curves, E. S. Parker. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 7, Sept. 1926, pp. 1335-1342, 4 figs. New method of analysis for tensions and sags in span of wire or cable.

Three-Core. The Economical Thickness of Dielectric in a Three-Core H.T. Cable, N. A. Allen. World Power, vol. 6, no. 33, Sept. 1926, pp. 143-146, 3 figs. Attempts to develop formula which will be correct for three-core cables.

CASE-HARDENING

Gas Furnaces for. Case-Hardening and Fuel Costs. Metal Industry (Lond.), vol. 29, no. 8, Aug. 20, 1926, pp. 178-179, 2 figs. Application of gas heating to different heating processes connected with case-hardening and similar work; describes type of furnace for work with system of double regenerators; developed by Davis Furnace Co., Luton; it is known as Revergen and operates upon coal gas at ordinary main pressure.

Case-Hardening in Gas-Heated Furnaces, A. J. Smith. Forging—Stamping—Heat Treating, vol. 12, no. 8, Aug. 1926, pp. 289-290, 1 fig. Application of reversible regeneration to case-hardening furnaces makes use of artificial gas a satisfactory and economical fuel.

Piston Rods. Carburizing Piston Rods and Long Tubes. Am. Mach., vol. 65, no. 12, Sept. 16, 1926, pp. 491-492, 3 figs. Methods that have been developed for handling large pieces commercially; securing uniform work that must meet very severe specifications.

CAST IRON

Heat Treatment, Effect of. Improve Gray Iron Properties by Heat Treatment, O. W. Potter. Foundry, vol. 54, no. 17, Sept. 1, 1926, pp. 678-680, 3 figs. Results obtained from various tests for tensile, transverse and impact properties; results of tests for dimensional changes and hardness, showing in detail effect of heat treating on physical properties of cast iron.

Testing. Shearing Tests to Determine Strength Properties of Cast Iron (Scherversuche zur Beurteilung der Festigkeitseigenschaften von Gusseisen), M. Rudeloff. Giesserei, vol. 13, nos. 33 and 34, Aug. 14 and 21, 1926, pp. 577-584 and 594-598, 20 figs. Method is tried out by which it is possible to determine properties of iron on different parts of casting varying in thickness.

CASTING

Aluminum. The Casting of Aluminum. Brass World, vol. 22, no. 8, Aug. 1926, pp. 255-256. Fundamental requirements necessary to obtain good results; gas or oil furnaces preferred to coke; electric arc not successful because of oxidation.

Centrifugal. Bronze Worm-Gear Blanks Produced by Centrifugal Casting, F. W. Rowe. Inst. Metals—Advance Paper, no. 411, for mtg. Sept. 1-4, 1926, 13 pp., 14 figs.; also abstract in Engineering, vol. 122, no. 3165, Sept. 10, 1926, 338-341, 8 figs. Describes general metallurgical features which obtain in bronze worm-wheel gears cast by various methods and improvements which result from casting these wheels by centrifugal method.

Centrifugal Casting and Its Problems, L. Frommer. Iron Age, vol. 118, no. 9, Aug. 26, 1926, pp. 548-550, 1 fig. Comparisons with sand casting; alloys suited for centrifugal product; phenomena in mold of each process. Translated abstract from Zeit. für Metallkunde, 1925, p. 245.

Cored Work in Iron. Casting Cored in Iron, W. J. May. Mech. World, vol. 80, no. 2065, July 30, 1926, pp. 90-91. Enclosed cores of any kind or shape should always be compressible up to certain stage.

CASTINGS

Inspection. Inspecting Castings. Metal Industry (Lond.), vol. 29, no. 8, Aug. 20, 1926, pp. 177-178. Duties of inspector.

Iron. *See Iron Castings.*

Specifications. Tentative Specifications for 88-8-4 Sand Castings. Foundry, vol. 54, no. 17, Sept. 1, 1926, supp. page. Foundry data sheet for physical properties and tests.

CENTRAL STATIONS

Control of Auxiliaries. Control Equipment for Electrically-Driven Central Station Auxiliaries, W. C. Plumer and J. W. Dodge. Gen. Elec. Rev., vol. 29, no. 9, Sept. 1926, pp. 617-623, 17 figs. Auxiliary control requirements for central stations; control for various types of a.c. and d.c. motors; automatic combustion regulation.

Organization of. Building Up an Organization to Operate the New Plant. Power, vol. 64, no. 9, Aug. 31, 1926, pp. 324-325. Finds out that continuity of service is most important thing in power station, and next most important is efficiency.

CHAINS

Standard. Standard Chains, Eyebolts and Shackles. Machy. (Lond.), vol. 28, no. 724, Aug. 26, 1926, pp. 613-614, 6 figs. Presents tables for standard chains (single and double), eyebolts and shackles which should be found of value inasmuch as usual tables do not state safe loads.

CHIMNEYS

Concrete, Shell Temperatures. Electrical Determination of Temperatures in Chimney Shells, E. A. Dockstader. Elec. World, vol. 88, no. 8, Aug. 21, 1926, pp. 363-365, 5 figs. Importance of temperature stresses in reinforced-concrete chimneys is emphasized; individual thermocouple circuits give best results; preliminary heat-drop data.

CIRCUIT BREAKERS

Oil. E.H.T. Oil Circuit-Breakers. Elecn., vol. 97, no. 2515, Aug. 13, 1926, p. 185, 3 figs. New heavy-current type for Canadian market; satisfactory heat and tripping tests.

CITY PLANNING

Aerial Surveys for. Aerial Surveys for City Planning, G. H. Matthews. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 7, Sept. 1926, pp. 1349-1360. Considers what kinds of maps are best suited for city planning and zoning, and in what way aerial photography may be used to advantage in producing such maps.

COAL

By-Products. Power Possibilities of Coal By-Products, W. H. Blauvelt. Franklin Inst.—Jl., vol. 202, no. 3, Sept. 1926, pp. 307-322, 6 figs. Presents lists of principal products obtained from petroleum and those obtained from treatment of coal; author claims that if advantages gained by processing of coal are to be anything like great advantages suggested by similar work done in petroleum industry, some efficient process for low-temperature distillation of raw coal must be found; improvements made in recent processes seem to offer hope that some of them will succeed in effecting improvement in form value of this raw material to advantage not only of power user, but to other industries.

Carbonization. The Low-Temperature Carbonization of Coal, R. V. Wheeler. Colliery Guardian, vol. 132, no. 3425, Aug. 20, 1926, pp. 405-406, 1 fig.

The Parr Process of Low-Temperature Carbonization of Coal, W. R. Chapman. Fuel, vol. 5, no. 8, Aug. 1926, pp. 355-361, 4 figs. Discusses process invented by S. W. Parr, which was one of earliest in point of time.

Coking. The Carbonization of Coal, J. Roberts. Combustion, vol. 15, no. 3, Sept. 1926, pp. 159-163, 3 figs. Coking and non-coking coals.

The Examination of Coking Coals and Estimation of Their Value, R. Kattwinkel. Fuel, vol. 5, no. 8, Aug. 1926, pp. 347-355, 10 figs. Methods of investigating coking coals—crucible test, distillation behaviour and coking power—and coke-density, porosity and friability; Meurice method for determining coking power was modified and new apparatus for this purpose described.

Combustion. The Combustion of Particles of Coal in Air, H. E. Newall and F. S. Sinnatt. Fuel, vol. 5, no. 8, Aug. 1926, pp. 335-339, 3 figs. Study of cenospheres.

Distillation. Low-Temperature Distillation of Coals. Colliery Guardian, vol. 132, no. 3424, Aug. 13, 1926, pp. 348-349, 2 figs. Details of Crozier process as practised at Wembley in Crozier retort; process of fractionation is entirely automatic under steady operating conditions; results in considerable reduction in refining costs, as compared with older methods of treatment; treatment of bituminous coals.

Pulverized. *See Pulverized Coal.*

COAL HANDLING

Equipment. Solving the Coal and Ash Handling Problem, E. J. Tournier. Indus. Mgmt. (N.Y.), vol. 72, no. 2, Aug. 1926, pp. 77-78, 27 figs. Modern mechanical equipment for large and small power plants.

Methods. Modern Methods in Coal and Ash Handling, W. W. Sayers. Power, vol. 64, nos. 4, 5, 6, 7 and 8, July 27, Aug. 3, 10, 17 and 24, 1926, pp. 133-136, 169-171, 204-206, 240-241 and 284-286, 35 figs. July 27: Traces progress made in field and emphasizes importance of fuel-handling problem. Aug. 3: Conditions governing selection and application of centrifugal discharge and continuous-bucket elevators, flight and screw conveyors. Aug. 10: Belt conveyors and skip hoists. Aug. 17: Bucket conveyors and storage equipment. Aug. 24: Equipment for crushing coal.

COAL MINES

Pit-Head Frames. Reinforced Concrete Pit-Head Frame at the National Maurits Colliery, Holland. Engineering, vol. 122, no. 3163, Aug. 27, 1926, pp. 258-260, 28 figs. partly on p. 266 and supp. plate. Total height above ground is 179.3 ft.; 2,100 cu. in. of concrete were employed in its construction, and 160 tons round steel bars for reinforcement.

COKE

Quenching. Economic Coke Quenching. Colliery Eng., vol. 3, no. 30, Aug. 1926, pp. 360-361, 1 fig. Novel process of quenching coke by Heller-Bamag system; advantages claimed for process are: production of high-pressure steam by heat contained in incandescent coke; production of water-gas; improvement in quality of coke; production of coke under conditions which are dustless and hygienic; small amount of space required by plant, and low initial and operating costs.

COMBUSTION

Chemistry. Unusual Features of Combustion Chemistry, R. T. Haslam and J. T. McCoy. Power Plant Eng., vol. 30, no. 17, Sept. 1, 1926, pp. 941-942, 2 figs. Hydrogen in fuel explains variation of CO_2 and O_2 in flue gas with changes in excess air.

Control. An Essential Principle for Scientific Boiler Firing (Un principe essentiel pour la conduit scientifique des combustions industrielles), M. Bouffart. Chaleur & Industrie, vol. 7, no. 76, Aug. 1926, pp. 437-442, 1 fig. Discusses theory of combustion of coal excess or deficiency of air; air supply and incombustibles; combustion of gas in blast furnaces, etc.

Automatic Combustion Control, J. F. Cassell. Gas Age-Rec., vol. 58, no. 9, Aug. 28, 1926, pp. 279-280 and 284, 7 figs. Results of study of various types of automatic combustion controls.

Surface. Surface Combustion and Its Influence on the Future Economics of Heat and Power, T. G. Tulloch. Chem. & Industry, vol. 45, no. 33, Aug. 13, 1926, pp. 280T-285T and (discussion) 285T-287T. Economics of surface combustion.

CONCRETE

Expansion. Expansion of Concrete, with Special Reference to Concrete Tanks, W. H. Glanville. Concrete & Constr. Eng., vol. 21, no. 8, Aug. 1926, pp. 561-568 and 572, 7 figs. Draws attention to particular example of construction of tank for storage of water at temperatures up to boiling point; results of stress analysis.

Manufacture Control. Controlling the Manufacture of Concrete to Obtain Uniformity of Strength, A. E. Wynn. Concrete & Constr. Eng., vol. 21, nos. 6, 7 and 8, June, July and Aug. 1926, pp. 413-423, 487-494 and 588-596, 14 figs. Shows how theory involving terms, such as water cement ratio, slump test, fineness modulus, etc., is put into practice on job under actual construction conditions. July: Job equipment for designing mixtures, design of mixture by fineness modulus method; effect of arbitrarily changing proportions; designing concrete mixture by "trial" method; tests. Aug.: Measuring material; measurement of aggregates by batchers; measuring sand, etc.

Permeability. Permeability of Concrete. Concrete & Constr. Eng., vol. 21, no. 8, Aug. 1926, pp. 573-577. Results of investigation of permeability of portland cement concrete, with object of determining conditions influencing permeability and their relative importance; influence of constituent materials, effect of methods of preparing concrete, and influence of subsequent treatment. Abstracted from Building Research Tech. Paper No. 3.

Strength Control. Old and New Ideas on Control of Strength of Concrete, J. G. Ahlers. Concrete, vol. 29, no. 2, Aug. 1926, pp. 13-19, 12 figs. Plain, practical discussion of factors that affect strength of concrete; theories explained; putting them into effect on job; how to control variables that affect strength of concrete.

Strength of Mortar and. The Strength of Mortar and Concrete as Influenced by the Grading of the Sand, J. G. Rose. Pub. Roads, vol. 7, no. 5, July 1926, pp. 106-107, 1 fig. Study of relation between grading of sand for use in concrete and strength developed in mortar and concrete; graph was developed which may be used as basis for preliminary judgment of quality of sands proposed for use.

Uniform Quality. Producing Concrete of Uniform Quality, R. B. Young. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 7, Sept. 1926, pp. 1394-1406. Points out that concrete to be successful must take into account different operations of manufacturing process, and provide proper conditions for their performance; author states thoroughly what these conditions are and methods by which one organization has attempted to provide them.

Water-Ratio Specification. Water-Ratio Specification for Concrete, F. R. McMillan and S. Walker. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 7, Sept. 1926, pp. 1407-1421, 4 figs. Presents specification based on fundamental principle that strength and other desirable properties of concrete are definitely determined by proportion of water to cement in mixture, provided only that concrete is plastic and workable and aggregates are clean, durable and structurally sound. Contains appendix on specification for concrete and concrete materials as used in construction of Portland Cement Association Building, Chicago, Ill.

CONCRETE CONSTRUCTION, REINFORCED

SLABS. The Thickness of Reinforced Concrete Slabs, M. A. Merciot. Concrete & Constr. Eng., vol. 21, no. 8, Aug. 1926, pp. 551-552. Describes method which avoids all guesswork about weight of slab; it may be applied to slabs of any degree of fixity at their ends. Translated from Constructeur de Ciment Arme.

CONCRETE, REINFORCED

BOND BETWEEN CONCRETE AND STEEL. Studies of Bond Between Concrete and Steel, D. A. Abrams. Concrete Products, vol. 31, no. 2, Aug. 1926, pp. 59-64, 11 figs. Study of bond resistance as influenced by variations in quantity of mixing water, grading of aggregate, quantity of cement, consistency, age, etc.

STEEL CORROSION. Corrosion of Structural Steel Within Concrete, G. W. Burke and P. B. Place. Concrete, vol. 29, no. 2, Aug. 1926, pp. 23-24, 3 figs. Discusses effects of corrosion and analysis of causes.

CONDENSERS, STEAM

FAILURES. Failure of Modern Condensers, F. J. Drover. Indus. Mgmt. (Lond.), vol. 13, no. 9, Sept. 1926, pp. 404 and 406. Considers causes of condenser failure, which in practically every case is due to failure of tubes and ferrules; and methods adopted to prevent, or at least greatly lessen, chances of serious breakdown.

SURFACE. Testing a Surface Condenser in Action, Chas. E. Colborn. Power, vol. 64, no. 12, Sept. 21, 1926, pp. 431-433, 6 figs. To secure maximum performance, continuous check is necessary, not only to detect unusual conditions such as air leaks, but to assist in forecasting probable need for cleaning of condenser tubes; suggestions for making condenser tests.

CONDUITS

PRESSURE. Determining Maximum Economic Dimensions of Metal Pressure Conduit (La Solution générale du Problème de la Détermination des Dimensions Economiques Maximum d'une Conduite forcés en Métal et son Application aux Calculs pratiques), P. Santo Rini. Houille Blanche, vol. 25, no. 200, May-June 1926, pp. 65-71. Calculation of discharge, diameter, coefficient of roughness in rivetted and welded pipe, effect of water hammer, etc.; gives examples.

COPPER ALLOYS

AMPCO. Characteristics of Ampco Metal. Am. Mach., vol. 65, no. 9, Aug. 26, 1926, p. 377. Reference-book sheet. Ampco is copper-aluminum alloy containing appreciable percentage of iron; nature of alloy; machining; forging and welding.

COPPER-MAGNESIUM. Preliminary Experiments on the Copper-Magnesium Alloys, W. T. Cook and W. R. D. Jones. Inst. Metals—Advance Paper, no. 410, for mtg. Sept. 1-4, 1926, 14 pp., 13 figs. Account of preliminary experiments of research; chief feature is production of sound chill-cast bars free from smooth-sided internal gas cavities by means of double-melting process, similar to that recently recommended by Archbutt for production of castings in aluminum free from pinholes; details of method adopted and type of bottom-pouring crucible used to eliminate inclusions of flux and slag; properties of chill-cast bars containing up to 10 per cent copper.

CORES

OVERHANGING. Setting Overhanging Core Simplified Through Practical Methods, H. N. Tuttle. Foundry, vol. 54, no. 17, Sept. 1, 1926, pp. 691-693, 8 figs. Overhanging core is name usually applied to core where print overhangs or projects beyond body of core; methods of setting these difficult cores.

CORROSION

IRON AND STEEL. The Corrosion and Rusting of Steel and Cast Iron (Recherches sur la corrosion et l'enrouillement de l'acier et de la fonte), R. Girard. Revue de Métallurgie, vol. 23, nos. 6 and 7, June and July 1926, pp. 361-367 and 407-417. 33 figs. June: Action of weak acid solutions on ferrous metals. July: Action of saline solutions.

CRANES

DESIGN. Tendencies of Modern Crane Design, E. G. Diegehen. Mech. World, vol. 80, nos. 2063 and 2065, July 16 and 30, 1926, pp. 47-48 and 85-86. Introduction of electric drive; wire ropes; improved materials. Review of recent developments indicates increasing tendency to adapt crane to its job and its environment, rather than to subordinate process to limitations of standard types of crane.

TRAVELLING. Travelling Cranes for Handling Freight Cars in Railway Terminal Yards, H. B. Dwight. Elec. Jl., vol. 23, no. 9, Sept. 1926, pp. 448-450, 3 figs. Method of moving long string of cars by means of cranes allow cars in most congested parts of yard to be taken out as easily as those on outside parts of yard and gives complete freedom in order in which cars are made up into train.

CUPOLAS

JET-CUTTING MACHINES. Jet-Cutting Machines. Machy. (Lond.), vol. 28, no. 722, Aug. 12, 1926, pp. 541-544, 6 figs. Application of machines, using jet of oxygen as cutting medium to railway-car building.

CUTTING TOOLS

COOLANTS. Coolants as Aids to Cutting Tools, S. French. Am. Mach., vol. 65, no. 9, Aug. 26, 1926, pp. 381-382. High-speed removal always requires coolants; effects of heating; qualities of coolants; dangers of separation of ingredients.

D

DAMS

VERTICAL BUTTERFLY GATE. Vertical Butterfly Gates on Exchequer Dam. Eng. News-Rec., vol. 97, no. 9, Aug. 26, 1926, pp. 344-346, 4 figs. Steel gates, made up in 14- x 24-ft. units, control spillways on recently-completed dam in California.

WINTER CONSTRUCTION. Dam Construction in Winter on the Androscoggin. Eng. News-Rec., vol. 97, no. 9, Aug. 26, 1926, pp. 326-331, 14 figs. New 27,000-hp. hydro-electric plant in Maine containing 90,000 cu. yd. of concrete involved special plant arrangement for mixing and conveying hot material.

DIELECTRICS

BREAKDOWN. The Mechanism of Breakdown of Dielectrics, P. L. Hoover. Am. Inst. Elec. Engrs., vol. 45, no. 9, Sept. 1926, pp. 824-831, 10 figs. Critical study of theories of dielectric behaviour have been made in attempt to obtain working hypothesis that more nearly meets stringent requirements of experimental facts; logarithmic formula is shown to give erroneous results if applied to high-voltage cables when they are operating under high stress; breakdown occurs when equilibrium conditions are so disturbed that installation as a whole become unstable, electrically; high stress or strain and high temperature affect conditions of equilibrium considerably.

DIE CASTING

BRASS AND BRONZE WORK. Conflicting Foundry Methods, J. G. Kaiser. Brass World, vol. 22, no. 8, Aug. 1926, pp. 263-264. Manufacturer of special foundry equipment presents arguments in favour of new machine for making die castings for brass and bronze work.

DIESEL ENGINES

AIRLESS-INJECTION. Compressorless Fuel Injection (Ueber die Mittel zur kompressorlosen Brennstoffeinspritzung), G. Eichelberg. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 32, Aug. 7, 1926, pp. 1079-1089, 43 figs. Requirements of fuel injectors; behaviour of fuel-injection devices with regard to these requirements; indirect injection with accumulation.

DESIGN. New Tendencies in Diesel-Engine Design (Neueste Bestrebungen im Bau von Dieselmotoren), F. E. Bielefeld. Schiffbau, vol. 27, nos. 11, 12 and June 2, 16 and July 7, 1926, pp. 313-316, 341-346 and 365-368, 50 figs.

DRAGLINE EXCAVATOR, FOR. Dragline Excavator with Diesel Engine. Engineering, vol. 122, no. 3165, Sept. 10, 1926, pp. 324-326, 7 figs. Details of Diesel engine developed by Northwest Engineering Co. of Chicago, based on experimental work extending over several years; it is of solid-injection type and has four cylinders.

FOUNDATIONS. Good Foundations Best Diesel Insurance, J. J. McDougall. Power Plant Eng., vol. 30, no. 18, Sept. 15, 1926, pp. 1005-1006, 7 figs. Points out that light, poorly constructed foundations endanger all parts of engine.

HEAVY-OIL. Development of Heavy-Oil Engines and Their Applications (l'evolution des moteurs à huile lourde et leurs applications), A. Veranneman. Technique Moderne, vol. 18, no. 15, Aug. 1926, pp. 449-460, 23 figs. Discusses advantages and disadvantages of various types; results of tests; efficiency and fuel consumption, including 4-stroke and 2-stroke engines, pneumatic and mechanical injection, semi-Diesels, still engine; heat recovery; marine Diesels, tractors, locomotives, etc.

LARGE. Large Diesel Engines, R. Johnstone-Taylor. Gas & Oil Power, vol. 21, no. 252, Sept. 2, 1926, pp. 263-264, 3 figs. Recent progress and research; details of Nobel and M.A.N. engine, and British design brought out by Richardsons Westgarth; engine of the future.

LOGGING EQUIPMENT, FOR. Largest Oil-Engined Logging Drum Commissioned. Oil Engine Power, vol. 4, no. 9, Sept. 1926, pp. 541-544, 4 figs. Long Bell Lumber Co. uses 150-hp. Diesel yarding engine; summarizes advantages of Diesel-equipped logging machinery.

OIL-VAPOUR EXTRACTION. A Diesel Engine Oil-Vapour Extractor. Mar. News, vol. 13, no. 4, Sept. 1926, pp. 60 and 67, 4 figs. Recently perfected apparatus recovers large portion of lubricating oil and prevents pollution of engine-room atmosphere.

SOLID-INJECTION. Boiler Fuel in the Solid Injection Engine, D. W. Dickie. Pac. Mar. Rev., vol. 23, no. 8, Aug. 1926, pp. 356-357, 1 fig. Heretofore experiments made by writer to get solid-injection engine to run on boiler fuel have been based upon theory that viscosity of boiler fuel was cause of trouble; this theory was entirely exploded by heating boiler fuel; steam-turbine nozzle experimenters threw light on subject of flow of steam through nozzles, and clew may possibly be obtained from their work.

TEMPERATURE STRESSES. Tests Explode the Myth of Excessive Temperature Stresses in Diesels. Power, vol. 64, no. 12, Sept. 21, 1926, pp. 438-440, 6 figs. Temperature distribution in cylinder walls based on volume and time; temperature stresses at starting and during operation; temperature measurements in Sulzer 2-stroke-cycle marine engine. Reported by Sulzer Bros., Winterthur, Switzerland.

WASTE-HEAT UTILIZATION. Use of Waste-Heat from Diesel Engines. Oil Eng. & Technology, vol. 7, no. 123, July 1926, pp. 301-302, 2 figs. Describes Diesel engine plant of King's College Hospital; economic combustion of boilers receives considerable aid from exhaust gases of Diesel engines by passing gases through air heater in which air to furnaces is pre-heated to about 20 deg. Fahr.; further saving is effected by utilizing cooling water from cylinder jackets of Diesel engines.

DIRECTION FINDING

RADIO. The Cause and Elimination of Night Errors in Radio Direction-Finding, R. L. Smith-Rose and R. H. Barfield. Instn. Elec. Engrs.—Jl., vol. 64, no. 356, Aug. 1926, pp. 831-838 and (conclusion) 838-842, 12 figs. Experiments carried out with view to obtaining more conclusive evidence as to causes of apparent variations in bearings observed under certain conditions on wireless direction-finders; Adcock 4-aerial direction-finder has been developed, and with its aid it is shown that actual deviation in azimuth of wireless constitutes proof that variable errors observed on closed-coil direction-finders at night are caused by downcoming waves arriving from upper atmosphere and polarized with electric force in horizontal plane; point out possibility of Adcock system being developed into practical direction-finder free from night errors.

DRILLING MACHINES

BOILER-PLATE. Multiple Boiler-Plate Drilling Machine. Boiler Maker, vol. 26, no. 8, Aug. 1926, pp. 234-235, 2 figs. Heavy-type plate and rivet-hole drilling machine specially designed for boiler, tank and structural shops, constructed by Cincinnati Bickford Tool Co., Ohio

INDEX PLATES. A Machine for Drilling Index Plates, M. Wright. Am. Mach., vol. 65, no. 9, Aug. 26, 1926, p. 369. Automatic drilling machine for drilling circles of holes in index plates for dividing heads.

DROP FORGING

PROCESS. The Drop Forging Process, J. H. G. Williams. Am. Soc. Steel Treating—Trans., vol. 10, no. 3, Sept. 1926, pp. 409-435, 10 figs. Describes entire process of drop forging from inspection of raw materials to finished products; estimate of cost of producing certain types of drop forging.

E

ELECTRIC DISTRIBUTION

ECONOMICS. Some Features of the Economics of Electrical Distribution, J. M. Kennedy. Engineering, vol. 122, no. 3161, Aug. 13, 1926, pp. 214-216, 1 fig. Considers problems to be faced in England if proposals before Parliament for co-ordination of generation throughout country materialize. Paper read before Sect. G of Brit. Assn.

ELECTRIC DISTRIBUTION SYSTEM

FEEDER-END PRESSURES. Measuring Feeder-End Pressures, J. A. McHugh and A. F. Hamdi. Elec. World, vol. 88, no. 8, Aug. 21, 1926, pp. 367-369, 2 figs. Method used by New York Edison Co. to measure individual and average feeder-end pressures on 3-wire d.c. network; may be used in automatic stations.

ELECTRIC GENERATORS, A.C.

STABILITY CHARACTERISTICS. Stability Characteristics of Alternators, O. E. Shirley. Am. Inst. Elec. Engrs., vol. 45, no. 9, Sept. 1926, pp. 813-819, 15 figs. Shows that power limits may be reached with very short lines and certain classes of load; criteria for stability of alternator as developed by author are short-circuit ratio, saturation, power factor, etc.

ELECTRIC LAMPS

ECONOMIC CHOICE. The Economics of Lamp Choice, D. J. Bolton. Instn. Elec. Engrs.—Jl., vol. 64, no. 356, Aug. 1926, pp. 844-848, 1 fig. Choice of type (carbon metallic vacuum and gas-filled) is first considered and then choice of rating for given type, latter being treated both graphically and algebraically.

ELECTRIC MEASURING INSTRUMENTS

RECOMMENDATIONS. Instruments and Measurements, A. E. Knowlton. Am. Inst. Elec. Engrs., vol. 45, no. 9, Sept. 1926, pp. 808-812, 4 figs. Report of Committee on instruments and measurements; selection of instrument transformers; potential transformers; current transformers; watt-hour meter; dielectric losses and power factor.

ELECTRIC METERS

THREE-PHASE FOUR-WIRE SYSTEMS, FOR. Methods of Metering Energy, C. Oman. Elec. Jl., vol. 23, no. 9, Sept. 1926, pp. 445-447, 11 figs. Discusses three methods in general use for metering energy in 3-phase 4-wire systems.

ELECTRIC MOTORS

CONTROL. Sectionalizing of Mine Circuits, E. L. Hough. Gen. Elec. Rev., vol. 29, no. 9, Sept. 1926, pp. 611-616, 5 figs. Character of mine electrification; advantages of sectionalizing mine distribution systems; automatic reclosing feeders; details of equipment and its operation.

ELECTRIC MOTORS, A.C.

CONTROL. Choice of Control for Synchronous Motors in Industrial Plants, R. M. Matson and D. W. McLenegan. Gen. Elec. Rev., vol. 29, no. 9, Sept. 1926, pp. 628-633, 1 fig. Fundamental considerations; essential control equipment; full-voltage and reduced-voltage starting; manual and automatic control; protection; instrument and meters.

SINGLE-PHASE. Characteristics of Single-Phase Motors, J. O. Walz. Elec. Jl., vol. 23, no. 9, Sept. 1926, pp. 461-467, 11 figs. Gives general theory of more commonly used motors and discusses their characteristics; those discussed are split-phase, repulsion, repulsion-start induction, and repulsion-induction motors.

SQUIRREL-CAGE. Alternating-Current Motors, Squirrel-Cage Rotors, B. A. Briggs. Power, vol. 64, no. 8, Aug. 24, 1926, pp. 276-278, 12 figs. Materials used in rotor windings; effects of winding resistances on starting torque of motor; methods of connecting end rings and slot conductors; troubles that develop in winding connections and how these are overcome.

The Squirrel-Cage Repulsion Motor, G. Windred. Elecn., vol. 97, no. 2517, Aug. 27, 1926, pp. 230-232, 7 figs. Recent development in single-phase commutator-motor construction and its advantages over existing types.

STARTING. Starting Squirrel-Cage Type Induction Motors, G. O. Wilms. Power, vol. 64, no. 12, Sept. 21, 1926, pp. 434-435, 4 figs. Comparison of advantages and disadvantages of compensator and resistance-type starting equipment.

Motor Starters and Controllers for Small Powers. Engineering, vol. 122, no. 3160, Aug. 6, 1926, pp. 179-181, 14 figs. Control generators of d.c. type constructed by Brookhurst Switchgear, Ltd., Chester, Eng.

STARTERS. The Selection of Starters for Induction Motors, L. F. Adams. Gen. Elec. Rev., vol. 29, no. 9, Sept. 1926, pp. 624-627. Large choice in motor-starting equipment; types suited to various motors; manual and automatic starters; motor-speed regulation; motor protection.

ELECTRIC TRANSMISSION LINES

INDUCTANCE. Inductance of Overhead Transmission Lines with Unequal Spacing of Wires, A. Still. Franklin Inst.—Jl., vol. 202, no. 3, Sept. 1926, pp. 365-372, 4 figs. Effect of transposing conductors of three-phase transmission; inductance of parallel circuits as affected by position of conductors.

INTERMEDIATE SUPPORTS. Calculation of Intermediate Supports for Transmission Lines, V. P. Farmakovsky. Electritchestvo, no. 6, June 1926, pp. 275-279, 8 figs. Combined graphical and analytical method of calculating intermediate supports for transmission lines for case of unilateral breakage of half of wires in span, adjoining to anchor support, with earth wire drawing together top of supports remaining whole. (In Russian.)

POWER LIMITS. An Investigation of Transmission-System Power Limits, C. A. Nickle and F. L. Lawton. Am. Inst. Elec. Engrs., vol. 45, no. 9, Sept. 1926, pp. 864-874, 6 figs. Discusses results of theoretical analysis, verified by miniature-system tests of power limits of transmission systems; concludes that criteria for stability under all conditions is steady-state power limit; charging kva. exercises marked detrimental effects of stability; characteristics of synchronous terminal apparatus are of great importance, etc.

TOWERS. Economic Base Width of Transmission Towers, C. R. Young, W. B. Dunbar and C. E. Lewis. Can. Engr., vol. 51, no. 7, Aug. 17, 1926, pp. 211-215, 8 figs. Least weight base width 0.215 of height for usual specifications; greater for high permissible slenderness ratios; stay members lessen weight but increase pound cost; designing diagonals for tension or compression advantageous.

ELECTRICAL SUPPLY

RURAL SERVICE COSTS. Allocating Rural Service Costs, L. C. White. Elec. World, vol. 88, no. 11, Sept. 11, 1926, pp. 524-526. Method of defining responsibilities of farm customers for plant investment required to serve them; importance of increasing energy consumption in reducing unit prices.

ELECTRIC WELDING

ARC. *See Electric Welding, Arc.*

SPOT. New Method of Spot Welding, R. G. Hudson. Elec. World, vol. 88, no. 8, Aug. 21, 1926, p. 375, 2 figs. Pin-type welding is developed to meet need for improvement over rivetted and spot-welded joints.

ELECTRIC WELDING, ARC

PENETRATION. Factors Affecting Penetration, J. B. Green. Welding Engr., vol. 11, no. 8, Aug. 1926, pp. 28-31, 3 figs. Study of penetration in metallic arc welding becomes simplified when it is considered in terms of heat.

STRUCTURAL STEEL. Electric Arc Welding Steel Structures, J. B. Abell. Elec. Light & Power, vol. 4, no. 9, Sept. 1926, pp. 21-23, 48 and 54, 5 figs. Application of arc welding to new two-storey and basement commercial building for Peerless Auto Sales Co. in Canton, Ohio.

Electric Welding Steel Structures. Gen. Elec. Rev., vol. 29, no. 9, Sept. 1926, pp. 33-34. Tests prove superiority of welded over rivetted connections; effort to amend building codes.

Tests of Arc Welded Structural Steel, A. M. Candy and G. D. Fish. Iron & Steel Engr., vol. 3, no. 8, Aug. 1926, pp. 380-384B. Describes series of test specimens which were all welded with various members located in same position and manner as would be required if various members were actually part of building structure.

ELECTRICITY

ENGINEERING TERMS. The B.E.S.A. Glossary of Electrical Engineering Terms, G. W. O. Howe. Engineering, vol. 122, no. 3162, Aug. 20, 1926, pp. 245-246; also Elecn., vol. 97, no. 2515, Aug. 13, 1926, pp. 178-179 and 184. Criticism of glossary published by British Engineering Standards Assn. with object in view (1) to standardize and co-ordinate electro-technical terms used in British Empire, and (2) to provide basis for British portion of international vocabulary, in course of preparation by International Electrotechnical Commission. Paper read before Sect. G of British Assn.

ELECTRICITY SUPPLY

DEVELOPMENTS. The Present and Future Development of Electricity Supply, J. F. C. Snell. Engineering, vol. 122, no. 3161, Aug. 13, 1926, pp. 194-198. Historical review of developments and future prospects. Presidential address to Sect. G of Brit. Assn.

ELEVATORS

BRAKES. Operation and Adjustment of A.C. Elevator Brakes, H. B. Cook and F. A. Annett. Power, vol. 64, no. 10, Sept. 7, 1926, pp. 366-370, 9 figs. Problems involved in obtaining satisfactory a.c. elevator brakes; operation and adjustment of three different designs.

ENGINEERS

CHANGING STATUS OF. The Changing Status of the Engineer, F. B. Jewett. Engrs'. Bul., vol. 10, no. 8, Aug. 1926, pp. 3-6. How twentieth century conditions are altering his relations to his profession, to industry, and to society.

EXHAUST STEAM

TEXTILE MILLS. The Use of Exhaust Steam for Process Work in Textile Plants, S. M. Green. Engrs. & Eng., vol. 43, no. 6, June 15, 1926, pp. 160-164, 2 figs. Details of recent installation of 3,500-kw. turbine and its performance.

F

FERTILIZERS

CHEMICAL PROBLEMS. Chemistry's Contributions to the Fertilizer Industry, J. E. Breckenridge. Indus. & Eng. Chem., vol. 18, no. 9, Sept. 1926, pp. 941-943, 2 figs. Perfection of acid-phosphate manufacture; harmful materials rendered useful; supply of nitrogen increased; American potash made available; further problems for chemistry.

FILTRATION PLANTS

WALTON, ENGLAND. New Filtration Plant at Walton-on-Thames. Engineer, vol. 142, nos. 3681, 3682 and 3683, July 30, Aug. 6 and 13, 1926, pp. 109-112, 134-136 and 160-164, 24 figs. partly on p. 118 and 172. Outstanding feature of new work is fact that filtration of water is effected in two stages, stored water from reservoirs, or when they are at low level water pumped direct from river, being first treated in primary filters, discharge from which is passed on to ordinary slow sand filters; filtration plant consists first of 18 primary open gravity filters, each designed to be capable of filtering between one and two million gallons of water per sq. ft. per hr., and secondly, of six ordinary slow sand filters; pumping machinery installed in connection with filtration plant.

FIREBRICK

STRENGTH OF TEXTURE. A Comparison of the Uniformity of Strength and Texture of Fire Brick Made by Different Processes, A. E. R. Westman and W. H. Pfeiffer. Am. Ceramic Soc.—Jl., vol. 9, no. 9, Sept. 1926, pp. 626-632, 1 fig. Of brands examined, those made by stiff-mud process are found to be more uniform in strength and less uniform in structure than those made by dry-press process.

FLIGHT

LONG-DISTANCE. Long-Distance Flying, A. Cobham. Roy. Aeronautical Soc.—Jl., vol. 30, no. 188, Aug. 1926, pp. 482-491 and (discussion) 492-494. Author discusses two main types of long-distance flying, firstly, long non-stop flights, and secondly, long flying journeys where many landings are made.

FLOODS

RAPIDLY RISING IN SMALL STREAM. Hydraulic Data on Rapidly-Rising Flood in Small Stream, D. J. F. Calkins. Eng. News-Rec., vol. 97, no. 11, Sept. 9, 1926, pp. 416-417, 1 fig. Squillchuck Creek in Central Washington has flood of great concentration though observed rainfall was low.

FLOW OF WATER

MEASUREMENTS. Flow Measurements with the Flat Plate Orifice. Pow Plant Eng., vol. 30, no. 18, Sept. 15, 1926, pp. 997-1000, 6 figs. Simplified formulas and coefficients facilitate use of flow meter for temporary, or portable-meter; use in air; steam and water measurement.

FORGE SHOPS

SAFETY WORK IN. Safety Work in the Drop Forge Shop, G. A. Kuechenmeister. Forging—Stamping—Heat Treating, vol. 12, no. 8, Aug. 1926, pp. 284-288, 4 figs. Points out that enforcement of safety rules and complete data on equipment may result in material reduction of accidents; board-hammer pulley catchers.

FORGING

BRASS. An Outline of the Methods Used in Forging Brass, F. W. Curtis. Am. Mach., vol. 65, no. 10, Sept. 2, 1926, pp. 393-396, 10 figs. Characteristics of metal and shapes that can be forged; temperatures necessary for best results; types of dies; important points to be considered.

TEMPERATURE, EFFECT OF. The Effect of Temperature in Forging, H. Brearley. Forging—Stamping—Heat Treating, vol. 12, no. 8, Aug. 1926, pp. 290-292 and 295, 4 figs. Improper heating of steel for hot-working is frequently responsible for introduction of serious mechanical defects in finished product.

UPSETTING. Upsetting Places Fibres in Compression, Not Tension, C. D. Harmon. Iron Trade Rev., vol. 79, no. 10, Sept. 2, 1926, pp. 574-575, 6 figs. Deals with action of steel when upset in modern forging machine.

FOUNDRIES

BRASS. *See Brass Foundries.*

MERCHANDIZING POLICY. Better Merchandizing is Need of American Foundry Industry, S. W. Utley. Iron Trade Rev., vol. 79, no. 12, Sept. 16, 1926, pp. 709-711 and 714. Author shows that faulty merchandizing is responsible for many of ills of foundry industry and that sacrificing profit in interest of increasing output is almost business suicide.

STEEL. Savings Results from Pre-Heating. Iron Age, vol. 118, no. 12, Sept. 16, 1926, pp. 759-762, 6 figs. Mechanical reclaiming of foundry sand, use of electricity for annealing steel castings in annealer of unique design, pre-heating of scrap before it is charged into electric melting furnace, and baking of cores electrically are features of practice of Industrial Steel Casting Co., Toledo, Ohio.

VARIETY OF PRODUCTS, FOR. Variety of Product a Factor in Success, R. Micks. Can. Foundryman, vol. 17, no. 8, Aug. 1926, pp. 5-6, 3 figs. Methods and equipment of foundry of Gilson Mfg. Co., Guelph, Ont.

FOUNDRY EQUIPMENT

MIXERS. Blast Furnace Metal Mixer Adapted for Foundry Use, H. Illies and A. Hesse-Wortmann. Foundry Trade Jl., vol. 34, no. 521, Aug. 2, 1926, pp. 131-132, 2 figs. Oil-fired 25-ton mixers with flat hearths operated in large pipe foundry in Germany; they are tilted hydraulically and receive all iron that arrives from blast furnaces; in case blast furnace furnishes insufficient metal, cupola iron is added, and any quantity can be tapped at desired time.

Sand Mixer. A New Mixing Apparatus for Moulding Sand (Eine neuartige Formsandaufbereitungsanlage), H. Behrens. Giesserei, vol. 13, no. 23, June 5, 1926, pp. 413-416, 8 figs; also translated abstract in Foundry Trade Jl., vol. 34, no. 522, Aug. 19, 1926, p. 154, 3 figs. New apparatus, known as "Eirich" patent, consisting of bottom plate rotating around vertical axis and runner with two scrapers moving around axis in opposite direction; table and runner can be regulated to any vertical distance.

FURNACES, HEAT TREATING

Hardening. Gas-Fired Hardening Furnaces Insure Accurate Temperature Control, J. A. Cameron. Iron Trade Rev., vol. 79, no. 12, Sept. 16, 1926, pp. 712-713, 4 figs. Gas-fired furnaces used in making of machines manufactured by Cameron Machine Co., combining new type of burner and method of radiation.

FURNACES, HEATING

Gas-Fired Rivet. Rivet Heating in Gas-Fired Furnaces, J. L. Munnis. Forging—Stamping—Heat Treating, vol. 12, no. 8, Aug. 1926, p. 295, 1 fig. Details of furnace used in large box-car plant.

Mechanical Firing. Heating Furnace Fired Mechanically, C. H. Lawrence. Iron Trade Rev., vol. 79, no. 12, Sept. 16, 1926, pp. 720 and 723, 2 figs. Stoker-operated billet-heating furnace at plant of Elyria Iron & Steel Co., Elyria, Ohio.

G

GAUGES

Slip. Slip Gauges. Indus. Mgmt. (Lond.), vol. 13, no. 9, Sept. 1926, pp. 407-408. Deals with slip or combination block gauge system of measurement.

GAS PRODUCERS

Progress in. Progress in Gas-Producer Practice. Colliery Eng., vol. 3, nos. 28 and 29, June and July, 1926, pp. 277-279 and 327-329, 9 figs. Automatic charging, mechanical agitators, and automatic ash removal discussed.

GEARS

Cast-Iron, Repairing. Repairing a Cast-Iron Gear, Discussion, E. Andrews. Am. Mach., vol. 65, no. 11, Sept. 9, 1926, pp. 454-455, 4 figs. Discussion of article by O. P. Williams published in same journal, vol. 63, p. 586. Modern welding methods have shown that welding in or building up gear-teeth, give homogeneous structure that may easily be machined and which possess degree of strength equal to that of original section.

Chain-Driven. A Continuously-Variable, Chain-Driven Change-Speed Gear. Engineer, vol. 142, no. 3685, Aug. 27, 1926, pp. 220-222, 8 figs. Positive, infinitely variable gear, manufactured by P.I.V. Gear Syndicate; it has been applied in bakery, confectionery and biscuit-making industries and in connection with manufacture of cement, paper, electric cables, cotton and artificial silk.

Stub Teeth. The Strength of Stub Teeth, W. E. Wright. Engineering, vol. 122, no. 3165, Sept. 10, 1926, pp. 316-317, 3 figs. Main features of stub tooth are that addendum and dedendum are smaller than those of Brown and Sharpe standard, while angle of contact is greater; discusses three principal systems of measurements of stub teeth in vogue, in all of which measurements along pitch circle are unaltered.

Teeth in Action. Gear Teeth in Action, E. Buckingham. Am. Mach., vol. 65, nos. 10 and 11, Sept. 2 and 9, 1926, pp. 389-392 and 451-454. Sept. 2: Eliminating gear noise in relation to uniformity of profiles and spacing; effect of eccentricity on gear noises; "Music of Gears"; resonance; harmonious ratios. Sept. 9: Relation of noise to design of gear blanks, cases and carriers; function of lubricant on gear teeth; selection of proper lubricant to meet various conditions.

Worm. Worm Gearing, H. E. Merritt. Machy. (Lond.), vol. 28, no. 724, Aug. 26, 1926, pp. 605-607, 4 figs. Theory and practice of design; detail dimensions of straight-sided worms; elements of worm-gear action; calculation of nominal and actual pitch diameters.

GOVERNORS

Steam-Turbine. Principles of Steam Turbine Governors. Power Plant Eng., vol. 30, no. 18, Sept. 15, 1926, pp. 991-996, 14 figs. Construction details and method of operation of various makes of governors in present-day use.

GRINDING

Cylindrical. Cylindrical Grinding Without Traverse, J. Denton. Am. Mach., vol. 65, no. 12, Sept. 16, 1926, p. 476, 1 fig. Describes grinding to diameter of outer races or cups of roller bearings.

GRINDING MILLS

Fine Grinding. Some Recent Research in the Art of Fine Grinding, G. Martin. Concrete, vol. 29, no. 2, Aug. 1926, pp. 95-97 and 110, 3 figs. Results of study made by British Portland Cement Research Assn. between 1923 and 1925; importance of fine grinding; tabulations of results; efficiency of grinding machines; discussion of sizes and shapes of ground material.

GUN METAL

Porosity, Prevention of. Prevention of Porosity and Improvement in the Physical Properties of Gun-metal, W. Reitmeister. Foundry Trade Jl., vol. 34, no. 523, Aug. 26, 1926, pp. 177-180, 5 figs.

H

HARDNESS

Testing. Methods of Hardness Testing. Am. Mach., vol. 65, no. 12, Sept. 16, 1926, p. 501, 2 figs. Rockwell hardness testing. Reference-book sheet.

HEAT TRANSMISSION

Theory. The Theory of Heat Transmission (Ueberblick über die Lehre von der Wärmeübertragung), H. Gröber. Zeit. des Vereines deutscher Ingenieure, vol. 70, no. 34, Aug. 21, 1926, pp. 1125-1128, 3 figs. Significance of heat-transmission coefficient; empirical and mathematical-physical method of research; heat transmission in solid bodies and in pipes; radiation of surfaces of solid bodies; radiation of gases; relation of theory of heat transmission to important technical problems.

HEATING, STEAM

Humid-Air Method. Analyzing the Humid-Air Method of Steam Heating Buildings, T. N. Thomson. Plumbers' Trade Jl., vol. 81, no. 4, Aug. 15, 1926, pp. 369-370 and 405. Mechanical construction of radiator steam valve and Venturi tube at radiator inlet, which are elements that made humid-air method possible.

Low-Pressure. Operating Data on Low Pressure Heating in Minneapolis Schools, A. L. Sanford. Am. Soc. Heat. & Vent. Engrs.—Jl., vol. 32, no. 9, Sept. 1926, pp. 647-654, 2 figs. Comparison of high- vs. low-pressure plants and description of typical heating plants of Minneapolis Public Schools. Paper read before Nat. Assn. Pub. Schools Officials, Toronto.

HYDRAULIC TURBINES

Developments. Recent Developments in Water Power Equipment. Power Engr., vol. 21, nos. 241, 242, 244, 245 and 246, Apr., May, July, Aug. and Sept. 1926, pp. 125-126, 174-176, 258-261, 301-303 and 344-346, 26 figs.

Pitting of Runners. Pitting of Hydraulic Turbine Runners. Nat. Elec. Light Assn.—Report, no. 256-318, Apr. 1926, 31 pp., 14 figs. Study for purpose of collecting actual experience data from operating companies in United States and Canada, and to classify and analyze these data in such fashion as to throw light on causes of and means of preventing pitting.

Propeller-Type. A 7,500-Horse Power Propeller Type Water Turbine. Engineer, vol. 142, no. 3686, Sept. 3, 1926, pp. 254-256, 6 figs. Turbines under construction for Kachlet Power Plant on Danube River by J. M. Voith, Germany; turbine is designed for total output of 7,500 h.p. when working under normal head of 7.65 m. and with water consumption of 87.5 cu. m. per sec., speed being 75 r.p.m.

25,000-H.P. A 25,000-H.P. Water Turbine and Alternator. English Elec. Jl., vol. 3, no. 5, July 1926, pp. 201-212, 16 figs. Details of "English Electric" turbine and generator installed in Sorocaba power station by Sao Paulo Elec. Co.; it is reaction type and operates under head of 670 ft.; alternator has full-load output of 20,500-kva., 3-phase, 60 cycles per sec. and power factor of 0.88 and pressure of 6,600 volts when running at 600 r.p.m.

HYDRAULICS

Problems. Some Problems in Hydraulics and River Engineering, E. S. Bellasis. Engineer, vol. 142, no. 3684, Aug. 20, 1926, pp. 202-203, 2 figs. Changes in rivers; dam sites; silt and scour; canals without barrage; backwater problems.

I

INDUCTANCE COILS

Audiofrequencies, for. On the Design of an Inductance Coil for Audiofrequencies which has the Iron Core with the Air Gap, H. Nukiyama and K. Nagai. Inst. Elec. Engrs. of Japan—Jl., no. 456, July 1926, pp. 734-741, 4 figs. Authors have obtained length of air gap theoretically; results of experimental tests. (In Japanese.)

INDUSTRIAL MANAGEMENT

Manufacturing Control. Estimating Forthcoming Orders by the Pooled Orders Index, J. H. Barber. Mfg. Industries, vol. 12, no. 3, Sept. 1926, pp. 199-202, 4 figs. Shows ways in which confidential pooled-orders index, developed by Walworth Co., give definite guidance.

Manufacturing Losses, Reducing. Tracing that Average 28 Per Cent Loss, C. U. Carpenter. Mfg. Industries, vol. 12, no. 3, Sept. 1926, pp. 179-184, 4 figs. In plant having 8,000 employees, production increased and costs came down when author set standards for each job; established bonus system, and provided additional incentive through three-step plan of promotion.

Production Methods. Bringing Production Methods to the Job Shop, J. Younger. Am. Mach., vol. 65, no. 9, Aug. 1926, pp. 349-351. One production shop, The Packard Motor Car Co., not only specifies chemical constituents of its steels, but also stipulates physical factors and further adds microphotographic specification; material turnover in job shop; standardization and simplification.

Purchasing Schedules. Complete Graphic Checks on Purchasing Schedules and Deliveries, H. D. Murphy. Mfg. Industries, vol. 12, no. 3, Sept. 1926, pp. 211-212, 2 figs.

INDUSTRIAL RELATIONS

Future of. The Future Relationship Between Employer and Employee, R. A. Hadfield. Indus. Mgmt. (Lond.), vol. 13, no. 8, Aug. 1926, pp. 358-359. Messages received from leaders of industry on future relationship between employer and employee and its bearing on industrial reconstruction; outlines conciliation system by which industrial strife may be avoided; striking just balance between capital and labor.

INDUSTRIAL TRUCKS

Automobile Manufacturing Plants. How the Automotive Industries Have Put the Electric Industrial Truck to Work, H. J. Payne. Indus. Mgmt. (N.Y.), vol. 72, no. 2, Aug. 1926, pp. 88-95, 15 figs. Discusses practical application of industrial trucks, handling fender stock; use in forge plants and in malleable foundry, in body building plant, and in glass plant; building automobile tires.

INSULATION, HEAT

Developments. Heat Insulation, R. H. Heilman. Engrs. & Eng., vol. 43, no. 8, Aug. 15, 1926, pp. 209-218, 5 figs. Author traces development of heat insulation during past 40 years; presents tables showing efficiencies, heat savings and unit heat losses which can be obtained from 3-in. thickness at heat insulation, and time required to repay original cost and savings per year for temperatures of 500 to 600 deg. Fahr.; explains how to make intelligent use of tables.

Tests. Heat Insulator Tests, C. H. Herter. Refrig. World, vol. 61, no. 8, Aug. 1926, pp. 9-12, 1 fig. Deals with such insulating materials as lith, balsam, wool, Cabot's cel-grass quilt, pyrocell, thermofill, house lining and paper-pulp boards.

INSULATORS, ELECTRIC

Pyrex vs. Porcelain. Temperature of Pyrex and Porcelain in Sunlight, J. T. Littleton, Jr., and W. W. Shaver. Am. Ceramic Soc.—Jl., vol. 9, no. 9, Sept. 1926, pp. 618-625, 6 figs. Relative temperatures of Pyrex glass insulators and porcelain insulators in sunlight are determined in three ways; experiments show that temperature of porcelain insulator increases on average about three and one-half times that of Pyrex glass insulator.

INTERNAL-COMBUSTION ENGINES

Compression-Ignition. Improving the Performance of a Compression Ignition Engine by Directing Flow of the Inlet Air, C. Kemper. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 242, July 1926, 9 pp., 6 figs. Results of tests to determine effect on engine performance of directing flow of inlet air to 5-in. by 7-in. single-cylinder, solid-injection, compression ignition engine; it was found that directing flow of inlet air towards fuel-injection valve gave steadier engine operation, appreciable increase in power and decreased fuel consumption; results indicate simple means for improving air flow in given combustion chamber without changing its shape.

Dust-Driven. An Engine that Runs on Dust, W. A. Noel and R. Hellback. Power, vol. 64, no. 11, Sept. 14, 1926, pp. 402-404, 5 figs. That engines can run on such dust as elevator floor sweeping, starch dust and powdered coal, has been proved in tests by Bureau of Chemistry, Department of Agriculture; preliminary experiments suggest that more attention be given to solid-fuel engine.

Solid-Injection. The Coal Fuel Engine. Gas & Oil Power, vol. 21, no. 251, Aug. 5, 1926, pp. 239-240, 5 figs. Development of solid-fuel internal-combustion engine by A. Schnürle, a German inventor; combustion is effected in special chamber which is in connection with working cylinder but separated from it by porous filter screen plate, through which gases can pass, but not coke and coal dust; chamber contains finely pulverized fuel which is in glowing state.

TEMPERATURE STRESSES. Temperature Stresses and Deflexions in the Fins and Barrels of an Air-Cooled Internal Combustion Engine Cylinder, A. M. Binnie. Lond., Edinburgh & Dublin Philosophical Mag. & Jl. of Science, vol. 2, no. 8, Aug. 1926, pp. 449-462, 21 figs. Attempt is made to evolve method of calculation; for simple case considered it is shown that much weight can be saved by reducing thickness of fins towards their tips; that spacing of fins is of importance; and that to small extent temperatures stresses in fins assist barrel to withstand internal pressure in cylinder.

See also Airplane Engines; Automobile Engines; Diesel Engines; Oil Engines.

IRON ALLOYS

STAINLESS IRON. Stainless Iron, N .L. Mochel. Am. Soc. Steel Treating—Trans., vol. 10, no. 3, Sept. 1926, pp. 353-392 and (discussion) 392-394, 38 figs. Characteristics of low-carbon chromium-iron alloys known commercially as stainless iron; data relative to physical properties of alloys of varying heat treatment; elastic limit and impact values; effect of varying chromium content and silicon, copper and nickel, on physical properties, microstructure, resistance to corrosion and workability of alloys.

IRON CASTINGS

CLEANING AND GRINDING. Cleaning and Grinding Castings, R. Micks. Can. Foundryman, vol. 17, no. 8, Aug. 1926, pp. 7-8. In majority of foundries, tumbling mill is principal method of cleaning castings; sand blast is another valuable cleaning agent, but much depends on quality of abrasive used; portable grinding wheels.

FURNACE SCRAP, FROM. Bad Castings and Furnace Scrap, H. H. Hopkins. Foundry Trade Jl., vol. 34, no. 522, Aug. 19, 1926, p. 164. Discusses question as to whether use of pig iron, made partly with scrap, results in defective castings; author gives practical results and points out errors in reasoning.

SHRINKAGE. Shrinkage Cracks in Steel and Iron Castings, G. A. Luers. Nat. Engr., vol. 30, no. 9, Sept. 1926, p. 406, 1 fig. Author claims that in nearly 50 per cent of cases, breakage is traced directly back to foundry.

STRAIGHTENING WARPED. Straightening Warped Iron Castings, W. J. May. Mech. World, vol. 80, no. 2069, Aug. 27, 1926, 3 figs. By careful heat treatment warping in most cases can be corrected without overmuch trouble; small partly machined castings which are warped will often recover their straightness by mere application of heat for some hours.

J

JIGS

ETCHING SYMBOLS. Etching Symbols on Jigs and Fixtures, R. B. White. Am. Mach., vol. 65, no. 9, Aug. 26, 1926, pp. 367-368, 1 fig. The pantograph and matrices; composition of acid-resisting ground; wax dam prevents acid from spreading; acids for etching different metals.

MANUFACTURE. Production Pointers in Jig Making, C. C. Hermann. Can. Machy., vol. 36, no. 10, Sept. 2, 1926, pp. 17-19, 11 figs. Points out that making of busing is difficult piece of work in ordinary shop, initial requirement being concentric hole so that surrounding metal will be uniform thickness.

L

LABOUR

BIBLIOGRAPHIES. Book Notes. Int. Labour Rev., vol. 14, no. 1, July 1926, pp. 135-150. International, official and non-official publications.

Publications Relating to Labour. Monthly Labour Rev., vol. 23, no. 2, Aug. 1926, pp. 236-239. Official and non-official publications in United States and foreign countries.

LAKES

LEVELS, GREAT LAKES, N.A. The Levels of the Great Lakes of North America, W. Porthouse. Engineer, vol. 142, no. 3685. Aug. 27, 1926, pp. 218-219, 1 fig. Levels of Great Lakes have provided problem of immense difficulty and supercomplexity.

LATHES

CENTRES. Design of Lathe Centres, F. Horner. Machy. (Lond.), vol. 28, nos. 721 and 722, Aug. 5 and 12, 1926, pp. 528-532 and 564-568, 16 figs. Typical designs for different classes of work.

LIGHTING

STREET. Remote Control Equipment for Street Lighting Circuits, H. R. Crago. Gen. Elec. Rev., vol. 29, no. 9, Sept. 1926, pp. 666-668, 7 figs. Advantages of centralized control.

LIGHTNING ARRESTERS

FUSE PROTECTION. Fuse Protection of Lightning Arresters, J. D. Roberts. Elec. Light & Power, vol. 4, no. 9, Sept. 1926, pp. 27 and 82, 2 figs. On large transmission system in Middle West, fuses are installed in connection with oxide film, electrolytic and auto-valve types of arresters where used in connection with 33,000-volt and 66,000-volt transmission system; fuses are only installed at isolated locations not having constant attendance.

KLYDONOGRAPH TESTS. Arrester Tests with the Klydonograph, L. R. Golladay. Elec. World, vol. 88, no. 10, Sept. 4, 1926, pp. 477-479, 6 figs. Results of investigations on several station-type auto-valve arresters during summer and fall of 1925; characteristics of lightning discharges observed for storms differing widely in degree of severity.

LIME

MANUFACTURE FROM SMALL STONE. Manufacture of Lime from Small Stone, W. M. Myers. Can. Min. Jl., vol. 47, no. 35, Aug. 27, 1926, pp. 846-850. Difficulty of calcining small stone; present method of study of sintering machine as means of lime burning; construction, operation and tests of sintering machine; properties of lime produced by sintering machine and its possible utilization in manufacture of lime.

LOCOMOTIVE BOILERS

PITTING. Pitting of Locomotive Boilers, W. A. Pownall. Ry. Rev., vol. 79, no. 8, Aug. 21, 1926, pp. 263-270, 5 figs. Observations of boiler corrosion in various forms.

Water-Tube. Suggestions for a Water-Tube Locomotive Boiler, L. A. Rehfuss. Boiler Maker, vol. 26, no. 8, Aug. 1926, pp. 218-219, 2 figs. Outline of advantages to be expected from carefully developed water-tube locomotive-boiler design.

LOCOMOTIVES

DESIGN AND CONSTRUCTION. Locomotive Design and Construction. Ry. Rev., vol. 79, no. 6, Aug. 7, 1926, pp. 197-207, 2 figs. Abstract of progress report on building engines to reduce track stresses.

DIESEL ENGINED. Geared Diesel Locomotive 2-E-1 of Russian State Railways (Diesel-Getriebelokomotive 2-E-1 für Staatsbahnen der U.S.S.R.), G. Lomonossoff. Organ für die Fortschritte des Eisenbahnwesens, vol. 81, no. 11, June 15, 1926, pp. 193-198, 13 figs. Design of Diesel locomotive of 1,200-h.p., with gear transmission by Hohenzollern, A.G., comparison with Diesel-electric locomotive; advantages of former. (Transl. from Russian.)

DRIVING WHEELS. On the Action of a Locomotive Driving Wheel, F. W. Carter. Roy. Soc.—Proc., vol. A112, no. A780, Aug. 3, 1926, pp. 151-157, 1 fig. Author attempts to compute tractive force per unit creepage to rail.

FOUR-CYLINDER COMPOUND. French Four-Cylinder Compound 4-8-2 Type Locomotive, M. Chambon. Ry. Age, vol. 8 , no. 7, Aug. 14, 1926, pp. 276-278, 3 figs. Develops 41,446-lb. tractive force, with 40,000-lb. axle loads; grate area large for European practice.

LUBRICATION. A High-Pressure Locomotive Lubricator. Engineer, vol. 142, no. 3683, Aug. 13, 1926, p. 180, 5 figs. New type of forced feed lubricator manufactured by Bosch Co.

OIL-ENGINED. Transmission of Power on Oil-Engine Locomotives, A. I. Lipetz. Mech. Eng., vol. 48, nos. 8 and 9, Aug. and Sept. 1926, pp. 797-806 and 929-940, 31 figs. Classification of power transmission in chronological order of their appearance in art; class A comprises full-power elastic-fluid transmissions; class B consists of differential elastic-fluid transmissions; class C pertains to mechanical (gear-clutch) and direct transmissions.

PACIFIC-TYPE. Atlantic & West Point Passenger Locomotives. Ry. Rev., vol. 79, no. 10, Sept. 4, 1926, pp. 331-333, 3 figs. Pacific-type engines designed to handle heavy trains over mountain grades at high speeds.

THREE-CYLINDER. Three-Cylinder Mountain Type Locomotive. Ry. Age, vol. 81, no. 10, Sept. 4, 1926, pp. 431-433, 3 figs. Built for Denver & Rio Grande Western for heavy passenger service; tractive force, 75,000 lb.

LUBRICATING OILS

VISCOSITY. Viscosity and the Conradson Carbon-Residues of Lubricating Oils, G. W. Burke. Soc. Automotive Engrs.—Jl., vol. 19, no. 3, Sept. 1926, pp. 249-251, 4 figs. Deals with relationship between viscosity and Conradson carbon-residues of lubricating oils for internal-combustion engines; present evidence indicating that true relationship does not exist between viscosity at any temperature and carbon-residue value, and shows in general way what can be expected as to carbon-residue value when viscosity is known.

LUBRICATION

PROTECTION. Lubrication Protection. Lubrication, vol. 12, no. 8, Aug. 1926, pp. 85-96, 22 figs. Oil filtration and purification; types of systems, namely, precipitation and filtration, centrifugal separation and mechanical coagulation of impurities with suitable chemicals; filtering and cleaning of air.

M

MACHINE TOOLS

RAILWAY SHOPS. New Machine Tools for Railway Workshops. Ry. Engr., vol. 47, no. 560, Sept. 1926, pp. 308-311, 4 figs. Heavy motor-driven wheel lathe, and special machine, also motor-driven for boring axle-boxes.

REPLACEMENT POLICY. Systematic Replacement of Machine Tools, H. K. Spencer. Machy. (N.Y.), vol. 33, no. 1, Sept. 1926, p. 19. Outlines method for systematically replacing machine-tool equipment in plant so that it may be kept up-to-date.

MACHINING METHODS

LOCOMOTIVE REPAIRS. Machining Methods that Cut Locomotive Repair Costs, F. W. Curtis. Am. Mach., vol. 65, nos. 4, 5 and 6, July 22, 29 and Aug. 5, 1926, pp. 159-161, 193-194 and 249-251, 24 figs. Methods used in locomotive repair shop. July 29: Milling shoes and wedges, planing crossheads; reboring cylinders; boring and facing driving boxes; air-operated tools for squaring valve parts and cutting out superheated flues. Aug. 5: Turning in drill press; trepanning flue sheets; gauges made in punch press.

MAGNETIZATION

LAW OF. Law of Magnetization, S. L. Gokhale. Am. Inst. Elec. Engrs., vol. 45, no. 9, Sept. 1926, pp. 846-863, 17 figs. Investigation of reliability of Frolich's law of magnetization near saturation; it was found that law is not as reliable as it is generally believed to be, particularly for purpose of computation of saturation value.

MALLEABLE IRON

BLACK-HEART. Carbon in Black-Heart Malleable, C. Kluijtmans. Foundry Trade Jl., vol. 34, no. 521, Aug. 12, 1926, pp. 133-135, 9 figs. For black-heart malleable, carbon content must be between 2.20 and 2.60 per cent; under 2.20 difficulties will be encountered in foundry on account of poor fluidity of such iron and chance of shrink; over 2.60 per cent, although this iron is quite suitable for moulding, higher carbon would produce primary graphite, thus precluding satisfactory annealing and in any case yielding weak casting; results of tests show that for similar annealing conditions the larger the initial masses of cementite the larger the resultant graphite.

MATERIALS HANDLING

CHAIN BLOCKS. The Chain Block and Its Almost Unlimited Field, F. C. Eibell. Indus. Mgmt. (N.Y.), vol. 72 no. 2, Aug. 1926, pp. 96-101, 14 figs. Discusses various types and their most economical applications; there are three general types in use; differential, screw-geared and spur-geared blocks.

GENERAL ELECTRIC CO., SCHENECTADY. Where Size and Variety Complicate the Handling of Materials, R. H. Rogers. Indus. Mgmt. (N.Y.), vol. 72, no. 2, Aug. 1926, pp. 125-131, 15 figs. How General Elec. Co. solves its materials-handling problems.

INDUSTRIAL PLANTS. Getting Production in a Limited Space, C. O. Herb. Machy. (N.Y.), vol. 33, no. 1, Sept. 1926, pp. 38-40, 10 figs. How lack of space was successfully overcome in one plant by adoption of time- and labour-saving methods of handling work.

MAN-POWER. Lifting and Handling by Man-Power, F. L. Eidmann. Indus. Mgmt. (N.Y.), vol. 72 no. 2, Aug. 1926, pp. 111-114, 14 figs. Lift truck and portable elevator as reducers of handling costs.

METALLURGY

DEVELOPMENTS. Metallurgy Fifty Years Ago and Now, W. M. Corse. Indus. & Eng. Chem., vol. 18, no. 9, Sept. 1926, pp. 892-895. Deals with copper, zinc, tin, lead, nickel, cadmium, antimony, chromium, molybdenum, uranium, tungsten, tantalum, titanium, zirconium, vanadium, manganese, silicon, etc.

METALS

CORROSION. Principles and Methods of Testing the Submerged Corrosion of Metals, F. N. Speller, R. P. Russell and W. G. Whitman. Mass. Inst. of Technology —Publications, vol. 62, no. 34, Aug. 1926, 8 pp., 6 figs. General principles and specifications for testing; submerged corrosion tests; method of reporting corrosion results and recommended testing methods.

TESTING. Modern Testing of Materials and Its Application (Die neuzeitliche Materialprüfung und ihre kritische Auswertung), R. Hinzmann. Gewerbefleiss, vol. 105, no. 6, June 1926, pp. 117-124, 17 figs. Discusses methods of physical and mechanical testing; tensile strength and elongation, hardness, notched-bar strength; metallographic testing; lays stress on testing for behaviour under given conditions.

METEOROLOGY

WEATHER FORECASTING. Solar Radiation and Weather Forecasting, C. F. Marvin and H. H. Kimball. Franklin Inst.—Jl., vol. 202, no. 3, Sept. 1926, pp. 273-306, 23 figs. Examination of measurements by Abbot of solar thermal energy and conclusions as to their weather-forecasting value. Bibliography.

MILLING MACHINES

TURBINE BLADES, FOR. Profile Milling Turbine Blades. Machy. (Lond.), vol. 28, no. 722, Aug. 12, 1926, pp 558-559, 4 figs. By means of slight modifications to their well-known profiling and cam-milling machine, Webster & Bennett, Coventry, have been successful in adapting it for profile milling back of turbine blades.

MINE HAULAGE

COAL MINES. Modern Haulage Systems for Coal Mines, G. Bright. Modern Min., vol. 3, no. 8, Aug. 1926, pp. 272-276, 6 figs. Deals with power distribution; rail weights to use, mine cars and locomotives.

MINE TIMBERING

PRESERVATIVE TREATMENT. Preservative Chemical Treatment for Mine Timbering, A. M. Howald. Modern Min., vol. 3, no. 8, Aug. 1926, pp. 242-244, 2 figs. Wood-treating plants for mine operator.

MOULDING METHODS

LARGE-SIZE STRAINER. Method of Moulding a Large-Size Strainer, J. H. List. Metal Industry (Lond.), vol. 29, no. 7, Aug. 13, 1926, p. 155. Method employed in moulding strainer 6 ft. long overall with 36-in. outside diameter of body and 20-in. inlet bore.

MACHINE MOULDING. Machine Moulding with Single Flask. Iron Age, vol. 118, no. 10, Sept. 2, 1926, pp. 604-606, 4 figs. Time for making asphalt moulds lowered by machine combining jolt ram, rollover power draw, and other operations.

MOULDS

DRYING. The Drying of Moulds, with Special Regard of Permissible Maximum Temperature (Ueber die Trocknung von Gussformen, unter besonderer Berücksichtigung der zurlässigen Höchsttemperateur), W. Schultze. Giesserei, vol. 13, no. 35, Aug. 28, 1926, pp. 634-647, 15 figs.

INGOT. Life of Ingot Moulds (Sur la Durée des Lingotières), A. Legrand. Fonderie Moderne, vol. 20, Aug. 1926, pp. 181-188, 4 figs. Discusses current formulas and ideas; excellent results obtained with theoretically poor composition and disastrous results with chemically perfect composition, etc.

MOTOR BUSES

BRAKES. Bus Brakes, K. W. Stillman. Automotive Industries, vol. 55, no. 9, Aug. 26, 1926, pp. 334-335. Problems of design and maintenance.

N

NON-FERROUS METALS

MELTING. Melting Soft Metals, E. L. Gates. Gas Age-Rec., vol. 58, no. 8, Aug. 21, 1926, pp. 241-244 and 248, 5 figs. Gives table listing more commonly used commercial alloys; brass melting furnaces using gas for fuel are of two types, crucible and non-crucible variety; recuperation and regeneration; cost of gas vs. coal in melting furnaces.

O

OIL

PREHEATERS. Oil Preheater Design, F. L. Kallam. Oil Bul., vol. 12, no. 8, Aug. 1926, pp. 847-848, 1 fig. Selection of metal for heater tubes; diameter and spacing of tubes; expansion of tubes and shells; oil and steam distribution.

COMBUSTION. Oil Engine Combustion Systems, C. E. Klitgaard. Pac. Mar. Rev., vol. 23, no. 8, Aug. 1926, pp. 358-360. Considers four phases of combustion, namely, injection, gasification, ignition and actual combustion.

COMBUSTION CONTROL. Control of Combustion in Oil Engines, A. B. Newell. Nat. Engr., vol. 30, no. 9, Sept. 1926, pp. 4.9-421. Principles of operation and hints on operation, repair, maintenance and adjustment of fuel-injection devices and valves of modern oil engines.

CONVERTIBLE OIL-GAS ENGINES. Convertible Oil-Gas Engine. Mech. World, vol. 80, no. 2070, Sept. 3, 1926, pp. 179-180, 1 fig. Engines placed on market by National Gas Engine Co., Manchester, Eng., as suitable for use with either gaseous or liquid fuel; can be changed over quite simply from one to other as economic conditions dictate.

FUEL COMBUSTION, IMPROVEMENT OF. Improving Fuel Combustion in Oil Engines, E. J. Kates. Oil Engine Power, vol. 4, no. 9, Sept. 1926, pp. 545-546. Increasing cyclic efficiency considered as possibility for reducing weight and cost.

INDICATING. Indicating a Paraffin Engine, N. Harwood. Mech. World, vol. 80, no. 2067, Aug. 13, 1926, pp. 126-127, 5 figs. Indicating device employed and method of application.

MARINE. Marine Oil Engine Trials. Instn. Mech. Engrs.—Proc., no. 3, Mar. 1926, pp. 523-595 and (discussion) 596-618, 32 figs; also abstract in Engineering, vol. 121, nos. 3150, 3151 and 3153, May 28, June 4 and 18, 1926, pp. 639-641, 675-677 and 742-744, 26 figs. Results of tests of M. V. British Aviator and also engines, covering shore and sea tests. Vessel was propelled by Balmer-Camellaird-Fullagar, opposed-piston, 2-stroke cycle, single-acting oil engine with blast-air fuel injection.

PISTONS. *See Pistons.*

SKETCHES AND WORKING. Sketches and Working of Oil Engines. Motorship, vol. 11, no. 9, Sept. 1926, pp. 686-690 and 695-696, 13 figs. Practical considerations underlying injection of fuel without use of compressed air.

STRAIN METERS FOR. Direct-Reading Strain Meter, J. Geiger. Oil Engine Power, vol. 4, no. 9, Sept. 1926, pp. 564-567, 10 figs. New instrument for measuring strains in engine parts by 200,000-fold magnification.

OIL FUEL

COMBUSTION. The Combustion of Fuel Oil, W. Kemp, Jr. Oil Eng. & Technology, vol. 7, no. 123, July 1926, pp. 303-308, 5 figs. Study of conditions for burning fuel oil efficiently.

Experiences with the Combustion of Fuel Oil in Power Plant Boilers, J. F. Barkley. Engrs. & Eng., vol. 43, no. 8, Aug. 15, 1926, pp. 221-224, 1 fig. Types of burners used are grouped into two general classes, those using steam to effect atomizing of oil, and those using mechanical means.

OIL WELLS

PUMPING. An Analysis of Deep-Well Oil Pumping, W. H. Clapp. Mech. Eng., vol. 48, no. 9, Sept. 1926, pp. 941-946, 12 figs. Points out that present methods of pumping oil from underground are unsatisfactory; author develops ideal motion where abrupt forces are reduced to minimum, thus reducing fatigue stresses and other causes of failure; develops design of air-driven engine which should have indicator card corresponding to ideal kinematic requirements, and summarizes its advantages in reducing chances of breakage in sucker rods and reducing friction in actuating mechanism; combination of central compressor plant actuated by internal combustion engines is shown to give possibility of cheaper source of power.

OXY-ACETYLENE CUTTING

RAILWAY-CAR CONSTRUCTION. Jet-Cutting Machines. Machy. (Lond.), vol. 28, no. 722, Aug. 12, 1926, pp. 541-544, 6 figs. Theory of oxygen cutting; preheating agents and cutting speeds; universal templet and universal mechanical machines; Hancock oxygen-cutting machine; pantograph machine.

OXY-ACETYLENE WELDING

ROOF TRUSSES. Tests on Oxwelded Roof Trusses, H. H. Moss. Welding Engr., vol. 11, no. 8, Aug. 1926, pp. 32-34, 5 figs. Demonstrating application of engineering principles and procedure control to oxy-acetylene welding of structural steel.

SHEET METAL. Oxy-Acetylene Welding and Cutting, F. X. Morio. Sheet Metal Worker, vol. 17, no. 15, Aug. 27, 1926, pp. 573-574 and 580, 4 figs. Theory and practice as applied to sheet-metal trade with suggestions as to welding and cutting various metals.

STEEL. Welding High Carbon Tool Steel and High-Speed Steel with the Oxy-Acetylene Torch, G. L. Walker. West. Machy. World, vol. 17, no. 8, Aug. 1926, pp. 350-353, 3 figs. Author points out that there yet remains need for further study and development in methods and materials before these steels are as successfully and as extensively welded as are lower-carbon steels.

TEXTILE-MILL EQUIPMENT. Oxy-Acetylene Welding Equipment for Mills. Textile World, vol. 70, no. 6, Aug. 7, 1926, pp. 63-64, 1 fig. Apparatus composing typical welding and cutting outfit capable of effecting large savings in any textile plant; advice in regard to purchase of torches, welding rods, flux, regulators and hose; cost of portable unit.

P

PAPER MANUFACTURE

PARCHMENT PAPER. Parchment Paper and Its Manufacture, M. DeKeghel. Paper Trade Jl., vol. 83, no. 10, Sept. 2, 1926, pp. 57-62. Parchmentizing with zinc-chloride apparatus for parchmentizing; properties and uses of parchment paper; parchment-paper preparations; artificial parchment.

PATENTS

CO-PATENTEES. Co-Patentees, E. L. Francis. Automobile Engr., vol. 16, no. 218, Aug. 1926, pp. 313-314. Consideration of their relative rights.

PATTERN-MAKING

FITTING IRREGULAR SHAPES. Fitting Irregular Pattern Shapes, J. McLachlan. Can. Foundryman, vol. 17, no. 8, Aug. 1926, pp. 14-15, 7 figs. Describes several methods of fitting branches, ribs and bosses on irregular shapes which are not rule-of-thumb and yet will be found very accurate, without use of geometry.

MACHINES AND DRIVING BELTS. Patternshop Machines and Driving Belts. Metal Industry (Lond.), vol. 28, nos. 24 and 25, June 11 and 18, 1926, pp. 554-555, 578-579. June 11: Combination-type and sandpapering machines. June 18: Advantages of wooden pulleys; belt problems.

PAVEMENTS, ASPHALT

FOUNDATIONS. Foundations for Asphalt Pavements, A. K. Vickery. Asphalt Assn.—Circular no. 36, 30 pp., 2 figs. Papers and extracts from papers and discussions presented at Fourth Annual Asphalt Paving Conference held at Detroit, Mich., Oct. 21-23, 1925. Includes specifications (on loose folders) for asphaltic concrete base, asphaltic concrete surface course, and sheet asphalt binder and surface courses.

PIERS

SUBSTRUCTURE. A New Design of Permanent Substructure for Piers and Wharves, W. G. Chase. World Ports, vol. 14, no. 10, Aug. 1926, pp. 32-34, 3 figs. Substructure proposed comprises combination of shells of spun reinforced concrete pipe assembled vertically with suitable end joints to form hollow columns of height desired; these columns are filled with concrete reinforced with rods and rings of steel to develop proper supporting strength.

PILES

DRIVING. Pile-Driving and Concreting Methods on a Large Substructure Contract, F. W. Skinner. Engineering, vol. 122, nos. 3 61 and 3163, Aug. 13, and 27, 1926, pp. 187-190 and 253-254, 11 figs. Describes driving of large number of wooden foundation piles for building for new telephone cable and switchboard manufacturing works of Western Elec. Co. now in process of construction on 60-acre site between Newark and New York; piles will be carried down average depth of about 35 ft. below low-tide level and covered with concrete footings; advantages of this type of foundation; total number of piles required will be about 200,000; work now under construction requires about 40,000; driving was accomplished as much as possible by floating equipment.

PIPE, SUBMERGED

LAYING. Laying 1,200-ft. of Submerged Pipe Line. Contract Rec., vol. 40, no. 34, Aug. 25, 1926, pp. 811-814 and 820, 7 figs. New 36-in. rivetted steel pipe line constructed by City of Vancouver, providing additional conduit from Seymour Creek intake to Little Mountain reservoir.

PIPE

CONNECTIONS. A Problem in Pipe Connection, W. T. McClenahan. Power, vol. 64, no. 8, Aug. 24, 1926, pp. 274-275, 2 figs. Presents results of mathematical analysis which develops fairly simple formulas applicable to any case.

PISTONS

OIL ENGINES, FOR. Light-Metal Piston for Oil Engines. Oil Engine Power, vol. 4, no. 9, Sept. 1926, pp. 548-550, 4 figs. Type of aluminum-alloy piston recently found best adapted to Diesel engines was first proved out by extensive practical use; pistons are cast of special alloy of nickel, aluminum and copper, produced by process which results in complete union of metals; bands of steel are cast in metal of skirt, one above piston pin, one near bottom edge, with additional bands in other locations if required.

POWER

COSTS INVESTIGATION. The Investigation of Power Costs, W. A. Shoudy. Mfg. Industries, vol. 12, no. 3, Sept. 1926, pp. 203-206, 6 figs. Methods for studying utilization and generation of power to show where costs can be reduced.

POWER FACTOR

CORRECTION. Methods of Correcting Power Factor, J. B. Holston. Indus. Engr., vol. 84, no. 9, Sept. 1926, pp. 409-414, 12 figs. Uses of Equipment in industrial plants designed for this purpose.

The Influence of Voltage Harmonics on Power-Factor Correction by Condensers, E. Hughes. Engineering, vol. 122, no. 3161, Aug. 13, 1926, pp. 216-218, 10 figs. Concludes that power factor of system having harmonics in voltage wave cannot be increased to unity by means of condensers; it is possible that after capacity calculated to give unity power factor for sinusoidal waves has been installed, final power factor may be lower than initial value. Paper read before Sect. G Brit. Assn.

IMPROVEMENT. Getting the Most Out of Your Power Lines, J. O. Coates. Mfg. Industries, vol. 12, no. 3, Sept. 1926, pp. 195-198, 4 figs. Methods by which low power factor can be improved.

MEASUREMENT. The Measurement of Power Factor in Unbalanced Three-Phase Systems, G. W. Stubbings. World Power, vol. 6, no. 33, Sept. 1926, pp. 124-126, 3 figs. Investigation of behaviour of 6-coil power-factor meter and reactive meter externally compensated with voltage unbalancing.

POWER TRANSMISSION

LINESHAFT DRIVE. Erecting and Aligning a Lineshaft Drive, G. Trimm. Indus. Engr., vol. 84, no. 9, Sept. 1926, pp. 398-401, 2 figs. Procedure in installing shaft which is of considerable length.

PROJECTILES

TOLERANCES. Sane Specifications and Intelligent Inspection, C. L. Ruggles. Mech. Eng., vol. 48, no. 9, Sept. 1926, pp. 909-915, 11 figs. Points out that problem of tolerances to be allowed in projectile manufacture can be solved only by experimental study of effects of dimensional variations.

PULVERIZED COAL

BOILER FIRING. Pulverized Coal Firing (Einige Bermerkungen über Kohlenstaubfeuerungen), W. Lulofs. Elektrotechnische Zeit., vol. 47, no. 24, June 17, 1926, pp. 694-696, 3 figs.

Pulverized Coal is Fuel for Industrial Plants (Poederkool als brandstof voor industrieele stookinrichtingen), D. Dresden. Iengenieur, vol. 41, no. 25, June 19, 1926, pp. 505-507, 2 figs. Advantages of pulverized coal firing and its application in various countries, including Holland.

GASIFIED-FUEL BURNING SYSTEM. The Gasified-Fuel System of Burning Pulverized Coal. Engineering, vol. 122, no. 3164, Sept. 3, 1926, pp. 294-296, 9 figs.

SUGAR MILLS. Producing Sugar with Pulverized Coal, A. Murphy. Power House, vol. 19, no. 15, Aug. 5, 1926, pp. 19-26 and 52, 15 figs. Describes new power plant of Dominion Sugar Co. at Wallaceburg, Ont., in which three 670-h.p. water-tube boilers, fired with pulverized coal, are effecting saving of 50 tons of fuel a day.

PULLEYS

TYPES AND CHARACTERISTICS. Pulleys. Power Engr., vol. 21, no. 246, Sept. 1926, pp. 347-349, 3 figs. Notes on several types and their characteristics.

PUMPS

BOILER-FEED. Boiler-Feed Pump Characteristics. Mech. World, vol. 80, no. 2065, July 30, 1926, pp. 79-80, 2 figs. Summarizes argument contained in pamphlet entitled The All-Electric Boiler-Feed Pump, issued by Mather and Platt, Manchester, Eng.; considers relative economies of steam-driven and electrically-driven pumps; typical characteristics of various types of pumps.

PUMPS, CENTRIFUGAL

SELF-PRIMING. A Self-Priming Centrifugal Pump. Engineer, vol. 142, no. 3683, Aug. 13, 1926, p. 179, 1 fig. Details of small Elmo pump, supplied by Siemens-Schuckert, and exhibited in South Kensington Science Museum, which will even continue to operate when it is sucking considerable proportion of air with water.

SPECIFICATIONS. Centrifugal Pump Specifications Should Be Complete, C. C. Brown. Power Plant Eng., vol. 30, no. 18, Sept. 15, 1926, pp. 996-997, 1 fig. Characteristics should be studied for each installation and all terms used in specifications defined.

R

RADIO COMMUNICATION

SHORT-WAVE LENGTHS. On the Relation Between Short-Wave Lengths and Possible Communication Hours Together with the Communication Distance, T. Nakayama, T. Ono and C. Anazawa. Inst. Elec. Engrs. of Janpan—Jl., no. 456, July 1926, pp. 695-711, 11 figs. Authors made long-distance communications with different short-wave lengths for one year to find out relation between wave lengths and communication distances; concludes that wave of about 24 m. is critical; waves having length of 25 m. or more are best utilized for long-distance night communication; waves having length of 22 or less are good for long-distance daylight communication; phenomena of skipped distance exists in short-wave transmission, especially for short-wave below 20 m. (In Japanese.)

RADIOTELEGRAPHY

HIGH-FREQUENCY TRANSMISSION. Relation Between the Height of the Kennelly-Heaviside Layer and High-Frequency Radio Transmission Phenomena, A. H. Taylor. Inst. Radio Engrs.—Proc., vol. 14, no. 4, Aug. 1926, pp. 521-540, 11 figs. Deals with waves short enough to show skip distance effect.

SHORT-WAVE. On the Wireless Beam of Short Electric Waves, S. Uda. Inst. Elec. Engrs. of Japan—Jl., no. 456, July 1926, pp. 712-724, 30 figs. Experiments in directional radio transmission on wave length of 4.4 m.; according to author's experience, parabolic reflector is not necessary; reflector consisting of vertical metallic rods arranged along polygonal base line drawn on ground is equally effective; gives various types of directive antennas, such as L type, inverted L type, U type and rectangular type. (In Japanese.)

FIELD-STRENGTH MEASUREMENTS. A Radio Field-Strength Measuring System for Frequencies up to Forty Megacycles, H. T. Friis and E. Bruce. Inst. Radio Engrs.—Proc., vol. 14, no. 4, Aug. 1926, pp. 507-519, 11 figs. Deals with new system of measurement which has been used successfully at frequency as high as 40 megacycles; apparatus is double detection receiving set equipped with calibrated intermediate frequency attenuator and local signal comparison oscillator.

RECTIFIERS

DIRECT-READING GAUGE. Direct-Reading Gauge for Mercury-Arc Power Rectifiers, A. Gaudenzi. Brown, Boveri Rev., vol. 13, no. 9, Sept. 1926, pp. 224-226, 7 figs. Direct-reading vacuum gauge of hot-wire type which allows pressure in cylinder to be observed continuously; designed by Brown, Boveri & Co.

MERCURY-VAPOUR. The Restification of Alternating Currents with Steel-Enclosed Mercury-Arc Power Rectifiers and their Auxiliary Devices, O. K. Marti. Am. Inst. Elec. Engrs., vol. 45, no. 9, Sept. 1926, pp. 832-846, 22 figs. Deals with most important theoretical treatments and describes steel-enclosed rectifier of modern design. Bibliography.

OXIDE. A Distinctly New Rectifier, H. H. Sheldon. Sci. Am., vol. 135, no. 3, Sept. 1926, pp. 186-187, 5 figs. Dry metal oxide between two electrodes makes rectifier for use in connection with radio sets.

REFRACTORIES

CARBORUNDUM. Carborundum as a Refractory Material, B. Kleinschmidt. Chem. Age, vol. 15, no. 373, Aug. 21, 1926, p. 178. Its increasing use in Germany; properties of carborundum and industrial applications.

FIREBRICK. *See Firebrick.*

FIREBRICK-COAL-ASH. Fusion Points of Firebrick-Coal-Ash Mixtures, L. C. Hewitt. Am. Ceramic Soc.—Jl., vol. 9, no. 9, Sept. 1926, pp. 575-582, 4 figs. Six types of refractory brick were tested with five types of coal ash; cone fusion points of brick ash mixtures being determined over range of 10 per cent brick, 90 per cent ash to 40 per cent brick, 60 per cent ash; results obtained indicate that cone-slag test is of very limited value as means of selecting refractories for boiler service.

REGULATORS

ACCELEROMETER-TACHOMETER. The Charmilles Accelero-Tachometric Regulator (Le régulateur accélérotachymétrique des Ateliers des Charmilles S. A. à Genève), M. E. Volet. Technique de la Suisse Romande—Bul., vol. 25, no. 16, July 31, 1926, pp. 190-196, 19 figs.

REFRIGERATING MACHINES

HIGH-SPEED. Modern High-Speed Refrigerating Machines, G. W. Daniels. Brit. Cold Storage & Ice Assn., vol. 22, no. 2, 1925-26, pp. 5-20 and (discussion) 21-45. Summarizes relative advantages of high-speed and low-speed types; points out that adoption of higher speeds necessitates number of changes in design, most important of which are discussed, such as valves, suction pipes and passages; lubrication, balancing, scantlings and motion work; types and examples of machines.

REFRIGERATION

ELECTRIC. A Record in Electric Refrigeration. Elec. World, vol. 88, no. 9, Aug. 28, 1926, pp. 424-425, 1 fig. Ohio Public Service Co. attains 2.3 per cent saturation of customers; experience in selling and installation; definite plan of sales organization.

RESEARCH

INDUSTRIAL. British Workshops Industrial Research. World Power, vol. 6, no. 33, Sept. 1926, pp. 159-164, 5 figs. Notes on Research Laboratories of (Brit.) General Electric Co.; main pipe trunks, electricity supply; routine testing, and laboratory-factory.

ROAD CONSTRUCTION

DOUBLE-DECKED HIGHWAY. Building Double-Decked Highway in Trap Rock Cut. Eng. News-Rec., vol. 97, no. 11, Sept. 9, 1926, pp. 415-416, 3 figs. Holland tunnel approach in New Jersey requires careful blasting because of nearby railroad cut and tunnel; novel concreting plan.

ROADS

SOIL TESTS. Adaptation of Atterberg Plasticity Tests for Subgrade Soils, A. M. Wintermeyer. Pub. Roads, vol. 7, no. 6, Aug. 1926, pp. 119-122, 8 figs. Results obtained so far with test have been so satisfactory that it has been decided to employ it regularly in conjunction with other tests now being used by Bureau of Public Roads in surveys being made to determine influence of subgrades, subbases and drainage of condition of pavements.

ROADS, CONCRETE

CRACKING. Cracking of a Concrete Road. Engineer, vol. 142, no. 3686, Sept. 3, 1926, pp. 247-247, 3 figs. Particulars concerning construction of road in Manchester, England, which recently fractured in curious manner.

S

SAND, MOULDING

HANDLING SYSTEMS. Sand-Handling System Yields Economies, R. A. Fiske. Iron Age, vol. 118, no. 11, Sept. 9, 1926, pp. 703-705, 4 figs. Equipment for handling and distributing sand in steel foundry saves labour and floor space, speeds up production, and simplifies shop routine.

SCREW MACHINES

AUTOMATIC. Smallpiece 1½-in. Automatic Screw Machine. Mech. World, vol. 80, no. 2070, Sept. 3, 1926, p. 179, 1 fig. Developed by Armstrong, Whitworth & Co., Manchester, Eng., to meet requirements of motor and air-craft industries; it is guaranteed to produce accurately most complex parts made from heat-treated high-tensile steels.

SCREWS

MEASUREMENT. Correction for Elastic Compression in the Measurement of Screws with Small Cylinders, G. A. Tomlinson. Machy. (Lond.), vol. 28, no. 724, Aug. 26, 1926, pp. 616-618, 2 figs. Points out that in accurate measurements of small screw, correction should be applied on account of compression that ordinarily occurs; presents nomogram for computing compression correction in effective diameter measurement.

SEWAGE DISPOSAL

AUSTIN, MINN. Struggles of Small Town with Large Sewage Problem, F. Bass. Eng. News-Rec., vol. 97, no. 9, Aug. 26, 1926, pp. 339-342, 3 figs. Austin, Minn., after strenuous controversy over direct oxidation, decides on Imhoff tank and sprinkling filters; packing-house waste receives partial separate treatment.

CHEMICAL AND BIOLOGICAL INVESTIGATIONS. Chemical and Biological Investigations of the Sanitary District, F. W. Mohlman. West. Soc. Engrs.—Jl., vol. 31, no. 7, July 1926, pp. 267-276, 3 figs. Routine analytical work and special investigations carried out by laboratories and testing stations of Sanitary District, including (1) bacteriological analyses of water from Lake Michigan and from municipal supplies taken from lake; (2) sanitary investigations of diversion channels and Illinois River; (3) control of operation of sewage treatment works and experimental testing of new processes of sewage treatment; (4) investigations of volume and character of industrial wastes and study of best methods for treatment of these wastes.

ACTIVATED SLUDGE. The Activated Sludge Process, H. T. Calvert. Contract Rec., vol. 40, no. 34, Aug. 25, 1926, pp. 804-806. Outline of chemical and bacteriological processes involved in this method of sewage treatment; latest developments.

GRIT-CHAMBER PRACTICE. Grit-Chamber Practice. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 7, Sept. 1926. Symposium of articles, as follows:—Grit-Chambers for Sewage Treatment Works, G. B. Gascoigne, pp. 1366-1382, 4 figs; Canadian Practice, F. A. Dallyn, pp. 1383-1385; British Practice in the Design of Grit-Chambers or Detritus Tanks, A. J. Martin, pp. 1386-1392, 3 figs; Grit-Chambers in German Sewage Purification Plants, K. Imhoff, p. 1393.

MECHANICAL VS. BIOLOGICAL TREATMENT. Mechanical vs. Biological Sewage Treatment, G. A. Johnson. Can. Engr., vol. 51, no. 9, Aug. 31, 1926, pp. 251-254. Arguments in support of statement that "man can never control bacterial mass action in sewage treatment," in order to stimulate interest in treatment of sewage by mechanical methods.

PUMPING STATION. East Chicago Sewage Pumping Station, H. D. White. Pub. Works, vol. 57, no. 7, Aug. 1926, pp. 242-245, 6 figs. Design of new Alder Street sewage pumping station at East Chicago, Ind., and methods of overcoming construction difficulties; vertical and horizontal pumps with total capacity of 145 M.G.D., operated by electric motors with oil engines as stand-by.

TORONTO, ONT. North Toronto Sewage Disposal Report, G. G. Nasmith and H. P. Eddy. Can. Engr., vol. 51, nos. 4 and 5, July 27 and Aug. 3, 1926, pp. 155-162, 6 figs. Report discussing three alternative projects; activated sludge plant with preliminary sedimentation recommended.

SHAFTS

ALIGNING. How to Align Long Shafts, A. B. Newell. Power, vol. 64, no. 12, Sept. 21, 1925, p. 448, 2 figs. Method of establishing a straight line used by large firm in mechanical field.

SLAG

BLAST-FURNACE. Blast-Furnace Slag Analyses, W. G. Imhoff. Iron Age, vol. 118, nos. 4, 9 and 10, July 22, Aug. 26 and Sept. 2, 1926, pp. 209-210, 547-548 and 612-613, 5 figs. July 22: Practical interpretation of significance of slag characteristics; iron, manganese and sulphur are heat indicators. Aug. 26: Relations between temperature and chemical composition; between basic and acid slags; two principles demonstrated. Sept. 2: Fifteen principles governing interpretation; examples show reasons for "Off" iron and how corrected.

SLIDE RULES

CIRCULAR. A New Circular Slide Rule. Engineer, vol. 142, no. 3684, Aug. 20, 1926, p. 206, 2 figs. Calculator in circular form developed by W. H. Fowler; advantages claimed for instrument are that it is more portable, gives extremely accurate results, is more easily and quickly operated, and is independent of climatic conditions.

SNOW REMOVAL

HIGHWAYS. Fighting Snow in Practice and Theory. Bus Transportation, vol. 5, no. 9, Sept. 1926, pp.469-473, 13 figs. Public facilities inadequate, although improving; co-operation from city and inter-city lines likely to be continued for long time to come; more powerful equipment to be used for 1926-1927 season; snow fences and similar preventive measures best remedy in many localities.

NEW YORK CITY. Snow Removal in New York City, R. Hawkins. Am. City, vol. 35, no. 3, Sept. 1926, pp. 327-329, 2 figs. Snow fighting and removal; famous storm of Feb. 1920, and snow-fighting speeded by motor equipment.

STEAM

CRITICAL VELOCITY. Critical Velocity of Steam with Counter-Flowing Condensate. W. A. Pearl and E. B. Parker. State College of Wash.—Eng. Bul., no. 13, vol. 5, no. 9, Feb. 1923, 18 pp., 2 figs. By critical velocity is meant maximum flow of steam that can be maintained without hindering continuous return of condensate; account of research to study conditions existing in one-pipe system and to arrive at conclusions that will be useful in any designs requiring counter-flowing condensate.

STEAM ACCUMULATORS

RUTHS. Steam Accumulators, H. E. Witz. Elecn., vol. 97, no. 2514, Aug. 6, 1926, pp. 154-155, 5 figs. Notes on their theory, application and development; Ruths principle in practice; use in traction stations. Abstract translated from Elektrotechnische Zeit.

STEAM ENGINES

BLEEDER-TYPE. A Bleeder-Type Steam Engine. Power, vol. 64, no. 11, Sept. 14, 1926, pp. 396-397, 3 figs. Exhaust belts of 6-cylinder uniflow are provided with selective process valves.

A Pass-Out Steam Engine. Engineer, vol. 142, no. 3686, Sept. 3, 1926, pp. 257-258, 8 figs, partly on p. 250. Engine installed in paper mill by Belliss and Morcom, to drive all machinery and supply low-pressure steam necessary for drying cylnider; it is standard triple-expansion set, differing from normal practice only in provision of means for abstracting some of steam between intermediate- and low-pressure cylinders for heating purposes in paper machines.

HORIZONTAL, ALIGNING. Simple Directions for Aligning a Horizontal Engine, Wm. Brehmer. Power, vol. 64, no. 9, Aug. 31, 1926, pp. 336-337, 3 figs. Although approximate alignment test can be made without removal of any of running parts, more accurate results can be obtained if shaft, connecting rod, cross-head, piston, stuffing box and cylinder head are removed; indicates general method of alignment.

STEAM GENERATION

SUPER-PRESSURE. Super-Pressure Steam Generators, D. Brownlie. Inst. Mar. Engrs.—Trans., vol. 37, Aug. 1926, pp. 103-133 and (discussion) 133-142, 5 figs. Attempt is made to give concise outline of subject; by super-pressure steam is meant use of pressures far beyond present average practice, and generally above 1,200-lb. per sq. in. gauge, intended mainly for power generation by means of engines or turbines, and with employment of apparatus different in principle to any ordinary type boiler at present in common use.

STEAM GENERATORS

BENSON SUPER-PRESSURE. Steam at 3,200-lbs. Pressure. Ry. Engr., vol. 47, no. 560, Sept. 1926, p. 326. "Benson" steam generator and its significance for locomotive work.

STEAM PIPES

DESIGN. Design and Construction of Modern Power Plant Piping Systems, G. A. Smith. Nat. Engr., vol. 30, no. 9, Sept. 1926, pp. 413-417. Points out that after sizes of main steam header, boiler inlets, and leads to various units have been decided upon, it is necessary that pipe of sufficient weight be specified to take care of pressure and strains caused by expansion and contraction, and quality of pipe must be such as to insure long life.

WELDED. Welded Steam Mains. Power Engr., vol. 21, no. 246, Sept. 1926, pp. 337-338. Precautions necessary for welding steam-pipe-line sections; describes typical installation.

STEAM POWER PLANTS

INDUSTRIAL. Our Industrial Power Plants and Their Effect on Power Rates, E. Douglas. Nat. Engr., vol. 30, no. 9, Sept. 1926, pp. 397-400, 1 fig. Points out that outlook for future permanency of business in equipment line for isolated plant is far brighter than outlook for industrial power business for central stations.

STEAM TRAPS

THERMOMETER TO CHECK OPERATION. Recording Thermometer Used to Check Operations of Steam Traps, R. A. Taylor. Power, vol. 64, no. 8, Aug. 24, 1926, p. 286. Where traps discharge water at temperature below 212 deg., which is boiling point at atmospheric pressure, recording thermometer can be used to good advantage to check their operations.

STEAM TURBINES

BREAKDOWNS. Breakdowns of Steam Turbines and Engines. Engineer, vol. 142, no. 3684, Aug. 20, 1926, p. 201. Review of reports for 1925 issued by British Engine Boiler and Electrical Insurance Co., discussing most noteworthy break-downs which have come under notice of Company's inspectors during year.

CHANGING OPERATING CONDITIONS FOR. Design Steam Turbine for Change in Operating Conditions. Elec. World, vol. 88, no. 8, Aug. 21, 1926, p. 377. Turbine that can be used with relatively low steam pressure and temperature in present station but that with slight changes can be used with steam of high pressure and temperature when station is modernized is being obtained by Trinidad Elec. Transmission Railway & Gas Co. of Colorado.

DE LAVAL. The Behaviour of Air in a De Laval Turbine, R. H. Grundy. Instn. Mech. Engrs.—Proc., no. 3, Mar. 1926, pp. 619-630, 6 figs. Principal experiments of large series made to examine behaviour of compressed air at various temperatures and pressures in De Laval turbine; with particular reference to temperatures and pressure in De Laval turbine; with particular reference to temperature drop realized, and brake horse power developed.

EXTRACTION. Utilization of Extraction Steam. Mech. World, vol. 80, nos. 2067, 2068 and 2069, Aug. 13, 20 and 27, 1926, pp. 129-130, 249 and 164. Part 1, E. D. Dickinson: Shows increasing demand for turbines where steam is to be used in manufacturing process. Part 2, A. D. Somes: Discusses ways in which various types of steam turbines may be applied to economical production of power and process steam for industrial processes. Part 3, R. G. Standerwick. Methods of regulating flow of steam through turbines, with particular reference to extraction and mixed-pressure applications; applies to General Elec Co. 3,600-r.p.m. units.

PACKING GLANDS. Packing Glands for Large Steam Turbine Shafts. Power Plant Eng., vol. 30, no. 17, Sept. 1, 1926, pp. 947-950, 6 figs. Carbon ring, water seal and labyrinth glands, or combinations of them, together with gland heaters, form important item in successful operation.

STEEL

ALLOY. *See Alloy Steel.*

HIGH-PRESSURE STEAM, FOR. Sound Metal Needed for High Pressures. Power Plant Eng., vol. 30, no. 18, Sept. 15, 1926, pp. 1000-1001, 3 figs. To determine condition of metal in high-pressure fittings, series of etching and X-ray tests were undertaken at Watertown Arsenal; tests disclosed defects which experts at foundry, where fittings were made, had no idea existed; summary of causes of defects.

HIGH-SPEED. *See Steel, High-Speed.*

INGOTS, SQUARE. Improvement in High-Grade Steel Industry Through Use of Turned Square Ingots (Verbesserung des Edelstahlbetriebes durch Verwendung abgedrehter Vierkantblöcke), P. Eyermann. Stahl u. Eisen, vol. 46, no. 32, Aug. 12, 1926, pp. 1083-1084, 3 figs. Reasons for discarding and subsequently resuming square ingot in high-grade steel industry; describes lathe for square ingots and gives operating results.

The Mechanical Properties of Four Heat-Treated Spring Steels, G. A. Hankins and G. W. Ford. Iron & Steel Inst.—Advance Paper, no. 6, for mtg. Aug. 1926, 26 pp., 15 figs. Investigation undertaken at National Physical Laboratory as part of systematic investigation of mechanical properties of steels commonly used in spring manufacture.

STEEL, HEAT TREATMENT OF

CALCULATING MACHINES. Where Heat-Treatment Increased the Life of Machines, F. H. Colvin. Am. Machinist, vol. 65, no. 12, Sept. 16, 1926, pp. 473-475. 7 figs. Methods and equipment that have proved successful in plant of Monroe Calculating Machine Co., Orange, N.J.

DIE BLOCKS. Heat-Treatment of Die Blocks, A. J. Porter, Jr. Am. Soc. Steel Treating—Trans., vol. 10, no. 3, Sept. 1926, pp. 447-456. Outlines development of die blocks to meet demands placed upon it through rapid growth of drop-forging industry; explains ways in which die blocks are mistreated, which causes breakage; advanced arguments for heat-treated die block.

Tentative Recommended Practices for the Heat Treatment of Plain and Alloy Steel Die Blocks. Am. Soc. Steel Treating—Trans., vol. 10, no. 3, Sept. 1926, pp. 477-486. Tentative recommended practice for heat-treatment of cold- and hot-forming die blocks and of alloy-steel die blocks, cold-heading dies, die blocks for silverware.

ELECTRIC. Heat-Treating Axe Bits by Electricity, C. H. Carpenter. Am. Mach., vol. 65, no. 12, Sept. 16, 1926, pp. 481-483, 2 figs. Use of electrically-heated lead bath permits accurate temperature control; description of apparatus and results obtained; at plant of Kelly Axe & Tool Co., Charleston, W.Va.

Heat-Treating Axle Shafts by Special Machinery, F. C. Hudson. Am. Mach., vol. 65, no. 12, Sept. 16, 1926, pp. 485-486, 2 figs. Electrically-heated furnaces with air-operated devices for placing and removing work; mechanical quenching; automatic timing of work in furnace.

MANGANESE STEEL. How to Treat Manganese Steel, Dr. B. Egeberg. Iron Age, vol. 118, no. 11, Sept. 9, 1926, pp. 676-678, 5 figs. Experience with both cast and forged product; manufacture and heat-treatment of austenitic type.

NICKEL STEEL. Effect of Heat-Treatment on Nickel Steel, J. Trantim, Jr. Forging—Stamping—Heat Treating, vol. 12, no. 8, Aug. 1926, pp. 293-294. Compilation of data on physical properties of rolled electric nickel steel, heat-treated by quenching in water and drawing at various temperatures.

STEEL, HIGH-SPEED

LATHE CUTTERS. The Performance and Testing of High-Speed Steel Cutters (Die Leistung von Schnellstahlmessern und ihre Prüfung), F. Rapatz. Stahl u. Eisen, vol. 48, no. 33, Aug. 19, 1926, pp. 1109-1116 and (discussion) 1116-1117, 35 figs. partly on supp. plates. Investigations of high-speed steel cutters; influence of hardening temperature and nature of hardening, annealing, cutting speed, and properties of workpiece on time required for cutting.

STOKERS

UNDERFEED. Over-Fire Air Injection with Underfeed Stokers, M. K. Drewry. Power, vol. 64, no. 12, Sept. 21, 1926, pp. 446-447, 2 figs. Experience of Milwaukee Elec. Ry. & Light Co., summarized from its test reports, shows how to reduce smoke and increase efficiency in installations having small furnace volume.

STRESSES

TORSIONAL AND REPEATED BENDING. Combined Torsional and Repeated Bending Stresses, F. C. Lea and H. P. Budgen. Engineering, vol. 122, no. 3162, Aug. 20, 1926, pp. 242-245, 16 figs. Effect of constant torsional stress upon specimens subjected to repeated bending stresses. Paper read before Sect. G of Brit. Assn.

SUB-STATIONS

A.C. DISTRIBUTION. Some Principles of Design of Alternating-Current Distribution Sub-Stations, H. E. Wolfing. Elec. Light & Power, vol. 4, no. 9, Sept. 1926, pp. 24-26, 76, 78, 80 and 82, 4 figs. Outstanding features that should be considered when new a.c. distribution sub-station for urban area is contemplated.

AUTOMATIC. Cleveland Railway Extends the Use of Automatic Sub-Stations, L. D. Bale. Elec. Ry. Jl., vol. 68, nos. 10 and 11, Sept. 4 and 11, 1926, pp. 373-374 and 417-422, 17 figs. All power is purchased and converted through system of manual and automatic sub-stations; 10 or 15 sub-stations are automatic but all are supervised by control system centralized in dispatcher's office; standard 1,500-kw. units used in all sub-stations.

AUTOMATIC CONTROL. Application of Automatically-Controlled Equipment to Sub-Stations, R. E. Powers. Elec. Ry. Jl., vol. 68, no. 7, Aug. 14, 1926, pp. 257-261, 4 figs. Complete control sequence of sub-station apparatus is necessary from time unit receives its initial starting impulse till it is taken out of service; various forms of supervisory control systems meet requirements.

Engineering Index

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A

ACCELEROMETERS

TWO-COMPONENT. The Cambridge Two-Component Recording Accelerometer. Engineering, vol. 122, no. 3167, Sept. 24, 1926, pp. 396-397, 7 figs. Instrument constructed by Cambridge Instrument Co., London, for obtaining record of accelerations in two planes at right angles, or in two directions at right angles in same plane; it is of portable type.

AIR COMPRESSORS

OIL-ENGINED. Oil Engine-Driven Air Compressor. Engineer, vol. 142, no. 3689, Sept. 24, 1926, pp. 333-334, 4 figs, 50-hp. direct-connected cold-starting oil engine and air compressor introduced by Ingersoll-Rand Co.; installation has been in continuous operation for some time in Derbyshire mine, where it is supplying air at pressure of 100 lb. per sq. in. for power purposes.

AIR CONDITIONING

DEPARTMENT STORES. Air Conditioning and Cooling in Hudson Stores, D. C. Lindsay. Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1120-1122, 4 figs. Experience has taught operators of department stores that temperature and humidity of atmosphere within store reacts directly upon volume of business; system installed in Detroit department store; new refrigerant, known as dichlorethylene, was used.

REFRIGERATION APPLIED TO. Refrigeration as Applied to Air Conditioning, A. Lewis. Domestic Eng. (Lond.), vol. 46, no. 9, Sept. 1926, pp. 179-182, 4 figs. Air conditioning of automatic telephone exchanges, where it is stipulated that humidity should not exeeed 70 per cent and that air should be clean.

AIRCRAFT

SPEED TESTING. Testing Aircraft on the Speed Triangle, H. H. Blee. Aviation, vol. 21, no. 16, Oct. 18, 1926, pp. 666-667, 3 figs. Simple method of determining true air speed of aircraft, regardless of direction and velocity of wind.

AIRPLANE ENGINES

TWO-STROKE. Power Output and Air Requirements of a Two-Stroke Cycle Engine for Aeronautical Use, C. R. Paton and C. Kemper. Nat. Advisory Committee for Aeronautics.

AIRPLANE PROPELLERS

MODEL TESTS. Report on Tests of Metal Model Propellers in Combination with a Model VE-7 Airplane, E. P. Lesley. Nat. Advisory Committee for Aeronautics—Tech. Notes, no. 245, Aug. 1926, 15 pp., 18 figs.

VORTEX RING STATES. The Analysis of Experimental Results in the Windmill Brake and Vortex Ring States of an Airscrew, H. Glauert. Aeronautical Research Committee—Reports and Memoranda, no. 1026, Feb. 1926, 8 pp., 2 figs.

AIRPLANES

ALL-METAL. Recent Development in the Construction and Operation of All-Metal Airplanes, C. Dornier. Nat. Advisory Committee for Aeronautics—Tech. Memorandums, no. 378, Sept. 1926, 23 pp., 24 figs.

ENGINEERING ASPECTS. The Engineering of the Modern Airplane, E. P. Warner. Boston. Soc. of Civ. Engrs.—Jl., vol. 13, no. 7, Sept. 1926, pp. 312-321 and (discussion) 321-323, 1 fig.

TAILLESS. The Tailless Aeroplane, G. T. R. Hill. Roy Aeronautical Soc.—Jl., vol. 30, no. 189, Sept. 1926, pp. 519-538 and (discussion) 538-544, 15 figs. Basic principles involved; functions of airplane controls; power of normal controls; evolution of tailless design; details of experimental work; results of flight tests.

WINGS. Formulas for Comparison of Polar Loci (Formules de comparaison des polaires Influenee de l'allongement des cellules), M. Roy. Aérophile, vol. 34, nos. 15-16, Aug. 1-15, 1926, pp. 241-246, 7 figs. Develops formulas for comparing wings of same type and different extension; tests of wings of different types to determine value of relative depth.

Wind Channel Tests of Slot and Aileron Control on a Wing of R.A.F. 15 Section, F. B. Bradfield, A. S. Hartsborn and L. Caygill. Aeronautical Research Committee—Reports and Memoranda, no. 1008, Nov. 1925, 29 pp., 11 figs. Part I: When central portion of wing is R.A.F. 15. Part II: When central portion of wing is slotted and fitted with flap.

ALLOYS

ALUMINUM. *See Aluminum Alloys.*
BRASS. *See Brass.*
BRONZES. *See Bronzes.*

ALUMINUM

CASTINGS. Aluminum Casting Output, Its Difficulties, R. Micks. Can. Foundryman, vol. 17, no. 9, Sept. 1926, pp. 32 and 37-39, 6 figs. Difficulties involved in production of aluminum castings, and improvement in practice; use of chloride of zinc; deseribes two types of machines.

ALUMINUM ALLOYS

ALPAX. Some Mechanical Tests of Cast Bars of Alpax, H. J. Tapsell. Aeronautical Research Committee—Reports and Memoranda, no. 1011, Dec. 1925, 9 pp., 2 figs. Results obtained from tests to determine mechanical properties at air temperature and at elevated temperatures of cast silicon-aluminum bars; it is shown that this material is valuable casting alloy; ultimate tensile strength compares favourably with that of chill-cast Y alloy.

CASTINGS. Aluminum-Alloy Permanent-Mold Castings, R. J. Anderson. Am. Foundrymen's Assn.—Preprint no. 5, for mtg. Sept. 27-Oct. 1, 1926, 29 pp., 10 figs. Indicates directions which have been taken by more recent developments in aluminum-alloy permanent-mold casting; discusses properties, mode of manufacture and fields of application, and gives comparison with sand and die castings; it is shown that aluminum-alloy permanent-mold castings have greater soundness, finer grain size, greater strength and hardness, greater resistance to impact and alternating-fatigue stresses, and greater resistance to corrosion than sand castings.

Recent Developments in the Production of Aluminum-Alloy Castings, R. J. Anderson. Am. Metal Market, vol. 33, no. 180, Sept. 18, 1926, pp. 9-10 and 13-14, 9 figs. Applications of aluminum-alloy castings; alloys for easting production; melting in foundry practice; heat treatment of castings; sand-casting and die-casting practice; permanent mould-casting.

CONSTITUTION. Constitution of Alloys of Aluminum, Zinc and Tin and Aluminum, Zinc and Cadmium, V. Jares. Am. Inst. Min. & Met. Engrs.—Trans., no. 1588-E, for mtg. Sept. 1926, 15 pp., 17 figs. Results of experiments on binary and ternary alloys.

AMMONIA COMPRESSORS

REFRIGERATING CAPACITY. Refrigerating Capacity of Ammonia Compressors, W. H. Motz. Refrigeration, vol. 40, no. 3, Sept. 1926, pp. 44-46, 1 fig. Refrigerating and ice-making capacities of ammonia compressors; effect of evaporator and eondenser pressures; practical problems on capacities.

VERTICAL DOUBLE-ACTING. Ammonia Compressor Design, E. Markham. Cold Storage, vol. 29, no. 342, Sept. 16, 1926, pp. 389-390. Advantages possessed by vertical double-acting machine over other types.

VERTICAL-SHELL AND TUBE-TYPE. Test of Vertical-Shell and Tube-Type Ammonia Condenser, F. R. Zumbro. Refrig. Eng., vol. 13, no. 2, Aug. 1926, pp. 49-57 and (discussion) 57-63 and 67, 13 figs. Results of tests made for purpose of obtaining such data as would enable one to prophesy, with reasonable accuracy, performance under various conditions; numerous advantages of this type of condenser.

APPRENTICES, TRAINING OF

CHANGING METHODS. Apprentice Methods Changing. Iron Trade Rev., vol. 79, no. 14, Sept. 30, 1926, pp. 846-847. Modern industrial conditions make different courses advisable; more attention paid to schooling.

ASH HANDLING

HYDRAULIC. Hydraulic Ash Disposal Proves Economical, L. C. Shelain. Power Plant Eng., vol. 30, no. 19, Oct. 1, 1926, pp. 1046-1048, 2 figs. System developed by Rockford Elec. Co., during war-time emergency, is simple and economical.

Hydraulic Removal of Ashes at the Paris Electricity Co.'s Northern Works (L'enlèvement hydraulique des macheferes à l'Usine Nord de la Compagnie Parisienne de Distribution d'Electricité), C. Postweiler. Génie Civil, vol. 89, no. 9, Aug. 28, 1926, pp. 179- 81, 3 figs. Describes system which has advantage that no piece subject to wear comes in contact with ashes, thus practically eliminating attendance and lubrication.

AUTOMOBILE ENGINES

CASTING-INSPECTION FIXTURES. Two Engine-Casting Inspection Fixtures, A. R. Fors. Soe. Automotive Engrs.—Jl., vol. 19, no. 4, Oct. 1926, pp. 370-372, 8 figs. Describes fixture for checking unit cylinder-and-crankcase blocks to assure that castings will be machined correctly; other device is gauge for checking depth of combustion chambers in cylinder-head castings to assure that they will have equal volumetric capacity and to eliminate expensive operation of machining them.

AVIATION

EUROPE. Air Transport in Europe. Soc. Automotive Engrs.—Jl., vol. 19, no. 4, Oct. 1926, pp. 337-342. Situation in Germany and France; British policy and air services; activity in other European countries; experimental work under way.

REGULATION. Regulation of Air Transport, W. P. MacCracken, Jr. Engrs. & Eng., vol. 43, no. 9, Sept. 15, 1926, pp. 242-243. Discusses problem of regulation in United States, and points to necessity that Federal Government take jurisdiction over all flying.

B

BEAMS

REINFORCED CONCRETE. Shear Tests of Reinforced Concrete Beams, W. A. Slater, A. R. Lord and R. R. Zipprodt. U. S. Bur. of Standards—Technologic Papers, vol. 20, no. 314, Apr. 13, 1926, pp. 387-493, 79 figs. Results of tests carried out in establishment of basis for design of concrete ships during World War; most of beams were I-shaped cross-section; web thickness varying from 2 to 12 in., depth from 8 in. to 10 ft. and span from 9 ft. 6 in. to 20 ft.; tensile stress in web and shearing strength of beam were generally independent of compressive strength of concrete of beam and dirctly dependent upon amount of web reinforcement; shearing strengths found were generally much higher than obtained in previous investigations.

BEARINGS

JOURNAL. Reclaiming Journal Bearings at the Great Northern Shops, F. W. Curtis. Am. Mach., vol. 65, no. 13, Sept. 23, 1926, pp. 519-520, 4 figs. Furnace for melting worn linings and reclaiming old bearing metal; boring, facing and relining brasses; relined brasses are finished by milling.

BELT DRIVE

EFFICIENCY. Efficiency in Belt Drives. Automobile Engr., vol. 16, no. 219, Sept. 1926, pp. 337-338. Points out necessity for cleanliness; belt dressings and capacities; jointing belts.

SMALL. Small Belt Drives. Machy. (Lond.), vol. 28, no. 723. Aug. 19, 1926. pp. 581-583, 8 figs. Their general application, types of belts used, and design of efficient pulleys.

BLAST FURNACES

SPECIFIC EFFICIENCY. Specific Efficiency of the Blast Furnace, R. Franchot. Min. & Met., vol. 7, no. 237, Sept. 1926, pp. 368-372 and (discussion) 372-374, 1 fig. Furnace burden now limited to that which can absorb less than half energy input is claimed by author. In discussion, T. L. Joseph questions these conclusions.

BOILER FEEDWATER

IMPURITIES. Water and Its Impurities, J. C. Moore. Power House, vol. 20, no. 17, Sept. 5, 1926, pp. 17-19. Effect of impurities in feedwater of boilers is to cause deposition of scale on interior of water-heating surfaces, in addition to deposition of mud or sediment, thus facilitating corrosion and foaming; corrosion results mainly from use of hard water; causes of hard water; how deposit becomes hard; carbonates of magnesia; alkalinity of water; test for calcium salts; treatment to prevent scale; water filtration.

PREHEATING PUMP. Preheating Pump, E. Josse. Eng. Progress, vol. 7, no. 8, Aug. 1926, pp. 208-209, 3 figs. Details of pump manufactured by firm of F. Seiffert & Co., Berlin, novel feature of which is that boiler feedwater is heated inside pump in direct contact with bleeder steam, pump raising pressure of condensate of prime movers fed back to boilers, from condenser pressure to boiler pressure.

REGULATORS. Campbell Boiler Feed Regulator. Paper Trade Jl., vol. 83, no. 13, Sept. 23, 1926, pp. 48-49, 1 fig. New regulator has no moving parts and is simple hollow casting with inlet, outlet and pressure port; describes how it works and its numerous advantages.

TREATMENT. Treatment of Feed Water. Nat. Elec. Light Assn.—Report, no. 256-71, July 1926, 30 pp., 21 figs. Results in several plants with use of sodium aluminate as accelerator in outside treating systems, and experience with acid-treating apparatus used in connection with zeolite system; scale troubles in interdeck and radiant-heat-type superheaters; boiler-scale troubles in high-pressure plant, which has been endeavouring to maintain suggested sulphate-carbonate ratio; caustic embrittlement troubles with boilers at Long Beach steam plant of Southern California Edison Co.; acid treatment of boiler water as developed by Dallas Power & Light Co.

BOILER FURNACES

CLINKER DISPOSAL. Methods of Clinker Disposal on Furnace Side Walls Using Chain Grate Stokers, F. Dawson. Eng. & Boiler House Rev., vol. 40, no. 3, Sept. 1926, pp. 124-128, 3 figs. American methods and devices.

DESTRUCTOR. The Industrial Steam Raising Destructor, D. Wilson. Power Engr., vol. 21, no. 247, Oct. 1926, pp. 377-378, 1 fig. Combined destructor furnace and water-tube boiler for dealing with refuse daily available from case and box-making factory; boiler portion of plant is of Vickers patent portable type.

STOKER-FIRED. Stokers and Furnaces. Nat. Elec. Light Assn.—Report, no. 256-257, June 1926, 80 pp., 94 figs. Few of new furnace installations, or those contemplated, are without water screening in some form or other; experimenting along lines of mixing and elimination of stratification in furnace gases; design of stoking equipment to meet demands for higher capacities; application of air-cooled walls to pulverized-fuel furnaces; air-heater performance, indicating increasing popularity of this apparatus; refractories.

BOILER PLANTS

INSTRUMENTS. Boiler and Turbine Room Instruments. Nat. Elec. Light Assn.—Report, no. 25-107, Jan. 1926, 23 pp., 28 figs. Gives operating experiences of companies with instruments of many kinds, and description of numerous applications of instruments to solution of power-plant problems.

PULVERIZED-COAL. Pulverized Fuel Plant and Boilers for Messrs. Synthetic Ammonia and Nitrates, Limited. Engineering, vol. 122, no. 3167, Sept. 24, 1926, pp. 381-383, 14 figs, partly on p. 388 and supp. plate. Installation comprises two Thompson 4-drum water-tube boilers fitted with Thompson superheaters, Foster economizers and Usco air heaters; Lopulco system of firing pulverized coal has been adopted, mills being of Raymond roller type and burners and furnaces with their water-cooled elements follow standard Lopulco practice.

SAFETY OF OPERATION. Safety of Operation in the Steam Plant. Nat. Elec. Light Assn.—Report, no. 256-268, July 1926, 6 pp., 6 figs. Deals with general hazards of boiler room and special hazards incident to pulverized coal.

BOILER PLATE

TIGHTENING MACHINE. A Pneumatic Boiler Plate Tightening Machine. Eng. & Boiler House Rev., vol. 40, no. 3, Sept. 1926, pp. 132-135, 3 figs. Machine known as Hallett Patent Pneumatic Plate Tightening Machine, consisting essentially of two sets of double toggles operated by opposed pistons travelling in pressed-steel cylinders.

BOILERS

BLOWDOWN. Chart Calculates Proper Boiler Blowdown, C. K. Jackson. Power, vol. 64, no. 16, Oct. 19, 1926, p. 582, 1 fig. Presents chart giving blowdown required to maintain concentration of 500 grains per gallon.

DEVELOPMENTS. Boiler, Superheaters and Economizers. Nat. Elec. Light Assn.—Report, no. 256-11. Apr. 1926, 60 pp., 61 figs. Data on operation at Edgar Station, Hudson Avenue Station, Chester Station of Phila. Elec. Co., and Hell Gate Station; radiant-superheater installations; statement by Uniform Boiler Law Society.

INSPECTION. Uniform Examinations for Boiler Inspectors, C. D. Thomas. Boiler Maker, vol. 26, no. 9, Sept. 1926, pp. 268-269. Discussion of necessity for uniform inspections and reports to provide for acceptance of boilers in all boiler-code States.

LOCOMOTIVE. *See Locomotive Boilers.*

SCALE PREVENTION. The Prevention of the Formation of Boiler Scale. Engineering, vol. 122, no. 3168, Oct. 1, 1926, pp. 415-416, 5 figs. Water-cooled type of apparatus known as filtrator, which is now being used to prevent formation of boiler scale for removal of old deposit.

WASTE-HEAT. The Economy of Waste-Heat Recovery, C. M. Walker. Gas Age-Rec., vol. 58, no. 14, Oct. 2, 1926, pp. 457-458, 2 figs. Installation by West Gas Improvement Co. of two Kirke waste-heat boilers at plant of Springfield Gas Light Co., which is example of what may be accomplished in way of utilizing heat previously wasted.

WATER-TUBE. *See Boilers, Water-Tube.*

BOILERS, WATER-TUBE

TEST CODE. A Contribution to the Test Code of Water-Tube Boilers, K. Kumabe. Soc. of Mech. Engrs. (Japan)—Jl., vol. 29, no. 112, Aug. 1926, pp. 474-480, 2 figs. In evaporation test of boilers, quantity of heat absorbed by furnace-wall during heating period is very large compared with that after thermal stationary state is reached; author proposes to establish rule on preliminary firing period for such cases to limit error of result within certain range, and formulas for calculation are given. (In English.)

BORING MACHINES

HORIZONTAL. Horizontal Boring Machines. Times Trade & Eng. Supp., vol. 18, no. 427, Sept. 11, 1926, p. 587. Modern designs; lathe-bed type; base-plate design; comparison of types; varied mechanisms.

BRAKING

ELECTRIC. Electric Braking, W. Wilson. Engineering, vol. 122, no. 3169, Oct. 8, 1926, pp. 435-437, 13 figs. Requirements of ideal electrically applied brake; solenoid braking; plugging; regenerative braking.

BRASS

EXUDATIONS. Exudations on Brass and Bronze, W. B. Price and A. J. Phillips. Am. Inst. Min. & Met. Engrs.—Trans., no. 1586-E, for mtg. Sept. 1926, 9 pp., 6 figs. Calls attention to phenomena which authors have encountered; protuberances on admiralty brass, bronze and on leaded brass; theory of inverse segregation.

MUNTZ METAL. Standardization of Microscopic Examinations of Muntz Metal Alloys, R. S. Pratt. Min. & Met., vol. 7, no. 237, Sept. 1926, pp. 374-375, 5 figs. Presents sketches adopted in preference to photomicrographs in laboratory of Bridgeport Brass Co., where it was felt that they could be more veniently made to present exact type of structure desired.

BRASS FOUNDRIES

DEVELOPMENTS. Controlling Quality in a Brass Foundry, R. Micks. Can. Foundryman, vol. 17, no. 9, Sept. 1926, pp. 19-21, 4 figs. Recent expansion in automotive, radio, vacuum-cleaner and electrical industries seems to assure development of brass foundry in Canada; equipment and methods of Sully Brass Foundry, Toronto.

BRICK

SPECIFICATION REQUIREMENTS. Discussion of Specification Requirements for Common Brick, C. O. Christenson. Clay-Worker, vol. 86, no. 3, Sept. 1926, pp. 197-203. Compilation of practically all available data on prescribed tests for brick and their respective relations to actual service; tests were made at various times at different testing laboratories; curves showing relations between compressive strength on edge and side, modulus of rupture and absorption by boiling and by immersion; summary of present building-code requirements.

BRIDGE DESIGN

BRACING. The Lateral and Transverse Bracing of Bridges, J. Husband. Structural Engr., vol. 4, no. 9, Sept. 1926, pp. 287-289, 2 figs. Majority of recognized specifications call for sway bracing to resist one-half panel wind load on upper chord in case of through spans; investigation shows that not more than 20 per cent of load of one track is likely to be transferred as vertical shear through transverse bracing from near to far side main girder, in case of deck bridges, and less than 10 per cent in case of through bridges.

BRIDGES, CONCRETE

ARCH. Novel Methods Used in Building Long Concrete Arch Bridge, W. H. DeButts. Eng. News-Rec., vol. 97, no. 16, Oct. 14, 1926, pp. 621-623, 5 figs. Pier foundation cylinders sunk from overhead suspension; raising and releasing steel arch centres for 304-ft. spans of Fort Snelling-Mendota Bridge, Minn.

Concrete Arch Bridges Support Clarifier Mechanism, L. G. Straub. Eng. News-Rec., vol. 97, no. 16, Oct. 14, 1926, pp. 619-620, 2 figs. Adopted for esthetic reasons in place of usual steel bridges for new plant at Springfield, Ill.

HIGHWAY. New Concrete Bridge at Galt. Can. Engr., vol. 51, no. 13, Sept. 28, 1926, p. 329, 2 figs. Old Ainslie Street bridge replaced by specially-designed concrete structure built in winter months.

BRIDGES, HIGHWAY

LANE LOADING. Maximum Shear Formulas for Lane Loading of Highway Bridges. C. M. Strahan. Eng. News-Rec., vol. 97, no. 12, Sept. 16, 1926, pp. 464-465, 2 figs. Live-load assumption adopted by state highway officials as basis for new shear formulas.

BRIDGES, RAILWAY

STEEL. Old Timber Truss Bridge Used for Erecting Steel Arch, H. F. Blood. Eng. News-Rec., vol. 97, no. 12, Sept. 16, 1926, pp. 466-468, 4 figs. Method adopted in railroad-bridge replacement on Clackamas River, Ore., in preference to cantilever erection.

BRIDGES, SUSPENSION

DELAWARE RIVER. The Delaware River Bridge at Philadelphia, C. E. Chase. Conn. Soc. Civ. Engrs.—Trans., 1926, pp. 3-17, 7 figs. Main piers were founded on caissons 70 x 143 ft. in plan; one of distinctive features of pneumatic caissons was that they were made of steel with no internal bracing in working chamber; flexible type of tower was adopted; cable construction, etc.

SELF-ANCHORED. Erecting a Self-Anchored Suspension Bridge—Seventh Street Bridge at Pittsburgh, V. R. Covell. Eng. News-Rec., vol. 97, no. 13, Sept. 23, 1926, pp. 502-505, 7 figs. Bold method of construction adopted in order to avoid falsework in channel; each half built as cantilever, with temporary diagonal struts between chains and stiffening girder.

BRONZES

COMMONLY USED. Bronzes in Common Usage, E. G. Jarvis. Brass World, vol. 22, no. 9, Sept. 1926, pp. 285-287. Formulas for preparing some of popular mixtures; effects of silicon, manganese, nickel and phosphorus.

HEAT TREATMENT. Heat Treatment Improves Bronzes, N. K. B. Patch. Iron Age, vol. 118, no. 13, Sept. 23, 1926, pp. 841-842, 2 figs. Modern methods for control of crystal structure in castings; effect on aluminum bronze.

BUILDING CONSTRUCTION

VAULTED ROOF. Vaulted Roof of Cut Stone Built from Steel Staging. Eng. News-Rec., vol. 97, no. 13, Sept. 23, 1926, pp. 490-493, 6 figs. Large erection structure of steel devised by contractor to support derricks and centreing for placing 90,000 tons masonry in St. John's Cathedral, New York City.

C

CABLES, ELECTRIC

FAILURES. Cable Operation and Underground System Maps and Records. Nat. Elec. Light Assn.—Report, no. 256-40, May 1926, 21 pp., 11 figs. Analysis of cable and joint failures on cables operating at 6600 volts and above as reported by 36 companies; it indicates that rate of burnouts is increasing, and goes into various causes for failures; comparative study of reliability of sector cable and round cable; cable of foreign manufacture and performance of cables inspected by Electrical Testing Laboratories; data on underground system maps and records reported by 18 companies and several geographic divisions; typical maps and forms adequately covering various planes of work.

INSPECTION AND TESTING. Inspection and Testing of Cable. Nat. Elec. Light Assn. —Report, no. 256-43, June 1926, 10 pp., 2 figs. Compares results of inspection and testing of cable by Electrical Testing Laboratories for three years and discusses general subject of inspection and testing, and development in cable construction as indicated by test results.

INSTALLATION. Cable Installation. Nat. Elec. Light Assn. Report, no. 26-7, Feb. 1926, 3 pp., 2 figs. New methods and practices; pulling stresses.

JOINTS. Cable Joint Design and Construction. Nat. Elec. Light Assn.—Report, no. 256-30, Apr. 1926, 6 pp., 5 figs. Experiences of Cleveland, Chicago and Brooklyn with migration of compound from joints using partly or entirely thin compound; describes single-conductor joint for 75 kv. 3-phase installation by Phila. Electric Co.; method of filling joints with pressure gun as used by Public Service Production Co.

LOCALIZATION. Fault Localization on Cables, N. A. Allen. Elec. Rev., vol. 99, no. 2549, Oct. 1, 1926, pp. 532-533, 2 figs. New applications of Kenotron apparatus.

UNDERGROUND. General Report of the Underground Systems Committee, 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-78, Aug. 1926, 12 pp. Includes following reports: 75 Kv. Underground Cable Installation at Philadelphia, J. W. Sylvester; 132 Kv. Underground Cable Installation, C. H. Shaw; Research Work Being Carried on Under Auspices of Impregnated Paper Insulated Cable Research Committee, F. M. Farmer; Revision of N.E.L.A. Cable Specifications; Underground Systems Reference Book.

CABLES, HOISTING

CARE OF. Lessons from a Hoisting Accident, L. Balliet. Eng. & Min. Jl., vol. 122, no. 16, Oct. 16, 1926, pp. 614-615. Broken cable caused little damage, thanks to counterweight; virtues of efficient rope lubrication.

CANALS

WELLAND SHIP. Good Progress on Welland Ship Canal. Can. Engr., vol. 51, no. 12, Sept. 21, 1926, pp. 303-305, 4 figs. It is expected that undertaking will be ready by spring of 1930; total cost estimated at $115,000,000; work in progress on all sections; quantities of materials excavated and used.

CARBON MONOXIDE

POISONING. Diagnosis of Carbon Monoxide Poisoning, W. P. Yant. Safety Eng., vol. 52, no. 3, Sept. 1926, pp. 110-115, 2 figs. Historical records of poisoning by CO; principles of diagnosis; possible errors; positive sign of CO poisoning; Bureau of Mines apparatus for testing of poisoning.

CAST IRON

ELASTICITY. Elasticity of Cast Iron at Ordinary and Elevated Temperatures, I. Sugimura. Soc. of Mech. Engrs. (Japan)—Jl., vol. 29, no. 112, Aug. 1926, pp. 437-473, 15 figs. For measurement of elasticity, newly-designed extensometer was employed; study was undertaken to obtain quantitative elucidation on casting stress phenomena; casting stresses are those stresses induced in metal on account of its being cast, corresponding to "Gusspannungen" in German. (In English.)

FATIGUE TESTS. Fatigue Tests of Cast Iron, C. H. Bulleid. Engineering, vol. 122, no. 3168, Oct. 1, 1926, pp. 429-430, 4 figs. Results of tests made with special type of Wöhler reversed bending machine; it is shown that for so variable material as cast iron, conclusions from tests of one sample must be made with due caution.

GRAPHITE IN. The Comparison of the Size and Distribution of Graphite in Cast Iron. Foundry Trade Jl., vol. 34, no. 526, Sept. 16, 1926, p. 237. For general purposes, most satisfactory method of comparing size and distribution of graphite in different specimens is use of comparative microstructures carefully prepared under comparative and standard conditions.

GROWTH. The Effects of Various Alloys on the Growth of Gray Iron Under Repeated Heatings, R. R. Kennedy and G. J. Oswald. Am. Foundrymen's Assn.—Advance Paper, no. 25, for mtg. Sept. 27-Oct. 1, 1926, 11 pp., 5 figs. Work undertaken with idea of developing gray iron having slow rate of growth under repeated heatings above critical range, and which could be reproduced by addition of various alloys to gray iron in ladle.

MANGANESE, DESULPHURIZING ACTION OF. Desulphurizing Action of Manganese in Iron, C. H. Herty, Jr., and J. M. Gaines, Jr. Am. Inst. Min. & Met. Engrs.—Trans., no. 1597-C, for mtg. Oct. 1926, 6 pp., 1 fig. In order to ascertain extent of and factors controlling elimination in ladle, several casts were sampled carefully at blast furnace and again when ladles were being emptied, either at mixer, open hearth or foundry; effect of temperature and time; percentage elimination of sulphur; conclusions.

NICKEL ADDITIONS. Improving Gray Cast Iron with Nickel. Int. Nickel Co.—Bul., no. 8, 11 pp., 5 figs. Describes various useful effects of nickel additions to gray iron and suggests ways in which they can be and are used to-day by iron foundries in meeting many problems; gives list of castings for which nickel additions are recommended and are being successfully used.

PHOSPHOROUS, INFLUENCE OF. The Influence of Phosphorus on Cast Iron, J. T. MacKenzie. Am. Foundrymen's Assn.—Advance Paper, no. 16, for mtg. Sept. 27-Oct. 1, 1926, 23 pp., 6 figs.

SHEARING TEST. A Shearing Test for Gray Cast Iron, G. K. Elliott. Am. Foundrymen's Assn.—Advance Paper, no. 13, for mtg. Sept. 27-Oct. 1, 1926, 13 pp., 6 figs.

STRENGTH AND THICKNESS. The Strength of Cast Iron in Relation to Its Thickness, W. H. Rother and V. Mazurie. Am. Foundrymen's Assn.—Preprint, no. 31, for mtg. Sept. 27, Oct-1. 1926, 21 pp., 6 figs. Cast iron beams of various thicknesses do not follow regular beam formulas as set down for rolled steel; investigation to determine just how cast iron varies with thickness.

TESTING. Testing Cast Iron, C. H. Bulleid. Foundry Trade Jl., vol. 34. no. 524, Sept. 2, 1926, p. 210. Describes work done by author. (Abstract.) Paper read before Brit. Assn.

Testing Cast Iron, A. E. LeThomas. Am. Foundrymen's Assn.—Advance Paper, no. 34, for mtg. Sept. 27-Oct. 1, 1926, 53 pp., 13 figs. Observations made in course of several years and in some of larger foundries regarding application of those methods which have been retained by Association Technique de Fonderie de France; economic justification of tests; reasons governing choice of methods of testing; properties of high-resistance cast iron; examination of testing methods; shearing, compression, static bending, ball and tensile tests; micrographic examination and chemical analysis; relation between results given by various methods of testing machine castings; bases of specification for machine castings. Bibliography.

CASTING

CENTRIFUGAL. Centrifugal Tube Casting in Hot Moulds, L. Cammen. Am. Foundrymen's Assn.—Preprint no. 36, for mtg. Sept. 27-Oct 1, 1926, 7 pp. Materials for heated moulds; experiments to develop material; protecting mould surface from solvent action of hot steel; temperature of hot moulds.

CEMENT

RAPID HARDENING. Rapid Hardening and Special Cements. Can. Engr., vol. 51, no. 11, Sept. 14, 1926, pp. 297-298. Report of Committee on Concrete appointed by Instn. of Structural Engineers, covering aluminous rapid hardening Portland cements of special character.

CEMENT, PORTLAND

PROPORTIONING. German Method of Proportioning Raw Cement Materials, H. Nitzsche. Rock Products, vol. 29, no. 18, Sept. 4, 1926, pp. 70-71. Deals with subject of combining materials in purely mathematical way; symbols are used for percentages of each element in raw materials and formulas are derived algebraically for lime limit, silica ratio and combining ratio of ignited and unignited materials; substitutions in formulas permit rapid calculation of quantities.

CENTRAL STATIONS

FOUNDATIONS. Building Foundation of a 1,000,000-Horse Power Generating Station, J. S. Kerins. Eng. World, vol. 29, no. 3, Sept. 1926, pp. 143-146, 5 figs. Construction details of foundation of station being erected by New York Edison Co. on East River at foot of 14th Street; building has average height of about 130 ft. with steel smoke stacks towering additional 240 ft. above roof; one of chief problems encountered was designing system for distributing concrete which would satisfactorily meet unusual requirements placed upon it; system of aerial distribution from mixing plant entirely outside area of excavation was finally adopted; details of excavation, etc.

FRANCE. Characteristics of Modern Central Stations (Les caractéristiques des grandes stations centrales à vapeur récentes ou en cours d'achèvement), A. de Casanova. Génie Civil, vol. 89, no. 5, July 31, 1926, pp. 104-105, and translated abstract in Eng. & Boiler House Rev., vol. 40, no. 3, Sept. 1926, pp. 142 and 144.

HUNLOCK CREEK, PENNA. Hunlock Creek, Penna., Power Station. Power Plant Eng., vol. 30, no. 19, Oct. 1. 1926, pp. 1040-1045, 4 figs. Initial capacity of new station was fixed at 20,000 kw. to meet rate of growth in load with plans for future development to 190,000 kw.; generators connected direct to transformers; turbine bled for feedwater heating; make-up water evaporated.

HYDRAULIC VS. STEAM. Economic Relations Between Hydraulic and Steam Generation of Electric Power (Die wirtschaftlichen Beziehungen zwischen der elektrischen Energie, die hydraulisch erzeugt wird und solcher, die man thermisch erzeugt, Bedingungen, unter denen beide systeme vorteilhaft zusammenarbeiten können), F. Kreiger. World Power Conference, Sect. Basle Mtg., 1926—Advance Paper, no. 57, 23 pp., 1 fig.

PULVERIZED-COAL BURNING. Pulverized Fuel at Ashley Street Plant, E. H. Tenney. Elec. Light & Power, vol. 4, no. 10, Oct. 1926, pp. 21-23, 6 figs. Unit type of pulverizer was chosen largely because physical arrangement of equipment already operating was not suited to application of central pulverizing system without unjustified cost.

SWEDEN. Turbine and Plant Efficiencies, R. H. Andrews. Power, vol. 64, no. 15, Oct. 12, 1926, p. 560, 2 figs. Presents efficiency curves obtained with Kaplan and propeller-type turbines in low-head plant at Lilla Edet in Sweden.

TECUMSEH, KANSAS. Tecumseh Serves Topeka District, Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1088-1094, 7 figs. New plant of Kansas Power & Light Co. is designed for ultimate capacity of 125,000 kva.; at present it has installed capacity of 15,000 kva. in two units with room for third unit of 20,000 kva.; steam is generated at 375-lb. pressure with 250 deg. superheat, house turbine and motor-driven auxiliaries are used; vertical condensers installed.

CHIMNEYS

STREAM-LINE. Tests on Stream-Line Stacks, E. Prat and L. C. Whiton, Jr. Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1101-1105, 8 figs. Determination of air flow, power used for induced draft and efficiency.

CIRCUIT-BREAKERS

OIL. Requirements of Oil Switch Operating Mechanisms, R. Wilkins. Elec. World, vol. 88, no. 15, Oct. 9, 1926, pp. 753-755, 3 figs. High speed of break, minimum power input and low cost are important factors; describes stored mechanical energy device.

CITY PLANNING

MARIEMONT, OHIO. The Development of Mariemont, Ohio, F. H. Hay. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 8, Oct. 1926, pp. 1619-1635, 8 figs. This town, situated just outside city limits of Cincinnati, is result of joint effort of men representing various professions; it is intended primarily as place of residence for families of widely different economic standing, and especially for wage-earners.

PROBLEMS. Town Planning and Its Relation to the Professions Involved, J. Nolen. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 8, Oct. 1926, pp. 1612-1618. Enumerates chief characteristics of town planning; nature of engineering, architecture and landscape architecture, especially as they are employed in community development.

COAL

CARBONIZATION. Low-Temperature Carbonization, D. Brownlie. Combustion, vol. 14, nos. 4, 5, 6, vol. 15, nos. 1, 2, 3 and 4, Apr. May, June, July, Aug., Sept. and Oct. 1926, pp. 253-259, 321-325, 385-391, 38-40, 108-110, 169-172 and 237-241, 7 figs. Apr.: Predrying of raw fuels before combustion carbonization, or gasification; low-temperature carbonization in conjunction with mechanically fired furnaces. May: Julius Pintsch process; work of Merz and McLellan, Ltd.; Pluto-stoker process. June: Carborite dual coal carbonization. July: Low-temperature carbonization in conjunction with pulverized-fuel firing; advantages and disadvantages. Aug.: McEwen-Runge process. Sept.: Midland Coal Products Co. process. Oct.: Staveley Coal & Iron Co. of Markham processes.

The "Midland Coal Products" Process, D. Brownlie. Gas Engr., vol. 42, no. 605, Sept. 1926, pp. 186-187, 2 figs. Low-temperature carbonization and partial gasification of briquetted small non-coking coal.

Low Carbonization of Coal, W. E. Standley. Instn. of Engrs. (India) —Jl., vol. 6, July 1926, pp. 146-161. Special reference to Bikaner lignite and "Tozer" process.

The Carbonization of Coal, J. Roberts. Combustion, vol. 15, no. 4, Oct. 1926, pp. 227-230, 9 figs. Plastic layer and its elimination; improving texture of coke; heat penetration.

The Economics of Low-Temperature Carbonization, P. C. Pope. Gas Engr., vol. 42, no. 605, Sept. 1926, pp. 192-193. Commercial aspect of distillation of coal at low temperature.

The Economics of Low-Temperature Carbonization, P. C. Pope. Eng. & Boiler House Rev., vol. 40, no. 3, Sept. 1926, pp. 113-114. Commercial aspect of distillation at low temperature.

COMBUSTION. Coal Testing and Combustion Calculations, F. Dransfield. Elec. Rev., vol. 99, no. 2546. Sept. 10, 1926, pp. 413-415, 4 figs. Attempt is made to correlate number of coal tests with view to either (1) obtaining flue-gas loss directly from proximate analysis, or (2) determining carbon content more exactly from proximate analysis so that losses can be calculated by existing methods.

DISTILLATION. Low-Temperature Distillation Systems. Machy. Market, no. 1351, Sept. 24, 1926, pp. 27-28, 5 figs. In Crozier process, induction of heat throughout mass is provided by means of diagonal flues arranged in series which pass across retort and distribute heat evenly throughout continuously descending material under treatment.

DRYING AND PREHEATING. Coal Drying and Preheating. Power Engr., vol. 21, no. 247, Oct. 1926, pp. 379-380, 1 fig. Discusses economy derived from preheating coal before firing.

OXIDATION. An Investigation of the Behaviour of Solid Fuels During Oxidation, B. Moore and F. S. Sinnatt. Fuel, vol. 5, no. 9, Sept. 1926, pp. 377-380, 4 figs. Method which indicates marked alteration in ignition properties of coal during storage; results show that modification leads to diminution of tendency of coal to ignite.

PULVERIZED. *See Pulverized Coal.*

COAL HANDLING

BRIDGES, PROTECTION OF. Wind Measurement and the Protection of Coal and Ore Bridges, C. Stenbol. Eng. Jl., vol. 9, no. 10, Oct. 1926, pp. 425-429, 2 figs. Discussion existing wind-recording instruments and special designs for use as protective measure on coal and ore bridges and study of wind action on such bridges.

TOWERS. A Four-Ton Coal-Handling Tower, M. R. Summer. Elec. World, vol. 88, no. 13, Sept. 25, 1926, pp. 653-654, 6 figs. Capacity, 400 tons per hour; hopper capacity, 125 tons; belt conveyor to bunkers; barge shifter used; construction details and costs.

UNLOADING PLANT. 2,000-Ton Coal Handling Plant and Automatic Weighing Machines. Eng. & Boiler House Rev., vol. 40, no. 3, Sept. 1926, pp. 128-132, 2 figs. Largest coal-unloading plant in Europe installed at Beckton Gas Works.

COKE

CENTRAL HEATING WITH. Coke Economy in Central Heating, Gunther. Gas World, vol. 85, no. 2198, Sept. 18, 1926, p. 243. For central heating, gas coke is to be preferred, but tests of this are necessary; two questions must be considered, namely, how is firing to be tended, and what is meant by economic heating.

COKE MANUFACTURE

FILMER PROCESS. Filmer Process for Coke Manufacture and Recovery of Oil Distillates in Closed-Circuit System. Can. Chem. & Met., vol. 10, no. 9, Sept. 1926, pp. 213-214, 2 figs. Objective of process is production of coke of domestic and metallurgical quality in course of from one to two hours and maximum elimination of gas products; as far as is known, this is first closed-circuit system producing coke, oil and hydrocarbon values without excessive pressures.

COMPRESSED AIR

HYGIENIC PROBLEMS. Compressed Air, Its Origin and Practical Uses and Its Effect Upon the Human System, E. Levy. Mun. Engrs'. Jl., vol. 12, 1926, pp. 102-120. Survey of developments that have led to present effective engineering operations employing compressed air; hygienic problems arising from operations using compressed air.

CONCRETE

MIXING. Vary Mix Design for Concrete to Be Used at Different Ages, R. T. Giles. Eng. News-Rec., vol. 97, no. 13, Sept. 23, 1926, pp. 510-511. Tests show water control has most effect on early strength and fine aggregate control most important for ultimate strength.

PROPORTIONING. Water-Ratio Method of Designing Concrete Mixtures, D. A. Abrams. Concrete, vol. 29, no. 3, Sept. 1926, pp. 45-46. Outline of Abrams' theory of proportioning; water-cement-ratio and fineness modulus; older forms of specifications; reports from other laboratories that confirm theory.

SEGREGATION. An Analysis of Certain Factors Affecting Segregation in Concrete, G. W. Hutchinson. Concrete, vol. 29, no. 3, Sept. 1926, pp. 13-16, 5 figs. Causes of variations in strengths of concrete; methods of controlling these factors; accurate proportioning; separation of materials in handling concrete; workability; effect of gradation of aggregates on strength of concrete; effect of segregation on strength.

CONCRETE CONSTRUCTION

GRAIN ELEVATORS. Water-Ratio on Grain Elevator Job. Concrete, vol. 29, no. 3, Sept. 1926, pp. 21-23, 10 figs. How C.M. & St.P. Railway is using Abrams' theory with ordinary equipment to obtain good and uniform concrete on grain tank job in Milwaukee.

CONDUCTORS

VIBRATION. Notes on the Vibration of Transmission-Line Conductors, T. Varney. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 953-957, 23 figs. Results of tests with graphic recorder to show vibration of transmission-line conductors under various conditions of wind velocity, conductor tension and span length; method of taking records; formulas for determining velocity of propagation of transverse waves along conductor, wave length of vibration and frequency of vibrations caused by eddies formed at conductor subjected to air currents.

CONDUITS

TYPES. Types of Water Conduits, W. A. Scott. Eng. World, vol. 29, no. 3, Sept. 1926, pp. 137-142, 14 figs. Refers to certain pipe installations and makes use of available data pertaining to them; deals with rivetted steel and lock-bar steel pipe, electric-arc welding pipe, wood-stave pipe and concrete conduits.

UNDERGROUND. Underground Conduit and Manhole Construction. Nat. Elec. Light Assn.—Report, no. 256-41, Apr. 1926, 3 pp., 2 figs. Chief among changes observed are tendency toward increase in size of ducts due to increase in voltage and size of cables; tendency toward increased separation of ducts as they enter manhole; experience with laying monolithic concrete ducts; crystallization of standards in manhole design; standardization of manhole frames; use of cast steel for manhole covers, etc.

WATER HAMMER. Water Hammer Not So Important Under Highest Heads. Eng. News-Rec., vol. 97, no. 15, Oct. 7, 1926, p. 577, 2 figs. On account of high initial pressure increase due to hammer is small in proportion and within safe limits.

CONVERTERS

SYNCHRONOUS. Step-Induction Regulator-Controlled Synchronous Converters, M. F. Packard. Elec. World, vol. 88, no. 15, Oct. 9, 1926, pp. 747-749, 2 figs. Automatic operation and absence of usual starting apparatus are features of this type of converter control; permit most effective utilization of equipment in emergencies.

CONVEYORS

AUTOMOBILE INDUSTRY. Conveyors Used in the Automotive Industry, C. A. Brock. Soc. Automotive Engrs.—Jl., vol. 19, no. 4, Oct. 1926, pp. 343-350, 18 figs. Describes various types of conveyors serviceable to automotive industry; principles of selection and design; drawings and photographs of some of latest developments.

Transportation by Conveyor, P. Phelps and N. H. Preble. Soc. Automotive Engrs.—Jl., vol. 19, no. 4, Oct. 1926, pp. 413-421, 21 figs.

COOLING PONDS

SPRAY. Costs of a Spray-Pond Cooling System, R. H. Emerick. Power, vol. 64, no. 15, Oct. 12, 1926, p. 559, 2 figs. Describes spray-pond cooling-water system.

COPPER MINES

MANITOBA. Mining North of the Pas, Manitoba, W. T. Thompson. Eng. Jl., vol. 9, no. 10, Oct. 1926, pp. 437-439, 1 fig. Mining claims and mineral prospects in this district.

CORE OVENS

ELECTRIC. Core Baking with Electric Heat. Nat. Elec. Light Assn.—Report, no. 256-288, Aug. 1926, 6 pp., 5 figs. Core sands and binders; strength of cores; preparation of core mixtures; drying core; electric core baking; advantages of electrically heated core ovens.

OIL-FIRED. Baking of Radiator Cores in Oil-Fired Ovens, I. S. Wishoski. Fuels & Furnaces, vol. 4, no. 9, Sept. 1926, pp. 1077-1079 and 1086, 3 figs. Car-type ovens arranged in two batteries of five ovens each are individually heated by single oil burners firing into long combustion chambers beneath ovens; very uniformly baked cores are produced and good fuel economy is obtained.

CORES

BINDERS FOR. A Standard Sand for Use in Testing Core Binders, H. L. Campbell. Am. Foundrymen's Assn.—Preprint no. 24, for mtg. Sept. 27-Oct. 1, 1926, 7 pp., 1 fig. Establishes specification for sand which would be recommended for general use in testing core binders; effect of grain size on dry bond and permeability was determined; from test results it was concluded that sand for testing purposes should be limited to one sieve size which, according to writer's opinion, is that sand which passes 60-mesh sieve and is retained on 70-mesh sieve.

Methods for Determining the Properties of Cores Made with Cereal Binders, H. L. Campbell. Am. Foundrymen's Assn.—Advance Paper, no. 30, for mtg. Sept. 27-Oct. 1, 1926, 10 pp., 2 figs.

CORE OILS. Some Properties of Core Oils, C. A. Hansen. Am. Foundrymen's Assn.—Preprint, no. 9, for mtg. Sept. 27-Oct. 1, 1926, 32 pp., 1 fig.

SUPPORTS. Core Supports in Large Castings, I. Lamoreux. Am. Foundrymen's Assn.—Preprint, no. 20, for mtg. Sept. 27-Oct. 1, 1926, 7 pp., 8 figs. By examining reactions of core support during casting, author tries to evolve instructions for founder.

CRUCIBLES

PROLONGING LIFE OF. How to Extend Crucible Life. Foundry, vol. 54, no. 18, Sept. 15, 1926, pp. 745 and 754, 2 figs. Attention directed to faulty practice resulting in rapid destruction of crucibles; detailed instructions given for simple annealing oven.

CUPOLAS

HOT-BLAST. Hot-Blast Cupola, P. Dwyer. Foundry, vol. 54, no. 18, Sept. 15, 1926, pp. 729-735 and 754, 14 figs. Preheated air effects economy in continuous and stringent service at foundry of Griffin Wheel Co., Chicago; heated and unconsumed gas is drawn from cupola through ring of tuyeres located 2 ft. below charging door level; this gas is burned with addition of little free air under insulated steel-plate chamber containing number of vertical cast-iron tubes; flame travels through these tubes and heats cold blast which enters through suitable opening and circulates among tubes.

MELTING STEEL CHARGES. Melting All-Steel Charges in a Cupola Furnace, T. F. Jennings. Am. Foundrymen's Assn.—Advance Paper, no. 6, for mtg. Sept. 27-Oct. 1, 1926, 8 pp.

MELTING ZONE OF. A Study of Iron Melted in the Cupola, R. E. Wendt and J. P. Walsted. Am. Foundrymen's Assn.—Advance Paper, no. 4, for mtg. Sept. 27-Oct. 1, 1926, 11 pp., 5 figs. Discusses question of melting zone of cupola and shows that all melting does not take place in what is commonly known as melting zone.

VOLUME MEASUREMENT. The Pitot Tube and the Measurement of Cupola Volume, J. F. Francis. Metal Industry (Lond.), vol. 29, no. 11, Sept. 10, 1926, pp. 247-248, 1 fig. Discusses Pitot-static tube method of measuring blast volume, and points out some of factors tending to cause inaccurate readings and how best to overcome them.

CUTTING METALS

OXYGEN PURITY AND TEMPERATURES. Relative Effect of Oxygen Purity and Temperature in Metal Cutting, F. P. Wilson, Jr. Gen. Elec. Rev., vol. 29, no. 10, Oct. 1926, pp. 722-727, 10 figs. Difference between cutting efficiency of 98.5 and 99.5 pure oxygen controversial; comparative tests show definite savings of much greater magnitude by preheating oxygen; maximum economy obtainable by using cheaper gas with preheat; preheat also facilitates quick starting, and eliminates moisture troubles and hardening face of cut.

D

DAMS

ARCH. Experimental Deformation of a Cylindrical Arched Dam, B. A. Smith. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 8, Oct. 1926, pp. 1596-1601, 1 fig. Results of tests to confirm author's formulas in paper published in same journal 1919-20, vol. 83, p. 2042; determination of elastic constants.

FAILURES. Two Arch Dams Fail Through Undermining of Abutments. Eng. News-Rec., vol. 97, no. 16. Oct. 14, 1926, pp. 616-618, 7 figs. One dam failure was that of Cynide Gold Mining Co. of Moyie River, Idaho, and other was that of Lake Lanier Developing Co., Tryon, N.C.

GRAVITY. Problem of Pressure at Base Gravity Dams (Il problema delle sottopressioni nelle dighe a gravita), E. Scimemi. Energia Elettrica, vol. 3, no. 5, Mar. 1926, pp. 393-402, 6 figs. New Italian regulations; static calculations of dams constructed on permeable ground and on rocks; experiences and examples.

Hydraulic Sluicing. Methods and Cost of Hydraulic Sluicing. Eng. & Contracting, vol. 65, no. 1, July 1926, pp. 25-32, 4 figs. How over 2,000,000 cu. yd. were excavated in Miami Conservancy District in Ohio.

Masonry. Water-Proof Masonry Dams, W. W. Pagon. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 8, Oct. 1926, pp. 1571-1577, 3 figs. Describes method of preventing uplift, rather than neutralizing it; it consists in provision of water-tight membrane or sheet, placed as near up-stream face of dam as is practicable, with, in addition, system of under-drainage to ensure removal of any seepage from foundation bed.

Movable. On the Design of Movable Dams, K. I. Karlsson. World Power Conference, Sect. Vasel Mtg., 1926—Advance Paper, no. 30, 9 pp., 6 figs. Discusses design based on conditions in Scandinavia; measures for securing proper service in winter and for facilitating rafting of timber; points out that ice troubles are hardly dependent upon special construction of sluices, but to great extent on accessibility of packings and glides; advantages of segment-shaped sluices for rafting.

Tieton, Washington. Puddle Core Investigations at Tieton Dam, Washington, I. E. Houk. Eng. News-Rec., vol. 97, no. 14, Sept. 30, 1926; pp. 544-547, 6 figs. Goldbeck cell readings show consolidation; sluicing controlled by corewall movements; direct-pressure observations; ball-penetration tests; friction coefficients.

DIES

Expanding. Dies for Expanding Pressed Shapes, E. Heller. Machy. (Lond.), vol. 28, no. 726, Sept. 9, 1926, pp. 694-696, 3 figs. Construction of expanding die; operation of die; angle of expanding cone; die with rubber expanding member; replacement of rubber member.

DIESEL ENGINES

Characteristics and Difficulties. Fundament Diesel Characteristics Important, J. J. McDougall. Power Plant Eng., vol. 30, no. 19, Oct. 1, 1926, pp. 1058-1059, 2 figs. Points out that poor maintenance and overloads are responsible for many Diesel-engine difficulties.

Large, Quantity Production of. Quantity Production of Larger Diesels Under Way. Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1107-1109, 4 figs. New units of 480, 600, and 720 hp. offered by Fairbanks-Morse & Co. to meet demands of industry for quantity production of larger engines.

DOCKS

Ore-Shipping. Ore-Dock Reconstruction on Two Different Designs. Eng. News-Rec., vol. 97, nos. 12 and 13, Sept. 16 and 23, 1926, pp. 455-457 and 496-499, 12 figs. All-concrete and combined concrete and steel docks; details of concrete design of Northern Pacific Railway.

DRILLING MACHINES

Heavy-Duty Gang. Heavy-Duty Gang-Drilling Machines. Engineering, vol. 122, no. 3167, Sept. 24, 1926, pp. 380-381, 2 figs. Four-spindle and three-spindle machines constructed by J. Archdale & Co., Birmingham, Eng.

Multiple-Spindle. Rapid Drilling and Tapping on Multiple-Spindle Machines. Machy. (Lond.), vol. 28, no. 726, Sept. 9, 1926, pp. 681-683, 6 figs. Drilling connecting rods; washing-machine parts, holes at angles, etc.; special jigs and fixtures, and machines on which they are used, made by Moline Tool Co., U.S.A.

Radial. New Radial Has Distinctive Features. Iron Age, vol. 118. no. 14, Sept. 30, 1926, pp. 929-930, 2 figs. Radial drill developed by Cincinnati Bickford Tool Co. and known as Super-Service radial; 36 speeds, 18 feeds and power rapid traverse are incorporated in head; control centralized, oiling is automatic; roller bearings employed.

E

EDUCATION, ENGINEERING

Foundry Instruction. Foundry Instruction in Technical Schools. Am. Foundrymen's Assn.—Advance Paper, no. 2, for mtg. Sept. 27-Oct. 1, 1926, 39 pp., 9 figs. Foundry instruction at Carnegie Inst. of Technology, Purdue Univ., Univ. of Michigan and Univ. of Illinois; purpose of courses and details of instruction.

Seminars for Practising Engineers. Excellent Seminars for Practising Engineers, E. Bennett. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 996-998. Brief sketch of two seminars for practising engineers sponsored by University of Wisconsin; significance of seminars to engineering education.

ELECTRIC CURRENTS

Transients. Measurement of Transients by the Lichtenberg Figures, K. B. McEachron. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 934-939, 13 figs. Results of comprehensive study of effect of transients on size and appearance of Lichtenberg figures; such transients may occur on transmission or distribution circuits during periods of disturbance.

ELECTRIC DISTRIBUTION

Rural. Rural Electrification in Western Canada, C. A. Clendening. Eng. Jl., vol. 9, no. 10, Oct. 1926, pp. 433-436. Compendium of problems encountered in venturing into new market for power, with particular reference to rural distribution.

ELECTRIC DISTRIBUTION SYSTEMS

A.C. Low-Voltage. Alternating-Current Low-Voltage Networks. Nat. Elec. Light Assn.—Report, no. 256-36, Apr. 1926, 26 pp., 18 figs. Details regarding systems in use, chief problems involved in their design and such data as are available on actual operating experience; deals particularly with multiple feed networks.

Philadelphia. An Alternating-Current Network, P. H. Chase. Elec. World, vol. 88, no. 13, Sept. 25, 1926, pp. 633-639, 12 figs. Philadelphia system designed to supply reliable and economical service over large areas; primary loop feeders, sectionalizing breakers and balanced pilot-wire control used.

ELECTRIC DRIVE

Individual and Group. Determining Economy of Individual Drive, F. H. Penney. Can. Machy., vol. 36, no. 13, Sept. 23, 1926, pp. 17 and 34. Although there is decided tendency toward individual motor drive for all tools in plant, author points out that group drive with its much smaller installed motor capacity is sometimes preferable.

Group and Individual Drive for Industrial Machinery, L. H. Hopkins. Indus. Mgmt. (N.Y.), vol. 72, no. 4, Oct. 1926, pp. 211-219, 3 figs. Factors to be studied in determining selection.

ELECTRIC FURNACES

Annealing. Annealing Iron and Steel in the Electric Furnace. Nat. Elec. Light Assn.—Report, no. 256-281, Aug. 1926, 5 pp., 4 figs.

Annealing Aluminum in. Annealing Aluminum in the Electric Furnace. Nat. Elec. Light Assn.—Report, no. 256-283, Aug. 1926, 3 pp., 2 figs.

Brass. Annealing Brass and Copper in the Electric Furnace. Nat. Elec. Light Assn.—Report, no. 256-259, Aug. 1926, 3 pp., 3 figs.

Melting Brass in the Electric Furnace. Nat. Elec. Light Assn.—Report, no. 256-287, Aug. 1926, 6 pp., 3 figs. Summary of disadvantages of fuel-fired furnaces and advantages of electric furnaces; induction, direct-arc, indirect-arc, indirect-resistance, combinations of previous principles, and high-frequency furnaces.

Melting. Melting Steel and Gray Iron in the Electric Furnace. Nat. Elec. Light Assn.—Report, no. 256-284, Aug. 1926, 6 pp., 4 figs. Discusses advantages of electric furnaces for this purpose.

Tempering. Rotary Tempering Furnace for Gears. Iron Age, vol. 118, no. 15, Oct. 7, 1926, pp. 1001-1002, 2 figs. Continuous electric, rotary-type, oil-tempering furnace with automatic control installed in plant of Warner Gear Co., Muncie, Ind.; it is used for heat-treating gears and is said to be first continuous oil-drawing furnace ever built; designed by Strong, Carlisle & Hammond Co., Cleveland.

Thermal Insulation. Thermal Insulation of Electric Furnaces, M. L. Hartmann and O. B. Westmount. Am. Electrochem. Soc.—Advance Paper, no. 12, for mtg. Oct. 7-9, 1926, pp. 155-176, 15 figs. Gives thermal conductivities of fused alumina, fused magnesia, fireclay and high-temperature insulating refractory; mean specific heat curves for these refractories are also given; suggests possibilities of energy conservation in electric furnaces by properly-designed composite walls.

ELECTRIC GENERATORS, A.C.

Synchronous. Synchronous Machines, R. E. Foherty and C. A. Nickle. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 974-987, 21 figs. Explanation of Blondel's two-reaction theory; it is shown that armature leakage flux which causes reactance voltage drop in synchronous operation comprises all fluxes due to armature currents which generate fundamental voltage except space fundamental component, latter constituting total flux of armature reaction.

ELECTRIC LAMPS, INCANDESCENT

Developments. Report of Lamp Committee 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-47, for mtg. May 17-21, 1926, 9 pp., 11 figs. Carbon filament lamps; standard voltages; street series lamps; standardization activities.

ELECTRIC LOCOMOTIVES

Brazil. New Electric Locomotive for Brazil. Elecn., vol. 97, no. 2518, Sept. 3, 1926, pp. 262-263, 3 figs. Details of 100-ton locomotive completed by Metropolitan-Vickers Electrical Co. for passenger service on Paulista Railway of Brazil; most powerful equipment yet constructed in England.

Tractive Resistance. The Tractive Resistance of Electric Locomotives and Cars, W. J. Davis, Jr. Gen. Elec. Rev., vol. 29, no. 10, Oct. 1926, pp. 685-707, 13 figs. Source of data; train resistance classified; discussion of three main classes; formulas for total resistance; tables and charts.

ELECTRIC METERS

N.E.L.A. Committee Report. Report of Meter Committee 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-17, May 17-21, 1926, 27 pp., 44 figs. Outline of proposed activities of National Meter Committee and status of work in National Sub-committees and Geographic Division Committees; records development in auxiliary testing apparatus and recent productions by manufacturers of meters and equipment used in installation and testing of meters.

ELECTRIC MOTORS

Protection, Pulverized Coal Plants. Protecting Motor Drives in Pulverized-Fuel Plants, M. B. Wyman. Power, vol. 64, no. 15, Oct. 12, 1926, pp. 557-559, 4 figs. Selecting proper protection for motors and controllers, electrical interlocking system to insure correct functioning of equipment and reliable power supply are three essentials to satisfactory operation.

ELECTRIC MOTORS, A.C.

High-Speed. A New High-Speed Three-Phase Motor, U. Herrenberg. Eng. Progress, vol. 7, no. 8, Aug. 1926, p. 224, 1 fig. New type, designed by Himmelwerk, Tübingen, Germany, which permits of attaining speeds of 3,750 to 6,000 r.p.m. in spite of fact that motor is connected up to normal three-phase supply system of 50 cycles per sec.

Induction. General Theory of the Single-Phase Induction Motor, G. Windred. World Power, vol. 6, no. 34, Oct. 1926, pp. 193-196, 3 figs. Analysis and practical application of trigonometrical theorems.

ELECTRIC MOTORS, D.C.

Interpole. The Theory and Development of the Interpole Motor, M. MacLaren. Franklin Inst.—Jl., vol. 202, no. 4, Oct. 1926, pp. 449-468. Traces development of d.c. machine in general; by use of interpoles, problem of commutation has been so far eliminated in many cases that this ceases to have controlling influence upon design; this type of motor has demonstrated its superiority over other forms for cranes, hoists and all forms of traction where cost of distribution is not controlling factor.

ELECTRIC POWER

Purchased vs. Generated. Economic Factors Governing the Purchase of Generation of Power, W. A. Shoudy. Engrs. & Eng., vol. 43, no. 9, Sept. 15, 1926, pp. 246-250. Items which must be considered in comparing cost of private with purchased power.

Saskatchewan. Electrical Development of Southern Saskatchewan, S. R. Parker. Eng. Jl., vol. 9, no. 10, Oct. 1926, pp. 430-432. Review of existing conditions and advantages of comprehensive scheme for development of power resources of province.

ELECTRIC TRANSMISSION LINES

Europe. Some Notes on Electricity Transmission, G. F. Chellis. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 958-967, 27 figs. Recent overhead and underground transmission developments in Europe, summary and analysis of recent report of Weir Commission of England, recommending policy with regard to superpower development in that country; report covers programme extending to 1940 and proposed plan of interconnection and base-load plant construction intended to tie together practically all parts of England.

Interconnection. Interchange of Energy, E. J. Fowler. Nat. Elec. Light Assn.—Report, no. 256-44, for mtg. May 17-21, 1926, 5 pp. Economic features involved in interconnection; advantages; proposed basis of interchange rates where water power is involved; interconnection and superpower.

220-Kv. 220-Kv. Transmission Line Construction, J. B. Wheeler. Elec. World, vol. 88, no. 13, Sept. 25, 1926, pp. 662-664, 3 figs. Third 220-Kv. transmission line, known as Vincent line, being built by Southern California Edison Co., will serve to bring out changes in methods and practice of constructing such lines; this line will be 223 miles in length and will serve as link between Big Creek hydro-electric plants in Central California and receiving substations at Eagle Rock and Laguna Bell, near Los Angeles.

Rural. Report of Rural Electric Service Committee 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-37, for mtg. May 17-21, 1926, 16 pp., 1 fig. Costs of rural lines; plan for rural service department; general rural extension plan of Adirondack Power & Light Corp., Ohio Public Service Co., Iowa Railway & Light Co., and Wisconsin Power & Light Co.; rules and regulations for rural service of Commonwealth of Pennsylvania.

OVERHEAD SYSTEMS. Report of Overhead Systems Committee 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-34, May 17-21, 1926, 41 pp., 42 figs. Service tests on treated and untreated poles; construction methods and labour-saving devices; live-line maintenance and construction methods and tools; insulators and protective devices for insulators.

ELECTRIC WELDING

BUTT. On Electric Butt Welding, T. Okamoto. Inst. Elec. Engrs. Japan—Jl., no. 457, Aug. 1926, pp. 885-898, 16 figs. Deals with butt welding of soft steel bars. (In Japanese, with brief English abstract.)

GAS HOLDERS. Electric Welding Steel Gas Holders, G. T. Horton. Can. Engr., vol. 51, no. 10, Sept. 7, 1926, pp. 277-279, 3 figs. Tendency towards heavier and more economical construction; welding various parts of gas holders; advantages of spherical pressure containers for gas or oil. Paper presented at Can. Gas Assn.

PRACTICAL ADVANTAGES. Practical Electrical Welding, S. Halas. Elecn., vol. 97, no. 2522, Oct. 1, 1926, pp. 388-390, 6 figs. Workshop advantages; mass production and special types; localizing heat; space question.

ELECTRIC WELDING, ARC

ELECTRODE EFFICIENCY. Electrode Efficiency, P. L. Roberts. Welding Engr., vol. 11, no. 9, Sept. 1926, pp. 25-27. Result of tests made to determine amount of electrode usefully deposited by metallic arc.

STRUCTURAL STEEL. Arc Welds in Structural Steel, A. M. Candy and G. D. Fish. Welding Engr., vol. 11, no. 9, Sept. 1926, pp. 30-33, 7 figs. Tests show that ultimate strength of structural members can be obtained and special designs are needed.

ELECTRIC WIRING

COST REDUCTION. Lower Wiring Costs. Nat. Elec. Light Assn.—Report, no. 256-35, May 17-21, 1926, 10 pp. One of principal objects of Committee was to discuss and encourage wiring methods which are economical and endeavour to stop growing tendencies toward making wiring increasingly costly; deals with non-metallic sheathed cables; National Electrical code; bare neutral wire; grounding of portable electrical appliances; attachment plugs and receptacles; additional safety rules; uniform electrical ordinance.

ELECTRICAL APPARATUS

DEVELOPMENT. Report of Electrical Apparatus Committee 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-29, May 17-21, 1926, 38 pp., 24 figs. Improvement in adequacy of electrical apparatus available for use on power systems through intensive study of service conditions and requirements of apparatus to meet such conditions; supervisory contact of this committee with other organizations dealing with subjects within committee's scope.

SPECIFICATIONS. Guides for Specifications Covering Electrical Apparatus and Equipment. Nat. Elec. Light Assn.—Report, no. 256-72, July 1926, 32 pp. Discusses various aspects entering into use of specifications from standpoint of both operating companies and manufacturers; use of guides for specifications covering electrical apparatus, equipment and materials; 14 guides to aid in preparation of specifications.

ELECTRICAL MACHINERY

DEVELOPMENTS. Electrical Machinery, B. L. Barns. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 940-952. Annual report of Committee on Electrical Machinery; list of subjects which Committee has under consideration; ventilation and testing; turbo-alternators; water-wheel driven alternators; d.c. machines; synchronous and induction motors; synchronous converters; regulators and rectifiers. Bibliographies.

ELECTRICAL MEASUREMENTS

BRIDGE. Solution of Wheatstone Bridge Network, H. P. St. Clair and C. A. Imburgia. Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1114-1115, 3 figs. Gives solution of network in form of Wheatstone bridge, consisting of two triangles.

ELECTRICITY, APPLICATIONS OF

AGRICULTURE. Rural Electrification and the Canadian Hydro, E. A. Stewart. Nat. Elec. Light Assn.—Bul., vol. 13, nos. 7, 8 and 9, July, Aug. and Sept. 1926, pp. 432-434, 504-509 and 563-564, 1 fig. July: Rural electrification of Ontario, Canada; rural line construction and costs. Aug.: Rates for rural service; electricity on farms; discussion of rates and uses of electricity. Sept.: Observations and conclusions.

The Development of Rural Electrification in the United States, E. A. White. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 78, 16 pp., 7 figs. At present rural electrification plays only minor part in United States; only 7.8 per cent of all farms use electricity for other purposes than lighting; recently national committee was founded to study relations between electricity and agriculture; of all states, California has done most to further agricultural electrification.

Application of Electricity to Agriculture, F. Ringwald. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. De, 17 pp. Review of nine reports received on this subject dealing with conditions in America, Germany, Japan, England, France, Switzerland, Denmark and Norway. English translation of original German text.

ELECTRICITY SUPPLY

RATE RESEARCH. Report of Rate Research Committee 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-51, for mtg. May 17-21, 1926, 5 pp. Information as to current rates and decisions bearing upon rates.

STATISTICAL METHODS. Report of Statistical Methods Committee 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-16, May 17-21, 1926, 6 pp. Presents principles of electric-utility statistics as foundation for future committee work; outlines tentative classification of statistics for development as guide to collection and arrangement; suggests definitions of few commonly used technical terms for criticism, with ultimate view to international standardization of terminology; principles underlying presentation of statistical data in tabular and graphic form.

ELECTRODEPOSITION

ADDITION AGENTS. The Common Properties of Addition Agents in Electrodeposition, G. Fuseya and K. Murata. Am. Electrochem. Soc.—Advance Paper, no. 7, for mtg. Oct. 7-9, 1926, pp. 87-114, 1 fig. Reviews various theories proposed to account for beneficial effect on cathode resulting from addition of glue and other substances of electrolyte.

ELECTRODES

TEMPERATURE OF CONTACT. Temperature of a Contact and Related Current-Interruption Problems, J. Slepian. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 930-933, 6 figs. Formula is derived for temperature rise of last contact point of pair of separating electrodes; relation of this to arcing at switch, brush drop and commutation; experiments on interruption of current by switch in vacuum.

ELEVATED RAILWAYS

SUSPENDED. Bennie Railplane System on Elevated Tracks. Tramways & Ry. World, vol. 60, no. 14, Sept. 16, 1926, pp. 131-134, 6 figs. System is combination of car constructed along lines of airship practice and monorail from which car is suspended; lower guide rail for purpose of avoiding sway of car is also provided, and system has points of novelty while yet broadly following methods adopted in transport system already in use on Barmen-Elberfeld line spanning Wupper River in Germany.

EMPLOYEES' REPRESENTATION

SURVEY OF. Survey of Employee Representation. Ry. Mech. Engr., vol. 100, no. 10, Oct. 1926, pp. 586-587. Discussion of books on improved supervision and better employee relations.

EMPLOYMENT MANAGEMENT

EFFICIENCY CONTESTS. Efficiency Contests Increase Production, J. A. Muir. Mfg. Industries, vol. 12, no. 4, Oct. 1926, pp. 255-256, 4 figs. Plan in use at Baltimore Works of General Electric Co. was adapted to suit plant conditions by collaboration of members of managerial staff of plant; it includes following points of review; workmanship, keeping of promises, economy, good housekeeping, attendance and punctuality and general deportment.

EVOLUTION OF. The Evolution of Personnel Management, W. J. Matherly. Indus. Mgmt. (N.Y.), vol. 72, no. 4, Oct. 1926, pp. 256-257. Beginning of factory system; twentieth-century methods; effects of World War and post-war reaction.

ENGINEERING

PROBLEMS, SOLUTION OF. The Solution of Engineering Problems, F. L. Watson. Am. Mach., vol. 65, no. 15, Oct. 7, 1926, pp. 581-583. Points out that engineering work can be done at its lowest cost during slump and new work is then ready for use when general demand rises, that is to say, when it is most wanted.

F

FATIGUE

INDUSTRIAL. Industrial Fatigue, E. J. Kunze. Indus. Mgmt. (N.Y.), vol. 72, no. 4, Oct. 1926, pp. 233-235. Methods of increasing satisfaction of tasks; effect of fatigue on failure; physical surroundings; stimulus of high wage; personal pride and individuality, as against submergence as cog.

FERROALLOYS

ADDITIONS, DETERMINING WEIGHT OF. Determining the Weight of Alloy Additions, R. S. Kerns. Blast Furnace & Steel Plant, vol. 14, no. 10, Oct. 1926, pp. 439-441, 1 fig. Author has prepared series of curves which make it possible to quickly determine amount of ferroalloy to be added to any weight of charge.

FILTRATION PLANTS

DESIGN. New Ideas in Filter Plant Construction, J. L. Porter. Water Works Eng., vol. 79, no. 18, Sept. 15, 1926, pp. 1197-1198 and 1210. Improved underdrain developed by local engineer for New Orleans purification system; interchangeability of old and new plants. (Abstract.) Paper read before Southwest Water Works Assn.

FLOTATION

BIBLIOGRAPHY. A Bibliography on Flotation. Eng. & Min. Jl., vol. 122, no. 14, Oct. 2, 1926, pp. 535-536. Lists of article appearing in this journal and several other periodicals, Government bulletins, books, patents, etc.

FLOW OF WATER

CULVERTS. Flow Through Culverts. Pub. Works, vol. 57, no. 8, Sept. 1926, pp. 282-285, 3 figs. Results of experiments at State University of Iowa on pipe and box culverts show relative carrying capacities of different sizes and kinds of pipe, different treatments of entrance and exit openings, wing walls, etc.

FLOW METERS

ELECTRIC. Electric Flow Meter Has Interesting Features, T. R. Harrison. Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1130-1132, 3 figs. Manometer made by Brown Instrument Co., and its operation.

FLOW OF FLUIDS

TURBULENCE. Some Experience on Motion of Fluids, T. Terada and K. Hattori. Aeronautical Research Inst., Tokyo Imperial Univ.—Report, vol. 2, no. 16, May 1926, pp. 88-112, 19 figs. Results of experimental investigations begun in 1922 in connection with inquiry into practical problem concerning airships; diffusion and scattering of fluid issuing from small aperture; convection currents in rectangular vessel; formation of whirl due to ascending current. (In English.)

FLUE-GAS ANALYSIS

SAMPLING LINES TO CO_2 RECORDERS. Successful Sampling Lines, C. C. Phelps. Power, vol. 64, no. 15, Oct. 12, 1926, pp. 546-548, 3 figs. Points out that slight changes in sampling line have eliminated 80 to 90 per cent of attention formerly required; brass or copper best for sampling lines, preventing galvanic action.

FORGING

FURNACES. Economically-Operated Forging Furnace, G. L. Davis. Ry. Mech. Engr., vol. 100, no. 10, Oct. 1926, pp. 632-633, 1 fig. Oil-fired adaptation of older type of down-draft, coal burning forge.

PRESSES. The Largest Steam-Hydraulic Forging-Press, W. J. Priestly. Min. & Met., vol. 7, no. 238, Oct. 1926, pp. 426-429, 5 figs. Notable war-time achievement described for first time; press used for forging armour, as well as bending and rectifying it, and forging ingots for large calibre guns.

FOUNDRIES

NON-FERROUS. Temperature Determination in the Non-Ferrous Foundry. Am. Foundrymen's Assn.—Advance Paper, no. 8, for mtg. Sept. 27-Oct. 1, 1926, 24 pp., 4 figs. Symposium of papers as follows: Pyrometer Control in a Brass Foundry, A. S. Hall; Use of Pyrometers in the Casting of Non-Ferrous Metals, R. D. Bean; Thermo-Couple for Ladle Temperatures of Brass, A. A. Grubb, L. H. Marshall and C. V. Nass; Visual Judgment of Non-Ferrous Metal Temperatures, R. R. Clark. See also Metal Industry (N.Y.), vol. 24, no. 10, Oct. 1926, pp. 409-416.

TEMPERATURE CONTROL. Temperature Control. Am. Foundrymen's Assn.—Advance Paper, no. 15, for mtg. Sept. 27-Oct. 1, 1926. Contains following articles: Temperature Control in Aluminum Foundries, K. Marsh, pp. 2-29, 7 figs.; Temperature Control in the Brass Foundry, H. M. St. John, pp. 30-36.

FUELS

COAL. *See Coal; Pulverized Coal.*

COKE. *See Coke.*

LOCOMOTIVE CLINKERS, RECOVERY FROM. Fuel Recovery from Locomotive Clinkers. Eng. Progress, vol. 7, no. 8, Aug. 1926, p. 212, 2 figs. Describes portable clinkers dressing plant employed by German State Railways for recovery of about 20 per cent utilizable fuel.

OIL. *See Oil Fuel.*

PULVERIZED COAL. *See Pulverized Coal.*

SOLID SMOKELESS. Conference on Solid Smokeless Fuel. Chem. & Industry, vol. 45, no. 35, Aug. 27, 1926, pp. 289T-295T and (discussion) 296T-301T. Summary of papers and discussion on this subject during 1925; requirements of solid smokeless fuel; present use of coke; ease of ignition and combustibility; dryness of coke; strength and compactness; coke grading.

FURNACES, GAS

RADIANT-HEAT. A Radiant-Heat Furnace. Gas Jl., vol. 175, no. 3302, Sept. 1, 1926, p. 474, 2 figs. Patented design was invented and applied by Wollers of Krupp Laboratories; its chief characteristics are (1) heating is entirely by radiation without flame formation, and consequently without disadvantages of flame contact with contents; (2) intimate admixture of gas and air (latter heated in recuperator) is effected in early stages.

FURNACES, INDUSTRIAL

DESIGN. General Principles of Furnace Construction and Design, W. Trinks. Gas Age-Rec., vol. 58, nos. 13 and 14, Sept. 25 and Oct. 2, 1926, pp. 4.9-422 and 453-456, 16 figs. Sept. 25.: Types and features of design; points out that heating capacity of furnace is based upon (1) temperature equalization in charge, (2) heat transfer to charge, (3) liberation of generation of heat. Oct. 2: Selection of cheapest fuel, everything considered; furnace design to utilize that fuel to best advantage; circulation of gases.

G

GARBAGE DISPOSAL

PRACTICE. Garbage Disposal. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 8, Oct. 1926. Symposium containing following articles: Administrative and Engineering Work in the Collection and Disposal of Garbage: A Review of Problem, S. A. Greeley, pp. 1642-1655; Garbage Collection and Disposal, Lansing, Michigan, E. D. Rich, pp. 1656-1659; California Practice of Garbage Disposal by Hog Feeding, W. T. Knowlton, pp. 1660-1661; The Disposal of Organic Waste by the Beccari System at Scarsdale, New York, A. Boniface, pp. 1662-1665; High-Temperature Incineration at Toronto, Ontario, Canada, J. A. Burnett, pp. 1666-1669; The Cobwell Ssystem of Garbage Reduction and Some Phases of Its Operation at Rochester, New York, J. V. Lewis, pp. 1670-1678.

GASES

DENSITY. A Review of the Literature Relating to the Normal Densities of Gases, M. S. Blanchard and S. F. Pickering, U.S. Bur. of Standards—Sci. Papers, no. 529, 1926, pp. 141-177. Attempt has been made to choose most reliable value for each gas.

GEARS

TEETH, STRENGTH OF. Strength of Gear Teeth, E. Kieft. Iron & Steel Engr., vol. 3, no. 9, Sept. 1926, pp. 405-415, 5 figs. Stresses due to load and shock.

WORM. Worm Gearing, H. E. Merritt. Machy. (Lond.), vol. 28, nos. 725, 726, 727 and 728, Sept. 2, 9, 16 and 23, 1926, pp. 648-650, 684-685, 716-718 and 743-744, 11 figs. Sept. 2: Undercutting; assembly interference; choice of thread section. Sept. 9 and 16: DBS standard module system of worm-gear design; basis of system; standard worm forms; calculation and choice of module; specification of work; addendum, dedendum and clearance; calculation of lead angle and normal module pitch; example of calculation of work and wheel dimensions. Sept. 23: Tooth reaction; journal and thrust loads.

Worm Gearing—Comment, F. W. Shaw. Machy. (Lond.), vol. 28, no. 728, Sept. 23, 1926, p. 747, 1 fig. Critical discussion of series of articles by H. E. Merritt in same journal, with special reference to assembly interference; author questions whether this really exists, and claims that it is not possible to generate wheels which will not assemble radially.

GRINDING MACHINES

CUTTER. Automatic Universal Cutter Grinder. Machy. (Lond.), vol. 28, no. 726, Sept. 9, 1926, pp. 686-687, 3 figs. Machine is intended for dry grinding, 3-in. suction pipe being provided for removing particles of abrasive.

VERTICAL-SPINDLE. Vertical-Spindle Surface Grinding Machine. Engineer, vol. 142, no. 3689, Sept. 24, 1926, p. 342, 2 figs. Built by Beyer, Peacock & Co., Manchester, Eng., for tool-room work such as finishing of templates, gauges, etc., and grinding of small details.

WORM. New Automatic Worm Grinder. Iron Age, vol. 118, no. 14, Sept. 30, 1926, p. 928, 2 figs. New machine for thread grinding on production basis made by Pratt & Whitney Co., Hartford, Conn.

H

HAMMERS

STEAM. Chambersburg Double-Frame Steam Hammer, Type B. Am. Mach., vol. 65, no. 15, Oct. 7, 1926, p. 613, 1 fig. Anvil is solid and cores have been avoided except at side for handling purposes.

HARBOR IMPROVEMENT

SUBMARINE LEDGE REMOVAL. Removing Submarine Ledges, J. R. Kennerly. Compressed Air Mag., vol. 31, no. 10, Oct. 1926, pp. 1795-1798, 13 figs. Methods employed in locating, drilling, blasting and clearing away obstructions of this kind.

HARDNESS

TESTERS. Comparison of Various Methods of Measuring Hardness of Tempered Metals (Les résultats comparatifs des diverses Méthodes de mesure de la dureté des métaux trempés), N. Swaine. Génie Civil, vol. 89, no. 8, Aug. 21, 1926, pp. 159-161, 7 figs. Discusses methods of Vickers, Hultgren, Rockwell, Brinell, Amsler, Baumann, and gives comparative figures.

HEAT TRANSMISSION

SKIN FRICTION AND. Further Experiments on the Relation Between Skin Friction and Heat Transmission, D. Marshall. Aeronautical Research Committee—Reports and Memoranda, no. 1004, Nov. 1925, 19 pp., 11 figs.

HEATING

LARGE BUILDINGS. General Principles of the Heating of Large Buildings, W. W. Nobbs. Domestic Eng. (Lond.), vol. 46, no. 9, Sept. 1926, pp. 183-185. Problems which beset both architect and engineer; heating systems applicable to large buildings; discusses hot air, steam and hot water, giving special applications and advantages of each.

HEATING, ELECTRIC

INDUSTRIAL. Industrial Electric Heating, J. R. Crossley. Elecn., vol. 97, no. 2522, Oct. 1, 1926, pp. 386-387 and 392, 5 figs. Discusses baking and other important applications; saving space.

HUMIDITY

CALCULATION. The Calculation of Atmospheric Humidity, A. L. Egan. S. African Min. & Eng. Jl., vol. 37, no. 1818, July 31, 1926, pp. 621-622, 1 fig. Author develops new method for determining humidity.

HYDRAULIC TURBINES

NET HEAD. Notes on the Definition of Net Head as Used for the Experimental Determination of Turbine Efficiency, R. Neeser. World Power Conference, Sect. Basel Mtg. 1926—Advance Paper, no. 62a, 9 pp. As defined in Switzerland and in Europe generally, net head is actual operating head on turbine wheel; gives American definition of net head set up by standard testing code for hydraulic turbines, adopted by Machinery Builders' Society, Oct. 11, 1917; author expresses wish that there should be universal agreement, not only on subject of net head definition and efficiency, but on the whole question with regard to experimental determination of efficiency of hydraulic machines. See also abstract in Engineering, vol. 122, no. 3169, Oct. 8, 1926, pp. 441-443.

PROPELLER TYPE. Swiss Test New Propeller Type Runner, F. Johnstone-Taylor. Power Plant Eng., vol. 30, no. 19, Oct. 1, 1926, p. 1066, 3 figs. Draft-tube design proves important in high-speed installation at Matte power station, Berne, Switzerland.

REGULATING GATES. Hydraulic Turbine Regulating Gates, L. H. Burpee. Can. Engr., vol. 51, no. 10, Sept. 7, 1926, pp. 267-271, 5 figs. Operating difficulties in connection with them; effects of trash in turbine casing; gate mechanisms; renewable parts; correction of "sprung" gates; record of gate troubles at several Canadian plants.

RUNNERS, AIR ADMISSION TO. Admitting Air to Turbine Runners Improves Efficiency, S. L. Kerr. Power, vol. 64, no. 16, Oct. 19, 1926, pp. 580-582, 4 figs. Methods of admitting air to turbine runners to improve efficiency and how to make tests to determine adjustment of air valves to obtain most efficient operating performance.

SPECIFICATIONS. Specifications for Hydraulic Turbines, J. S. Carpenter. Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1118-1120. Points out that uniform practice with regard to specifications is needed to eliminate misunderstandings.

SWEDEN. Turbine Designs: Latest Progress in Sweden, H. Munding. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 31, 15 pp., 11 figs.

SWISS. Water-Power Utilization and Inland Navigation (Wasserkraftnutzung und Binnenschiffahrt), A. L. Caflisch. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 53, 26 pp., 16 figs. Hydraulic turbines by Swiss concerns, turbines of propeller, screw and Kaplan types which have been installed in low-head stations, have realized efficiencies up to 91 per cent with specific speeds up to 900; for very large output, high-head Francis turbine with vertical shaft has been developed to high state of perfection; impulse turbines of horizontal-shaft type have been built with great economic efficiency; new principles of quantity production have been applied to manufacture of governors; pipe lines are constructed with view to best utilization of material and minimum loss of head.

HYDRAULICS

PARAMETERS, USE OF. On the Use of vd/v as a Parameter in the Practice of Hydraulics, E. Parry. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 3, 11 pp., 2 figs. Author advocates abandonment of all empirical formulas for coefficient of frictional resistance in hydraulics and substitution from series of curves determined by experiment, each curve representing particular degree of roughness in relation to diameter; points out that such series of curves are universal in character and apply equally to all fluids, gascous or liquid, and at all temperatures.

HYDRO-ELECTRIC DEVELOPMENTS

FRANCE. Hydro-Electric Development in France, D. Fitz. Roy. Engrs. Jl., vol. 40, no. 3, Sept. 1926, pp. 458-468, 13 figs. Geographical distribution of water power in France; nature of works; high-head plants; economics of water power.

Power Developments on Gatineau River. Can. Engr., vol. 51, no. 13, Sept. 28, 1926, pp. 321-324, 6 figs. Two power developments, storage reservoir dam, and large newsprint mill under construction in Gatineau River district, Chelsea and Farmer's Rapids power developments; new mill of International Paper Co.; transmission lines.

WASHINGTON. Skagit River Hydro-Electric Development for Seattle, J. D. Ross. West. Constr. News, vol. 1, no. 18, Sept. 25, 1926, pp. 26-31, 10 figs. Commencement of $63,000,000 programme; 4.25-mil. extension of railway to dam site in Diablo Canyon; construction of dam 365 ft. high to follow soon after.

HYDRO-ELECTRIC PLANTS

AUTOMATIC. Automatic Hydro-Electric Power Stations in Sweden, F. Zachrisson. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 32, 7 pp., 4 figs.

AUTOMATIC AND SUPERVISORY CONTROL. Automatic and Supervisory Control of Hydro-electric Generating Stations, F. V. Smith. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 967-973, 8 figs., and (discussion), pp. 1029-1035, 2 figs. Application of automatic equipment and supervisory control to number of interesting hydro-electric installations.

COMBINED STEAM AND. Economic Problems of Water Power and Interconnections Between Hydro-Electric and Steam Plants (Considérations économiques sur l'energie hydro-électrique et les liaisons entre centrales hydro-électriques et centrales thermiques), M. Lassalle. World Power Conference, Sect. Basel Meeting, 1926—Advance Paper, no. 7, 20 pp., 6 figs.

Interconnection of Hydro-Electric and Steam Plants (Hydroelektrische Verbundwirtschaft unter Mitwirkung kalorischer Anlagen), R. Hofbauer. World Power Conference, Sect. Basel Meeting, 1926—Advance Paper, no. 16, 15 pp., 7 figs. Discusses question of co-operation between steam and hydro-electric plants in Austria.

CONSTRUCTION. Distinctive Features of Hydro-Electric Construction, L. F. Harza. Elec. World, vol. 88, no. 13, Sept. 25, 1926, pp 657-661, 5 figs. Discusses phases of hydro-electric construction; factors which determine schedule; making draft-tube forms ready for excavation; grading methods; progress records.

Economical Hydro-Electric Plant Construction, J. F. Vaughan. Elec. World, vol. 88, no. 13, Sept. 25, 1926, pp. 627-628. Importance of seeking to control fixed charges; rewards of detailed planning; individual responsibility more important than contract forms.

ELECTRICAL EQUIPMENT. Electrical Equipment of Swiss Design for Hydro-Electric Plants (Die elektrischen Einrichtungen hydro-elektrischer Werke schweizerischer Herkunft), W. Wyssling. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 61a, 27 pp., 11 figs.

FRANCE. The Eguzon Hydro-Electric Power Station, L. B. Desbleds. Elecn., vol. 97, no. 2521, Sept. 24, 1926, pp. 351-353, 6 figs. Long-distance supply of Paris; meeting traction load on Orleans Railway; interconnections with Gennevilliers; constructional details.

ITALY. The Arquata Scrivia Plant of the Edison Co. (L'officina di Arquata Scrivia della Soceita Edison), G. Guastalla. Energia Elettrica, vol. 3, no. 6, June 1926, pp. 459-483, 36 figs. Describes plant and equipment, consisting of repair shop, transformer station (130,000 volt.), generating plant of 3 groups of asynchronous alternators of 6,500 kw. each, and synchronous condensers of 6,000 kva., switch-plant, busbars, etc.

Low-Pressure. Low-Pressure Hydro-Electric Plants (Niederdruckwasserkraftwerke), H. E. Gruner. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 26, 14 pp., 1 fig. Capacity of low-head plants of Switzerland is considerably larger than capacity corresponding to minimum flow.

I

INDUSTRIAL MANAGEMENT

Automobile Manufacturing Plants. A Simple Works System. Automobile Engr., vol. 16, no. 219, Sept. 1926, pp. 343-347, 12 figs. Organization of automobile factory for moderate and varied output.

Budgetary Control. Budgetary Procedure for the Rubber Industry. Mfg. Industries, vol. 12, no. 4, Oct. 1926, pp. 283-288. Miscellaneous adjustments; forecast of collections from accounts receivable; estimated profit and loss statement; comparison form budget versus actual amounts monthly and to date.

Business Forecasting. We Owe 1926 Profits to Our Business Forecast, H. Coonley. Factory, vol. 37, no. 4, Oct. 1926, pp. 591-595, 660, 662, 748 and 750. Practice of planning department of Walworth Co., Boston; from study of coming year's sales it is possible to arrive rather definitely at what costs and prices will be.

Economical Manufacturing Quantities, Determining. How to Determine Economical Manufacturing Quantities, B. Cooper. Indus. Mgmt. (N.Y.), vol. 72 no. 4, Oct. 1926, pp. 228-233, 7 figs. Method for determining most economical manufacturing quantities, incorporating both accuracy and relative simplicity; formulas and charts are developed.

Production Control. A Flexible Production Control System, E. J. Kunze. Mfg. Industries, vol. 12, no. 4, Oct. 1926, pp. 289-292, 5 figs. System applied to both manufacturing and special orders.

Costs and Selling Prices. Normal Costs and Selling Prices, L. P. Alford. Mfg. Industries, vol. 12, no. 4, Oct. 1926, pp. 269-272, 1 fig. Deals with following questions: What constitute costs, how much profit should be made, and how should selling prices be set?

Taylor System. Taylor System of Scientific Management (Il sistema Taylor d'organizzazione scientifica del lavoro), L. A. Boncinelli. Industria, vol. 40, no. 11, July 1926, pp. 283-285. Discusses advantages and disadvantages, and analyses results of application of Taylor system in Italy; conclusions are in its favour generally.

World Progress. The World Movement of Scientific Organization. Int. Permanent Delegation of Sci. Mgmt. Congress, vol. 1, no. 1-2, June 1926, pp. 16-27. Deals with technical science and management; importance, endeavours and progress of scientific organization. See same article in French, pp. 4-15.

INDUSTRIAL ORGANIZATION

Pacific Gas and Electric Co. Administrative Methods of the Second Largest Gas and Electric Company in the Country, Chas. W. Geiger. Indus. Mgmt. (N.Y.), vol. 72, no. 3, Sept. 1926, pp. 196-199.

INDUSTRIAL RELATIONS

N.E.L.A. Committee Report. Report of Industrial Relations Committee 1925-1926. Nat. Elec. Light Assn.—Report, no. 256-32, May 17-21, 1926, 29 pp., 7 figs. Studies of phases of employment, compensation and pensions.

Plant Programme. Plan Wins Employees' Good Will, B. Finney. Iron Age, vol. 118, no. 13, Sept. 23, 1926, pp. 835, 1 fig. Industrial-relations programme in moderate-sized plant of Diamond Chain & Mfg. Co., Indianapolis; individual instruction given apprentices; group insurance and mutual-relief association are features.

INDUSTRIAL TRUCKS

Electric. Saving in Foundry Handling with the Electric Industrial Truck, H. J. Payne. Am. Foundrymen's Assn.—Preprint no. 11, for mtg. Sept. 27-Oct. 1, 1926, 16 pp., 10 figs.

INSULATION, HEAT

Furnaces. Selection of Proper Furnace Insulation, M. H. Mawhinney. Forging—Stamping—Heat Treating, vol. 12, no. 9, Sept. 1926, pp. 328-333, 12 figs. Also Blast Furnace & Steel Plant, vol. 14, no. 10, Oct. 1926, pp. 426-431, 12 figs. Suggestions for selection of proper furnace insulation for various conditions which are commonly found in practice.

INTERNAL-COMBUSTION ENGINES

Detonation. The Effect of Metallic Sols in Delaying Detonation in Internal Combustion Engines, C. J. Sims and E. W. J. Mardles. Aeronautical Research Committee—Reports and Memoranda, no. 1021, May 1926, 11 pp. It was found that colloidal solutions of iron, lead and nickel in gasoline are as effective in delaying detonation as organic compounds of these metals; metallic iron seems to be more effective than its carbonyl compound.

Horizontal Multi-Cylinder. The Case for the Horizontal Multi-Cylinder Internal Combustion Engine, R. M. H. Lewis. Roy. Engrs. Jl., vol. 40, no. 3, Sept. 1926, pp. 403-410, 12 figs. Criticizes various claims for superiority put forward on behalf of vertical multi-cylinder engine; advantages of horizontal type.

See also Automobile Engines; Diesel Engines; Oil Engines.

IRON CASTINGS

Gating. On Gating Iron Castings, H. W. Dietert. Am. Foundrymen's Assn.—Preprint no. 26, for mtg. Sept. 27-Oct. 1, 1926, 11 pp., 4 figs; also abstract in Foundry Trade Jl., vol. 34, no. 529, Oct. 7, 1926, pp. 313-314 and 316, 4 figs. To determine factors of gating in common use in plant with which author is connected, study was made of rates of pouring of castings according to weights; pouring times of numerous moulds were plotted against weights of castings in moulds; data secured show that there is definite relation between pouring time and weight; as result of investigation, charts were developed which enables foundry organization to specify sizes of gates for various castings and rates of pourings.

L

LABOUR TURNOVER

Cost of. Your Labour Turnover: Good or Bad? W. A. Berridge. Factory, vol. 37, no. 3, Sept. 1926, pp. 416-418, 528, 532, 536 and 540, 3 figs. Author explains what can be done to make labour-turnover figures real measure of efforts to stabilize force.

LABORATORIES

Heat-Treatment. Heat-Treatment Industrial Laboratories. Metal Industry (Lond.), vol. 29, no. 13, Sept. 24, 1926, pp. 290-291, 2 figs. Methods and equipment of laboratory of city of Birmingham Gas Department, England; details of recuperator furnaces and temperature recorders; research work; demonstrations on commercial scale of hardening, tempering, case-hardening or normalizing.

Metallographic. Wheel Makers Expand Laboratory, R. A. Fiske. Iron Age, vol. 118, no. 13, Sept. 23, 1926, pp. 838-840, 4 figs. Test specimens studied in new metallographic department of Assn. of Manufacturers of Chilled Car Wheels; laboratory is located at plant of Griffin Wheel Co., Chicago, where facilities of chemical laboratory are available to supplement microphotographing and physical testing equipment owned by Association.

Methods and Equipment. Laboratory Technique, Methods and Equipment, F. Jehle. Soc. Automotive Engrs.—Jl., vol. 19, no. 4, Oct. 1926, pp. 373-384, 14 figs. Methods to be followed in making investigation are elucidated by examples of study of adapting existing carburetor to existing engine and of study of charge distribution by manifold to cylinders of four-cylinder engine.

LACQUERS

Inflammable, Storage and Handling of. Storage and Handling of Inflammable Lacquer Materials. Paint Mfrs'. Assn. of U. S., Sci. Section—Circular, no. 285, Sept. 1926, pp. 133-139. Approved methods for safe handling, storage and use of inflammable materials in lacquer industry.

LAKES

Storage. Some Principles of Lake Storage with Special Reference to Swedish Conditions, C. Schmidt. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 28, 10 pp., 2 figs. In order to avoid unnecessary damage on account of raised water levels and too large discharges of water, and in order to utilize stored water in rational manner, it is necessary to draw up plan for economical distribution of water.

LATHES

Developments and Uses. Development and Use of the Lathe, L. A. Catlin. Can. Machy., vol. 36, no. 12, Sept. 16, 1926, pp. 15-17, 7 figs. It is shown that development of lathe through ages was slow. (Abstract.) Paper read before Glasgow & West of Scotland Assn. of Foremen Engrs.

Flywheel Machining in. Machining of Flywheels. Brit. Machine Tool Eng., vol. 4, no. 41, Sept.-Oct. 1926, pp. 478-479, 2 figs. Butler flywheel turning, boring and bossing lathe on which gas-engine flywheel 5 ft. diameter may be completely finished in 3 hours, 50 minutes; machine is provided with five cutting tools, all of which may be in operation simultaneously.

LIGHTING

Factories. How Much Does Light Affect Production? R. A. Palmer. Mfg. Industries, vol. 12, no. 4, Oct. 1926, pp. 263-267, 7 figs. Fifteen cases show increases in output varying from 8.5 to 35 per cent due to better lighting.

Street. Modern Street Lighting and the Future, S. B. Langlands. Elec. Times, vol. 70, no. 1822, Sept. 23, 1926, pp. 345-346, 2 figs. Discusses controversial points in present-day public lighting practice, including question of bare lamps, as against sprayed lamps; question of overhead suspension as against special lighting poles or wall brackets, etc.

What is Street Lighting? H. T. Harrison. Elec. Times, vol. 70, no. 1822, Sept. 23, 1926, pp. 346-347. Points out that street lighting is not question of illumination only, and must be considered from following points of view: (1) public or casual observer, (2) police, and (3) vehicle driver.

LIGHTNING ARRESTERS

Characteristics. Time, Voltage and Current Characteristics of Lightning Arresters, K. B. McEachron. Gen. Elec. Rev., vol. 29, no. 10, Oct. 1926, pp. 678-685, 7 figs. Influence of electrostatic field; action during discharge; values of flashover voltage and discharge current; operation of different types of arresters; test with Dufour oscillograph.

LOCOMOTIVE BOILERS

Water-Tube. Structural Changes in the McClellon Water-Tube Locomotive Boiler. Boiler Maker, vol. 26, no. 9, Sept. 1926, pp. 249-255, 11 figs. Side water-tube arrangements altered in recent order for 10 locomotives for New York, New Haven & Hartford R. R.

LOCOMOTIVES

Design. Some Important Details, C. T. Ripley. Ry. Age, vol. 81, no. 12, Sept. 18, 1926, pp. 499-500. Discusses question of design of detailed parts of locomotive, particularly those features which need improvement; expansion stresses in firebox; frames and moving parts; need of cross-counterbalancing.

Diesel-Engined. Diesel Locomotive Operation in Russia, G. V. Lomonossoff. Ry. Rev., vol. 79, no. 13, Sept. 25, 1926, pp. 457-459, 5 figs. Gear-magnetic transmission compared with electric drive and gear-shift system.

Diesel Locomotives for Main Line Traffic. Ry. Engr., vol. 47, no. 561, Oct. 1926, pp. 357-363 and 368, 11 figs. Two separate designs for Russia, one with electric and other with geared transmission; first was supplied by Brown-Boveri & Co. and is 2-10-2 type; and other is 4-10-2 type, supplied by Hohenzollern Works, Germany; locomotive-testing plant.

Steam-Turbine. Visit to Santa Fé and Inspection and Trial of Ljungström Turbo-Condensing Locomotive. Ry. Gaz., vol. 45, no. 11, Sept. 10, 1926, pp. 310-312, 3 figs. Account of locomotive in service; test results; spark-prevention devices on locomotives.

LUBRICATING OILS

Deleterious Properties. Some Deleterious Properties of Lubricating Oils, J. E. Hackford. Diesel Engine Users' Assn.—Report, no. S72, for mtg. June 25, 1926, 22 pp., 2 figs. Author describes tests that may help to predict future behaviour of oil; includes discussion.

Kerosene Addition. The Effect of the Addition of Kerosene on the Oiliness of Lubricating Oils, S. A. McKee. Soc. Automotive Engrs.—Jl., vol. 19, no. 4, Oct. 1926, pp. 356-360, 6 figs. Results of tests of performance of oils diluted with kerosene in journal-bearing friction machine with regard to so-called oiliness property of lubricant, oiliness being defined as property that causes difference in friction when two lubricants of same viscosity at temperature of oil film are used under identical conditions; method of procedure and precautions taken to keep speed, load, bearing temperature and oil pressure constant throughout duration of run; results show that, under conditions of these tests, addition of kerosene decreases oiliness effect of lubricant.

Properties and Application. The General Properties of Lubricating Oils and Their Practical Application, A. E. Dunstan and R. W. L. Clarke. Chem. & Industry, vol. 45, no. 39, Sept. 24, 1926, pp. 690-694. Manufacture of lubricating oils from petroleum; nomenclature of lubricating oils; general properties.

M

MACHINE TOOLS

National Steel and Machine Tool Exhibition, Chicago. Exhibitors and What They Will Exhibit at the National Steel and Machine Tool Exhibition. Forging—Stamping—Heat Treating, vol. 12, no. 9, Sept. 1926, pp. 318-324 and 338, 2 figs. List of exhibits arranged alphabetically according to makers.

MACHINING METHODS

COST REDUCTION. Reducing Machining Costs. Machy. (Lond.), vol. 28, no. 727, Sept. 16, 1926, pp. 701-708, 16 figs. Use of specially prepared forms of metals; bright drawn steels, turned and ground stock, hollow bars and seamless tubing, die castings, hot pressing and stampings, close-to-limit castings and extruded sections.

ICE MACHINES. Production Methods in an Ice-Machine Plant, F. W. Curtis. Am. Mach., vol. 65, no. 16, Oct. 14, 1926, pp. 623-625, 9 figs. Methods and equipment of Baker Ice Machine Co., Omaha, Neb.

MALLEABLE CASTINGS

BLACK-HEART. Black-Heart Malleable (Remarques sur la malléable à coeur noir), C. Kluytmans. Fonderie Moderne, vol. 20, Sept. 1926, pp. 209-214, 12 figs. Discusses defects of black-heart malleable produced in reverberatory furnace, originating in crude metal of casting, and in annealing, and gives examples.

PROPERTIES. A Study of Malleable Cast Iron, O. Quadrat and J. Koritta. Am. Foundrymen's Assn.—Preprint no. 21, for mtg. Sept. 27-Oct. 1, 1926, 7 pp.

REQUIREMENTS. What May Be Required of Malleable Cast Iron, H. A. Schwartz. Am. Foundrymen's Assn.—Advance Paper, no. 44, for mtg. Sept. 27-Oct. 1, 1926, 16 pp.

STRENGTH. Resistance of Malleable Iron to Repeated Impact Stresses and Comparison of Strength of Machined and Unmachined Malleable Castings, E. Touceda. Am. Foundrymen's Assn.—Preprint, no. 39, for mtg. Sept. 27-Oct. 1, 1926, 9 pp., 2 figs. Results of tests.

METALS

CORROSION-RESISTING. Metals to Resist Corrosion or High Temperatures, H. J. French. Am. Electro-Chem. Soc.—Advance Paper, no. 5, for mtg. Oct. 7-9, 1926, pp. 47-79, 6 figs. Principal characteristics and typical applications of metals used industrially to resist high temperatures or corrosion; those considered include commercially pure copper, aluminum, lead, tin, silver, nickel and iron, and their alloys.

DILATOMETRIC ANALYSIS. Principles and Chief Applications of Dilatometric Analysis of Materials, A. Portevin and P. Chevenard. Am. Foundrymen's Assn.—Advance Paper, no. 22, for mtg. Sept. 27-Oct. 1, 1926, 43 pp., 34 figs. Thermal and physical analysis; superiority of dilatometric analysis; calculation of coefficient of expansion; application of dilatometric analysis.

PLASTIC DEFORMATION. The Question of Plastic Deformation, H. Preussler. Blast Furnace & Steel Plant, vol. 14, no. 10, Oct. 1926, pp. 442-447, 17 figs. Author gives insight into character of plastic deformation; various observations and theories discussed; application to rolling, forging and pressing. Translated from Stahl u. Eisen.

METALLURGY

BIBLIOGRAPHY. Research in Metallurgical Literature, R. Rimbach. Forging—Stamping—Heat Treating, vol. 12, no. 9, Sept. 1926, pp. 354-357. Outlines procedure to be followed in making research into metallurgical literature; gives list of periodicals and magazines as guide.

MICROSCOPES

TOOLMAKERS'. Bausch & Lomb Toolmakers' Microscope. Am. Mach., vol. 65, no. 16, Oct. 14, 1926, pp. 652-653, 2 figs. Principle of operations of instrument adapted to workshop and laboratory.

MILLING MACHINES

AUTOMOBILE INDUSTRY. Tooling 1927 Models of Auto Industry, H. Rowland. Can. Machy., vol. 36, no. 13, Sept. 23, 1926, pp. 14-16, 8 figs. Describes recent installations of productive milling equipment.

UNIVERSAL. Large Universal Milling Machine. Machy. (Lond.), vol. 28, no. 728, Sept. 23, 1926, pp. 745-746, 5 figs. Machines built by P. Huré & Cie, Paris, using table with universal head; drive is by constant-speed single pulley; most interesting feature of machine is double swivelling head.

MOULDING METHODS

DIFFERENTIAL-PITCH PROPELLERS. Metal Industry (Lond.), vol. 29, no. 10, Sept. 3, 1926, pp. 223-224, 6 figs. Most usual method is to employ inner and outer templets; explains why this is unsatisfactory method; author suggests that it is not only possible, but really simpler to strike it with one templet; sweeping bed is done by means of two boards, one being fixed to spindle and other being pinned to it near centre.

MOULDS

PERMANENT. Permanent and Long-Life Moulds, R. Moldenke. Am. Foundrymen's Assn.—Advance Paper, no. 32, for mtg. Sept. 27-Oct. 1, 1926, 8 pp.

Permanent and Long-Life Moulds. Am. Foundrymen's Assn.—Advance Paper, no. 10, for mtg. Sept. 27-Oct. 1, 1926, 28 pp., 7 figs. Symposium of following papers: Durable Moulds, J. A. Murphy; A. Permanent Mould Process, H. A. Schwarts; Some Considerations of Metal for Heavy Iron Castings in Permanent Moulds, H. P. Kimber and S. M. Udale.

SAND, MELTING STEEL FOR. Melting Steel for Sand Moulds, T. F. Hull. Foundry, vol. 54, no. 19, Oct. 1, 1926, pp. 785-787. Points out that requirements for castings differ from ingots; metal must be superheated shrinkage and contraction; liquidity and fluidity. (Abstract.) Paper presented before West Yorkshire Met. Soc. of England.

MOTOR TRUCKS

ELECTRIC. The Commercial Use of Electric Vehicles, H. A. Child. Instn. Engrs. Australia, vol. 7, no. 2, 1926, pp. 37-64, 8 figs. History of development of electric vehicle; mechanical construction of trucks, design of motor, controller and battery, and characteristics; charging and maintenance.

O

OFFICE MANAGEMENT

FORM DESIGN AND PRINTING. Design and Printing of Forms. Nat. Elec. Light Assn.—Report, no. 256-322, Apr. 1926, 11 pp., 3 figs. Outline of considerations to be given to design, selection of paper and methods of printing forms for office or general business use.

OIL ENGINES

MAINTENANCE. Factors That Influence Oil-Engine Maintenance, L. H. Morrison. Power, vol. 64, no. 16, Oct. 19, 1926, pp. 590-592, 3 figs. Points out that prestudy of plant conditions permits accurate prediction of repair costs.

OIL FUEL

ATOMIZATION IN BURNERS. Factors Affecting Atomization in Oil Burners, J. F. Barkley. Power Plant Eng., vol. 30, no. 19, Oct. 1, 1926, pp. 1048-1049, 1 fig. Data secured and conclusions drawn from experiences with combustion of oil in power-plant furnaces.

BURNERS. Progress in Industrial Heating, L. Macleod. West. Machy. World, vol. 17, no. 9, Sept. 1926, pp. 388-390, 5 figs. Details of Ray fuel-oil burning system, which is supplied with oil from independent pump set; applications of these burners to industry.

DEVELOPMENTS. Burning of Liquid and Gaseous Fuels. Nat. Elec. Light Assn.—Report, no. 25-106, Jan. 1926, 15 pp., 11 figs. Effect of furnace-volume upon maintenance, given by New Orleans Public Service; results of burning residuum from cracking stills as reported by Wichita Falls Electric Co.; progress made in burning of oil in combination with gas and coal, and results of recent developments and operating experience.

HANDLING FROM CAR TO BURNER. Handling Fuel Oil from Car to Burner, W. C. Kammerer. Forging—Stamping—Heat Treating, vol. 12, no. 9, Sept. 1926, pp. 333-334, 2 figs. Sets forth important factors that must be taken into consideration in handling of heavy fuel oil from tank car to burner.

RESEARCH. Fuel and Lubrication Research, W. A. Whatmough. Automobile Engr., vol. 16, no. 219, Sept. 1926, pp. 329-330, 2 figs. Résumé of recent investigation in carburation and oils.

OPEN-HEARTH FURNACES

SULPHUR ABSORPTION IN. Absorption of Sulphur During Melting in the Open-Hearth Furnace, C. H. Herty, Jr. Min. & Met., vol. 7, no. 238, Oct. 1926, pp. 444-447, 4 figs. High-sulphur gas imparts sulphur to scrap during melting; low-sulphur gas partly desulphurizes scrap; keep sulphur in fuel low.

P

PAINTS

LIFE OF. Paint and Varnish as Enemies of Corrosion, E. B. Timmerman. Can. Chem. & Met., vol. 10, no. 9, Sept. 1926, pp. 205-207. General discussion of factors affecting life of paint and varnish.

WHITE. Primers for White Paints Used on Refrigeration Cork Board Insulations, H. A. Gardner. Paint Mfrs'. Assn. of U. S., Sci. Section—Circular, no. 288, Sept. 1926, pp. 150-154, 1 fig. Note on iron sulphate as stain preventive in applying white paints to some woods.

PAPER MILLS

HEAT LOSSES. Heat Losses in Paper Mills, F. C. Farnsworth. Paper Mill, vol. 49, no. 39, Sept. 25, 1926, pp. 20 and 22. Recent test of Harrisburg Dual Clearance Uniflow Engine shows that reclamation of heat from compression that is ordinarily lost in common counterflow cylinder and saving of condensation losses actually shows saving of steam amounting to 20 to 30 per cent of total steam used; describes various ways in which heat losses prevail in paper mills and damage that water does when it lies on surface of heating units.

POWER AND HEAT PROBLEM. The Power and Heat Problem of a Roofing Felt Mill, K. B. Howell. Power, vol. 64, no. 15, Oct. 12, 1926, pp. 542-543. Points out that in common with other types of paper mills, power problem of mill manufacturing roofing felt is essentially determination of most economical feasible layout which will supply combined requirements of process steam and mechanical power; full-load plant costs do not tell whole story; actual variations in load have large influence.

SPEED REDUCTION. Speed Reduction Methods. Paper Trade Jl., vol. 83, no. 12, Sept. 16, 1926, p. 55. Comparison between cone and step pulley drives and Reeves variable speed transmissions in number of New England paper mills.

PATTERNMAKING

BAND SAW, USE IN. Band Saw is Important Pattern Shop Tool, W. C. Ewalt. Foundry, vol. 54, no. 18, Sept. 15, 1926, pp. 746-749, 14 figs. Points out that special care is necessary in successful operation of this machine tool, and safety measures are essential.

PHOTO-ELASTICITY

EYE-SHAPED BAR-END INVESTIGATION. Eye-Shaped End of Bar Investigated by Photo-Elastic Method, K. Takemura and Y. Hosokawa. Aeronautical Research Inst., Tokyo Imperial Univ.—Report, vol. 11, no. 4, July 1926, pp. 127-143, 21 figs. Point of maximum stress at inner edge of eye-shaped end changes its position according to manner of loading, and magnitude of maximum stress varies considerably with contour of eye-shaped end.

PIPE, CAST-IRON

CENTRIFUGALLY CAST. Experience with the Use of De Lavaud Centrifugally Cast Iron Pipe, P. J. Hurtgen. Am. Water Works Assn.—Jl., vol. 16, no. 3, Sept. 1926, pp. 373-386. Author relates actual experiences of water-works officials on use of de Lavaud pipe.

STRESSES IN SOCKETS. Stresses in Cast Iron Pipe Sockets. Engineer, vol. 142, no. 3690, Oct. 1, 1926, pp. 366-368, 7 figs. Investigation made by R. G. Batson and W. F. Cope at National Physical Laboratory.

PIPE, STEEL

ARC WELDING. Progress of Welded Pipe Lines for Oakland Water-Supply. Contractors' & Engrs'. Monthly, vol. 13, no. 3, Sept. 1926, pp. 71-72, 3 figs. Steel pipe fabricated by new process of arc welding used throughout.

PLANERS

HELICAL-GEAR. "Sunderland" Double Helical-Gear Planer. Brit. Machine Tool Eng., vol. 4, no. 41, Sept.-Oct. 1926, pp. 465-473, 15 figs. Application of Sunderland generating system as embodied in new Parkinson-Sunderland double helical-gear planers.

PLOWS

ELECTRIC. Electric Ploughing, R. B. Matthews. World Power Conference, Sect. Basel Meeting, 1926—Advance Paper, no. 17, 47 pp., 26 figs. Establishes formula for power needed in ploughing; discusses factors affecting this, including soil resistance, adjustment of plough, size of furrow and speed; recent experiments have established electrical method of reducing draft; advantages of electric ploughing; power is generally supplied from high-tension overhead lines by special tappings.

POWER FACTOR

IMPROVEMENT. Power Factor Improvement. Nat. Elec. Light Assn.—Report, no. 25-104, Jan. 1926, 26 pp., 7 figs. Report indicates that generally power-factor improvement equipment can be installed on growing systems with over-all gain in economy.

PROFIT SHARING

GREAT BRITAIN. Profit Sharing. Monthly Labour Rev., vol. 23, no. 3, Sept. 1926, pp. 62-64. Profit sharing and labour co-partnership in Great Britain and Northern Ireland in 1925.

PROSPECTING

ELECTRICAL. Practical Points on Electrical Prospecting for Location of Mineral Deposits, H. Lundberg. Min. Congress Jl., vol. 12, no. 10, Oct. 1926, pp. 737-738 and 763. Results dependent on conductivity and position of ore bodies; geological reconnaissance essential; sulphide deposits especially favourable; cost usually less than drilling; nature of ore body and zones of dissemination disclosed.

Electrical Prospecting at the Britannia Mine, J. I. Moore, Jr., and F. Ebbutt. Can. Inst. Min. & Met.—Bul., no. 173, Sept. 1926, pp. 1017-1028, 8 figs. Electrical prospecting is not intended to displace prospecting of old type, but to aid established methods, supplementing work of prospector and geologist, and is to be followed effectively by diamond drill; general and potential methods.

PULVERIZED COAL

Boiler Firing. A New System for Firing Boilers with Powdered Fuel. Iron & Coal Trades Rev., vol. 113, no. 3052, Aug. 27, 1926, p. 296, 1 fig. Improved system at Gateshead Works of Clarke, Chapman & Co., England.

Pulverized Fuel Firing at a French Colliery, M. Sohm. Colliery Guardian, vol. 132, no. 3427, Sept. 3, 1926, p. 509, 3 figs. Details of installation at Bruay power station; in designing plant, chief objects were systematic removal of all dust from coal intended to be washed to facilitate washing operation and to prevent formation of slime; deduction of amount of labour in boiler-house, at same time improving condition of boiler-house workers. Translated from French.

Developments. Pulverized Fuel. Nat. Elec. Light Assn.—Report, no. 256-79, Aug. 1926, 78 pp., 64 figs. Bibliography. See abstract in Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1098-1100, 1 fig.

Making Electrical Drives Safe in Pulverized Coal Plants, M. B. Wyman. Power, vol. 64, no. 14, Oct. 5, 1926, pp. 504-507, 7 figs. Methods used to eliminate explosion hazard in pulverized coal plants and how to select motors and controllers for these applications.

Low-Temperature Solid Residuals as. Low-Temperature Solid Residuals as Powdered Fuels, H. Nielson. Iron & Coal Trades Rev., vol. 113, no. 3054, Sept. 10, 1926, pp. 384-386, 4 figs. Powdered distilled residue, provided that it is result of low-temperature distillation, where primary oil products have been subjected to slight, if any, cracking, burns as freely as powdered raw coal, if not more so; it occupies same volume, ton for ton, as that of raw coal; physical properties, specific gravities, moisture absorption and combustibility were for practical purposes identical.

Pulverizers. The Clarke Chapman Turbo-Pulverizer. Machy. Market, no. 1349, Sept. 10, 1926, pp. 25-26, 5 figs. Machine is so arranged that all wearing parts can be inspected and replaced in minimum amount of time; fan for primary air, which is integral part of machine, draws fine coal from separator and discharges coal and primary air direct to burners.

Water Works, Use in. Use of Pulverized Fuel in the Water Works Plant, C. S. Denman. Am. Water Works Assn.—Jl., vol. 16, no. 3, Sept. 1926, pp. 296-301. Enumerates advantages of pulverized coal firing. Bibliography.

PUMPING STATIONS

Automatic. Automatic Public Water Supply. Engineering, vol. 122, no. 3169, Oct. 8, 1926, pp. 454-455, 5 figs. First public water supply with automatic pumping plant in England opened at Princes Risborough; plant consists of two sets of three-throw pumps, one driven by gasoline engine and other by electric motor, together with two cylindrical tanks.

PUMPS

Rotary. A New Conical Rotary Pump. Mech. World, vol. 80, 2073, Sept. 24, 1926, p. 239, 2 figs. Developed by A. G. Mumford, Ltd., Colchester, Eng.; it is known as Niagara pump and is intended for pumping oil fuel, brine, and for general work.

PYROMETERS

Radiation. Some Considerations on Radiation Pyrometers, A. J. Philpot. Sci. Instruments Jl., vol. 3, no. 11, Aug. 1926, pp. 366-373. Theoretical consideration of effect of varying distance from radiating source in total-radiation pyrometers of focusing and non-focusing lens and mirror types.

The Measurement of Combustion-Chamber Temperatures, H. W. G. Westlake. Eng. & Boiler House Rev., vol. 40, no. 3, Sept. 1926, pp. 115-117, 4 figs. Describes radiation-type pyrometer.

R

RADIOTELEGRAPHY

Transmitters. The Keying of Valve Transmitters, W. T. Ditcham. Experimental Wireless, vol. 3, no. 36, Sept. 1926, pp. 526-531, 9 figs. Deals with two main divisons of valve transmitters, namely, self-excited oscillators and magnifiers excited by master oscillator.

RAILWAY ELECTRIFICATION

Developments. The Electrification of Railways, E. Huber-Stockar. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, Ee, 22 pp.

France. Electrification of a Section of the Orleans Railway, H. Parodi. Instn. Elec. Engrs.—Jl., vol. 64, no. 357, Sept. 1926, pp. 893-908 and (discussion) 909-919, 24 figs.

Railway Electrification in France (Electrification des chemins de fer Francais), H. Parodi. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 43, 29 pp., 5 figs.

Paris Suburban. Paris Suburban Electrification, T. Rich. Elecn., vol. 97, no. 2520, Sept. 17, 1926, pp. 316-317, 8 figs. Details of cable and track system; avoiding ice troubles; third-rail insulations.

South Africa. The Natal Electrification. S. African Engr., vol. 16, no. 99, July 1926, pp. 3-11, 9 figs. Electrified section covers route mileage of 175 miles and track mileage of 309; it is largest electrification in world on 3-ft. 6-in. gauge.

United States. Railroad Electrification, W. S. Murray. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 74, 14 pp. Compares development which in past 25 years has been made in United States in field of power transmission and railway electrification.

RAILWAY MANAGEMENT

Purchasing. The C. M. & St. Paul Budgets Its Purchases. Ry. Age, vol. 81, no. 15, Oct. 9, 1926, pp. 665-669, 5 figs. Plan for budgeting purchases called allotment plan, whereby orders for material must be kept within predetermined amount each month; this allotment is fixed by chief purchasing officer and operates through general storekeeper and local storekeepers.

Statistics, Development of. Development of Railway Statistics, with Special View of Economy in Operation. Int. Ry. Congress—Bul., vol. 8, nos. 9-10, Sept.-Oct. 1926, pp. 841-853. Discussion by sections; contains appendix giving statistics published annually by Italian State Railways, in addition to statistics contained in annual report and monthly bulletins.

RAILWAY TRACK

Gravity-Electric Power Units. The Sheremeteff Gravity-Electric Power Unit, J. A. Malan. Australasian Elec. Times, vol. 5, no. 7, July 27, 1926, pp. 493-494, 6 figs. Apparatus installed on Darling railway line, Melbourne, invented and patented by Russian railway engineer, by means of which power in form of gravity is obtained from passing rolling-stock wheels and stored up in raised weight; power thus obtained is controlled electrically, and can be used for operating points or signals or possibly other apparatus.

Joints. Track Joints and Their Maintenance. Ry. Age, Sect. 1, vol. 81, no. 13, Sept. 25, 1926, pp. 552-553. Length of track joints; kind of bolts and springs; installation and maintenance of joints. (Abstract.) Paper read before Roadmasters' & Maintenance of Way Assn.

RAINFALL

Skew-Frequency Laws. Straight-Line Plotting of Skew-Frequency Data, R. D. Goodrich. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 6, Aug. 1926, pp. 1063-1105, 17 figs. Deals with application of new equations for both " integral " or " duration " curve and " frequency " or " differential " curve; and for expressing variations in occurrence of phenomena which follow skew-frequency laws as to their distribution; these equations are particularly applicable to plotting of hydraulic data (rainfall and run-off) having limited number of observations in series; examples of use of equations in plotting of curves on new type of skew-frequency paper.

REFRACTORIES

Foundry. Foundry Refractories, M. C. Booze. Fuels & Furnaces, vol. 4, no. 9, Sept. 1926, pp. 1071-1076. Discusses conditions imposed on refractories in foundry furnaces, namely, abrasion, flame, impingement and expansion, and wall construction; insulation, effect of joints, wall thickness and heat capacity; specifications and method of testing.

REFRIGERANTS

Properties. Engineering Tables of Properties of New Refrigerants. Power, vol. 64, no 14, Oct. 5, 1926, pp. 512-513. Tabular data on properties of butane, isobutane and propane.

REFRIGERATING MACHINES

Water-Vapour. Water-Vapour Refrigeration, W. W. O'Mahoney. Ice & Cold Storage, vol. 29, no. 342, Sept. 1926, pp. 227-229, 3 figs. Details of new Follain machine with account of its application to industrial uses.

REFRIGERATING PLANTS

Corrosion. The Prevention and Retardation of Corrosion in Refrigerating Systems, N. B. Ornitzor. Refrig. Eng., vol. 13, no. 2, Aug. 1926, pp. 64-65 and (discussion) 65-67.

REFUSE DISPOSAL

Destructor, from. San Francisco Makes Fills with Residue from Destructor. Eng. News-Rec., vol. 97, no. 12, Sept. 16, 1926, pp. 469-470, 2 figs. Total of 600 tons of refuse handled daily; ashes and unburned waste delivered in railroad cars to fills on bay shore.

RESEARCH

Engineering College and Industry. Research Relations Between Engineering Colleges and Industry, W. E. Wickenden. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 987-988. Points out that policy of concentrating resources in Europe has led to upbuilding of group of notable and distinctive research centres which are principal factor in attracting and holding to educational and research work outstanding authorities in several fields; results have been to give several institutions individuality quite unknown in United States.

RIVERS

Retards. Brush, Wire Mesh and Old Rails Make River Retards. Eng. News-Rec., vol. 97, no. 15, Oct. 7, 1926, pp. 576-577, 3 figs. Channel of river in Pueblo, Colo., restored; bank caving reduced; protection of bridge piers a feature.

ROADS, CONCRETE

Finishing and Curing. Finishing and Curing of Concrete Roads, C. L. McKesson. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 6, Aug. 1926, pp. 1125-1138, 6 figs. Reviews modern practice and appliances in finishing concrete; data regarding tests for determining relative efficiency of finishing machines of two well-known types; use of Vialog is recommended as aid in securing smooth pavement surface; results of investigations of curing concrete indicate that period of watering may be much reduced from present standard practice; and average time during which pavement is kept closed to traffic may be reduced.

ROADS, EARTH

Maintenance. Dirt Road Maintenance. Pub. Works, vol. 57, no. 8, Sept. 1926, pp. 290-292. Supplementing table published in May issue and containing information furnished by questionnaires received since it was compiled; kind, width and crown of road, equipment used and frequency of treatment.

ROLLING MILLS

Rolling, Theory and Practice of. The Theory and Practice of Rolling Steel, W. Tafel. Iron Trade Rev., vol. 79, nos. 2, 4, 6 and 8, July 8 and 22, Aug. 5 and 19, 1926, p. 76-79, 196-199, 313-315, 436-437 and 446, 22 figs. July 8: Rolled cast designs. July 22: Considerations to be used for so-called ornamental iron, which is tye of periodic profile; complex profiles. Aug. 5: Power required for rolling; how to determine work; determination to relation of rolling passes to total working time. Aug. 19: Use of gas-steam engines for rolling-mill drive.

Seamless-Tube Manufacture. Make 50-Ft. Tubes from Ingots. Iron Age, vol. 118, no. 13, Sept. 23, 1926, pp. 846-850, 11 figs. Seamless-tube plant at Allenport, Pa., embraces one piercing mill and two pilger mills; reheating and polishing feature finishing operations.

S

SAND, MOULDING

Clay Bond, Use of. Practical and Technical Data Obtained from the Use of Clay Bond in Moulding Sand Heaps, R. F. Harrington, A. S. Wright and M. A. Hosmer. Am. Foundrymen's Assn.—Preprint no. 29, for mtg. Sept. 27-Oct. 1, 1926, 18 pp.

Control. Sand Control in the Foundry, H. W. Dietert and H. W. Wakefield, Jr. Am. Foundrymen's Assn.—Preprint no. 35, for mtg. Sept. 27-Oct. 1, 1926, 23 pp., 10 figs.

Grading. The Grading of Moulding Sands, C. A. Hansen. Am. Foundrymen's Assn.—Preprint no. 3, for mtg. Sept. 27-Oct. 1, 1926, 30 pp., 8 figs.

Metallurgical Control. Metallurgical Control of Foundry Sands, L. B. Thomas. Am. Foundrymen's Assn.—Advance Paper, no. 18, for mtg. Sept. 27-Oct. 1, 1926, 22 pp., 1 fig.

Mulling, Effect of. The Effect of Mulling on the Physical Properties of Foundry Sands, A. V. Leun. Am. Foundrymen's Assn.—Preprint no. 33, for mtg. Sept. 27-Oct. 1, 1926, 34 pp., 12 figs. Results of experiments to determine compressive strength, tensile strength, permeability and distribution.

Refractoriness. Some Experiments on the Retractoriness of Foundry Sands, D. W. Trainer, Jr. Am. Foundrymen's Assn.—Advance Paper, no. 27, for mtg. Sept. 27-Oct. 1, 1926, 19 pp., 5 figs.

SEWAGE DISPOSAL

Plants. The Design, Construction and Operation of a Small Sewage Disposal Plant, F. Hudson, Jr. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 8, Oct. 1926, pp. 1602-1611, 6 figs. Describes plant at Stroud, Okla., town of 2,000 inhabitants.

Small Plants. Design of Small Sewage Disposal Plants, F. Johnstone Taylor. Can. Engr., vol. 51, no. 11, Sept. 14, 1926, pp. 285-287, 4 figs. Construction and operation of septic tanks for residences and institutions; method of dealing with domestic sewage in districts where sewerage facilities are not available; process in tank similar to that in large plants.

SEWERS

Connections. Experiments on Hydraulic Jump in Sewer Connections, W. H. Ashley. Eng. News-Rec., vol. 97, no. 14, Sept. 30, 1926, pp. 548-550, 4 figs. Drop connection, rather than free fall, drop manhole or flight manhole; eliminates odor, noise, vibration and energy.

SHEET METAL

Galvanized, Bend Tests of. Bend Tests of Galvanized Sheet Metal, H. A. Stacy. Am. Inst. Min. & Met. Engrs.—Trans., no. 1600-C, for mtg. Oct. 1926. 35 pp., 22 figs. Results of series of tests; study of tabulated results and curves show that for substantial proportion of all sheets there were few specimens showing bend failure with high mandrel thickness; curves, as a rule, show fairly uniform gradient up to 90 per cent point.

SHERARDIZING

Electric. Electro-Sherardizing. Nat. Elec. Light Assn.—Report, no. 256-85, Aug. 1926, 4 pp., 2 figs. Consists of covering iron or steel with protective coating by revolving material in drums in zinc-dust preparation maintained at temperature of approximately 375 to 400 deg. cent. by means of electric heat; data on electric sherardizing.

SILK

Artificial. Manufacture of Artificial Silk (La fabrication de la soie artificielle), A. Guillaumin. Technique Moderne, vol. 18, no. 18, Sept. 15, 1926, pp. 545-551, 16 figs. Principle of viscose production; preparation, grinding, ripening of alkaline cellulose; scanthogenate; purification of viscose, etc., and apparatus used.

SLAGS

Open-Hearth. Open-Hearth Slags, W. C. Hamilton. Am. Foundrymen's Assn.—Advance Paper, no. 7, for mtg. Sept. 27-Oct. 1, 1926, 11 pp. Discusses acid and basic slags, their function, composition and control; particular attention is paid to limestone, dolomite and use of fluorspar.

SMOKE ABATEMENT

Smokeless Heat and Power Production. Smokeless Production of Heat and Power, M. Fishenden. Gas. J., vol. 175, no. 3304, Sept. 15, 1926, pp. 606-608.

SNOW REMOVAL

Organization and Operation. Snow Removal Problems of Organization and Operation, G. E. Hamlin. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 6, Aug. 1926, pp. 1121-1124. Experience of several years in development of snow-removal organization in Connecticut has been utilized in general recommendations for maintenance problem.

Snow Control. The Possibilities of Snow Control to Reduce Snow Removal, C. A. Wagner. Highway Mag., vol. 17, no. 10, Oct. 1926, pp. 239-240, 4 figs. Points out that snow fence cannot take place of snow removal, but its use in modern improved form will in many cases prevent deep drifts and make light traffic roads passable for many additional days during winter.

SOLDERS

Electrically-Heated. Electrically-Heated Lead, Solder and Babbitt Pots. Nat. Elec. Light Assn.—Report, no. 256-90, Aug. 1926, 7 pp., 3 figs. Sizes and types considered; electrical rating of pot; babbitting motor bearings.

STANDARDIZATION

Engineering Aspects. Some Engineering Aspects of Standardization, E. G. Bern. Gen. Elec. Rev., vol. 29, no. 10, Oct. 1926, pp. 736-741, 6 figs.

STANDARDS

Introducing. Best Ways to Introduce Standards, L. F. Swenson. Mfg. Industries, vol. 12, no. 4, Oct. 1926, pp. 261-262, 2 figs.

STEAM

High-Pressure. Higher Steam Pressures and Temperatures. Nat. Elec. Light Assn.—Report, no. 256-77, July 1926, 8 pp., 5 figs. Data from plants employing high-pressure or high-temperature steam cycle have been tabulated in such form that heat consumption of these plants can be analyzed; gives curves showing behaviour of metal under prolonged stress at high temperature.

STEAM ACCUMULATORS

Uses of. Smoothing Out the Load with a Steam Accumulator, A. A. Potter and M. J. Zucrow. Power, vol. 64, no. 15, Oct. 12, 1926, pp. 554-556, 3 figs. Constant boiler load with variable steam demand extends boiler capacity, improves efficiency and opens way to use of inferior fuels.

STEAM PIPES

Distribution Lines. Steam Distribution Lines at Rochester, E. R. Benedict. Power Plant Eng., vol. 30, no. 19, Oct. 1, 1926, pp. 1067-1070, 5 figs. Construction operations involved in furnishing city with heat from central line station.

High-Pressure. Long Steam Line Efficient at High Pressure, R. H. Baker. Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1095-1097, 5 figs. Steam equivalent to 10,000 kw. delivered at 163 lb. through 4,500-ft. line with 3 per cent loss.

STEAM POWER PLANTS

Developments. Modern Steam Generation, J. D. Troup. Int. Sugar Jl., vol. 28, nos. 327, 328, 329 and 333, Mar., Apr., May and Sept. 1926, pp. 133-136, 188-191, 240-244 and 459-462, 3 figs. Developments in water-tube boilers, furnace designs and stoking, air preheating, boiler pressures, increasing furnace temperature. Apr.: Feedwater, steam accumulator. May: Boiler-house control. Sept.: Maintaining clean heating surfaces; steam-jet principle; soot blowers; pneumatic system.

Recent Developments as Affecting Design and Construction of Power Plants, W. P. Gavit. Elec. World, vol. 88, no. 13, Sept. 25, 1926, pp. 623-627, 10 figs. Points out that reheating, regeneration, preheating and burning of pulverized coal have, except for last, not imposed large changes in practices of power-house design and construction.

Fuel Economy. How to Cut 14 Per Cent from the Power Bill, W. A. Shoudy. Mfg. Industries, vol. 12, no. 4, Oct. 1926, pp. 273-276, 4 figs. Points out that a few simple, inexpensive instruments and an intelligent fireman will assist effectively in reducing fuel consumption.

The Use and Abuse of Fuel in the Industrial Power Plant, F. H. Daniels. Engrs. & Eng., vol. 43, no. 9, Sept. 15, 1926, pp. 233-237. Characteristics of coal and sizing; suggestions for coal saving; improvement due to stokers; type of stokers; pulverized coal versus stokers; comparison of pulverized coal equipment and stokers.

STEAM TURBINES

Developments. Steam Turbine Development Since 1900, C. C. Brown. Power Plant Eng., vol. 30, no. 20, Oct. 15, 1926, pp. 1106-1107, 2 figs. Sets forth graphically trend of steam-turbine development from standpoint of steam economy, steam temperatures and pressures, and unit capacities, as experienced in actual operation of number of plants which were installed in various years; also daily fuel-oil consumption for two western steam-generating plants.

Turbines. Nat. Elec. Light Assn.—Report, no. 25-103, Dec. 1925, 52 pp., 64 figs. Characteristics of outstanding turbine installations made during past year; evaluation of present-day tendencies in design. Bibliography.

15,000-Kw. Test of 15,000Kw. Turbine at the Cleveland Municipal Plant, L. A. Quayle. Power, vol. 64, no. 16, Oct. 19, 1926, pp. 583-585, 6 figs.

High-Pressure. The Use of High Pressures for Steam Turbine Installations, S. S. Cook. Nature (Lond.), vol. 118, no. 2969, Sept. 25, 1926, pp. 450-452, 1 fig. Presents diagram exhibiting shortcomings of Rankine cycle in comparison with ideal Carnot cycle, and points out that similar departures from ideal are present in any type of engine in practical use; shows that not only high temperatures, as in case of adoption of high superheat, but also high boiler pressures, lead to substantial increase in overall thermal efficiency.

STEEL

Fatigue Tests. Some Comparative Fatigue Tests in Special Relation to the Impressed Conditions of Tests, H. J. Gough and H. J. Tapsell. Aeronautical Research Committee—Reports and Memoranda, no. 1012, Apr. 1926, 21 pp. Results of lengthy series of endurance tests on two steels adopted by Aeronautical Research Committee as standard material for comparative tests by various investigators.

Hardness. A Further Study of the Distribution of Hardness in Quenched Carbon Steels, and Quenching Cracks, T. Kasé. Tohoku Imperial Univ.—Sci. Reports, vol. 15, no. 3, July 1926, pp. 371-386, 21 figs.

STEEL CASTINGS

Converter Process. Some Physical Properties and Composition of Cast Converter Steel, C. M. Campbell. Am. Foundrymen's Assn.—Preprint, no. 37, for mtg. Sept. 27-Oct. 1, 1926, 6 pp.

Defects. Defects in Steel Castings Discovered After Shipment from the Foundry, J. M. Sampson. Am. Foundrymen's Assn.—Preprint no. 41, for mtg. Sept. 27-Oct. 1, 1926, 23 pp., 11 figs.

Defects in Steel Castings in the Foundry, R. S. Munson. Am. Foundrymen's Assn.—Preprint no. 38, for mtg. Sept. 27-Oct. 1, 1926, 8 pp.

Manganese in. Manganese in Cast Steels, J. H. Hall. Am. Foundrymen's Assn.—Preprint no. 40, for mtg. Sept. 27-Oct. 1, 1926, 16 pp., 4 figs. In author's opinion, results of tests fully justify opinion that heat-treated cast steels containing from .20 per cent to .30 per cent carbon, and manganese from 1 to 2 per cent. possess remarkable combination of properties that makes them of greatest value for severe service in machine parts.

Annealing. The Heat Treatment of Steel, H. M. Boylston. Fuels & Furnaces, vol. 4, no. 9, Sept. 1926, pp. 1035-1066, 22 figs. Annealing of forged or rolled carbon-steel objects of cold-worked objects, steel castings, and tool steel, high-speed steel and special steels; furnaces for annealing; toughening treatments, hardening, tempering, carburizing and case-hardening; heat treatment of case-hardened objects.

Ferro-Carbon-Titanium. Treatment of Steel with Ferro-Carbon-Titanium, G. F. Comstock. Foundry Trade Jr., vol. 34, no. 524, Sept. 2, 1926, pp. 205-207.

STREAM POLLUTION

Industrial Wastes in. Stream Pollution and Industrial Wastes, J. A. Newlands. Conn. Soc. Civil Engrs.—Trans., 1926, pp. 52-67. Points out that industrial-waste investigations have nowhere kept pace with constantly-increasing diversity of wastes produced; co-operative investigation between states and its industries is, in author's belief, logical method of attacking these problems.

STRUCTURAL STEEL

Philadelphia Central Station. Architectural Development and the Use of Silicon Steel in the Richmond Power Station, F. N. Kneas. Eng. News-Rec., vol. 97, no. 12, Sept. 16, 1926, pp. 450-455, 7 figs. Impressive and esthetic appearance primary objective in planning Philadelphia's largest electric station; turbine hall has steel arch roof, in which 8,000 tons silicon steel were used; results of punching and impact tests.

SUBSTATIONS

Automatic. Automatic Substations on Pacific Electric System, S. H. Anderson. Elec. Jl., vol. 23, no. 10, Oct. 1926, pp. 496-499, 5 figs. Automatic substations have been operated on this system 7 years with entirely satisfactory results, under wide diversity of operating conditions; total installed capacity of all of substations, both manual and automatic, is 68,000 kw., of which 25 per cent is automatically operated; all equipments except one are operated in 600-volt service.

Interconnection. An Interconnection Substation, M. R. Summer. Elec. World, vol. 88, no. 13, Sept. 25, 1926, pp. 648-652, 14 figs. Construction features and details of station at one end of 66-kv. tie line between Penn-Ohio Electric Co. and Duquesne Light Co.; handling of equipment and costs of substation elements.

SURVEYING

Aerial Photographic. Improvements in Photogrammetric Survey, C. H. Pollog. Eng. Progress, vol. 7, no. 8, Aug. 1926, pp. 213-215, 2 figs. Describes photogrammetric map with contours obtained by ground survey, and apparatus for rectifying aerial photographs for production of above-mentioned maps.

Azimuth and Time from Sun Observation. Azimuth and Time from Sun Observation, A. Lighthall. Can. Engr., vol. 51, no. 12, Sept. 21, 1926, pp. 307-308. Simplified and workable method of finding direction of line and time from sun observation knowing latitude and longitude; formulas for finding azimuth and hour angles.

T

TELEPHONY

Carrier-Current. Carrier-Current Communication on Submarine Cables, H. W. Hitchcock. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 923-929, 13 figs. Seven telephone channels and one telegraph channel on one single-conductor deep sea cable have been made possible by employment of carrier-current on one side of two submarine cables across Cataline channel; this is only application of carrier telephony to deep sea cables; system is shortest carrier system (26 mi.) in commercial operation, and it provides more separate carrier channels (six) than has been previously attempted...

TERMINALS, LOCOMOTIVE

Roundhouses. An Effective Combination of New and Old Roundhouses. Ry. Age, vol. 81, no. 14, Oct. 2, 1926, pp. 623-628, 7 figs.

THERMOMETERS

DEVELOPMENTS. Thermometry, W. F. Higgins. Roy. Soc. of Arts—Jl., vol. 74, nos. 3850, 3851 and 3852, Sept. 3, 10 and 17, 1926, pp. 946-959, 962-975 and 978-986, 16 figs. Sept. 3: Consideration of historical aspect for purpose of tracing evolution of thermometer from early types to modern instrument; introduction of mercury thermometers; pressure corrections; scales of temperatures. Sept. 10: Principal types of thermometric glass used at present time; consideration of types of zero variation; typical specification for thermometer. Sept. 17: Method of obtaining greatest accuracy in use of mercury thermometer; question of thermometric lag; comparison of thermometers with standard instruments.

REFRIGERATION PLANTS. Thermometers and Other Instruments for Refrigeration Plants, R. Harrison. Ice & Cold Storage, vol. 29, no. 341, Aug. 1926, pp. 207-209, 7 figs. Dial and distance thermometers; recording thermometers or thermographs; indication of humidity.

REMOTE-CONTROL. Distance Control Thermometers (Les Thermometres à distance), L. Poincaré. Aéronautique, vol. 8, no. 88, Sept. 1926, pp. 300-304, 6 figs. Principle of Chenu and Fournier types of thermometers based on measuring vapour tension of volatile liquid; Aero thermometer, design and operation.

TESTS AND TESTING

METAL. The Mechanical Engineer and Testing Materials (Konstrukteur und Materialprüfung), L. Traeger. Maschinenbau, vol. 5, no. 15, Aug. 5, 1926, pp. 689-692. Testing metals for tensile strength and limit of elongation; dynamic elongation and limit of elasticity, standards for dynamic testing of materials, etc., in connection with machine-shop practice.

TIDAL POWER

PASSAMAQUODDY PROJECT, CONN. Some Aspects of the Passamaquoddy Tidal Power Project, D. S. Cooper. Conn. Soc. of Civ. Engrs.—Trans., 1926, pp. 29-34 and (discussion) 34-36. Power development is located in Maine near Eastport, and contemplates construction of modern low-head hydro-electric station using tides as source of water supply.

UTILIZATION. Using Tides and Ocean Waves for Electric Power Production (Ausnützung der Gezeiten und Meereswogen zur elektrischen Energieerzeugung), W. Meyer. Elektrotechnischer Anzieger, vol. 43, nos. 64 and 65, Aug. 11 and 14, 1926, pp. 719-721 and 729-730. Severn (England) and Vraach (France) projects; single-basin and double-basin system; compressed air and electricity as means for equalizing fluctuations in energy. Bibliography.

TOLERANCES

QUANTITY PRODUCTION, FOR. Checking Dimensions in Quantity Production (Le contrôle des dimensions des pièces mécaniques, les tolérances), S. Thomas. Génie Civil, vol. 89, nos. 3, 4 and 5, July 17, 24 and 31, 1926, pp. 56-59, 76-79 and 93-96, 12 figs. Discusses accurate and rapid checking of parts produced in quantities; formulato express error; limit gauges and other devices for checking; tolerances, screw threads; relative diameters of holes and shafts in various types of assembly.

TOOLS

STRAIGHT-FORM. Considerations Governing the Design of Straight-Form Tools with Top Rake, F. Parks. Machy. (Lond.), vol. 28, no. 725, Sept. 2, 1926, pp. 651-653, 3 figs. Recent investigations have resulted in development of formulas which are original, as far as author is aware.

TOOL STEEL

SELECTION OF. Selection of Proper Material for Tool Manufacture, J. B. Mudge. West. Soc. Engrs.—Jl., vol. 31, no. 8, Aug. 1926, pp. 295-305, 7 figs. Reviews practice by company in selecting raw material, such as tool steel; selection of steel for job.

TRACTORS

CRANKCASE DILUTION. Crankcase Dilution in Kerosene Tractors, L. G. Heimpel. Agric. Eng., vol. 7, no. 8, Aug. 1926, pp. 273-275, 2 figs. Results of investigation seem to indicate that close relationship exists between mechanical condition of engine and rate of dilution.

TRAFFIC

BUILDING CONDITIONS, EFFECT ON. Street Traffic as Affecting Building Conditions, M. McClintock. Highway Engr. & Contractor, vol. 15, no. 3, Sept. 1926, pp. 63-67, 2 figs. Author claims that traffic congestion in cities has direct effect upon rental values of property in congested areas, and point is reached in congestion when circulation of traffic is so clogged that serious loss follows; discusses problems and steps to be taken to remedy conditions.

TRANSFORMERS

AIR BLAST. Air Blast Transformers, L. H. Burnham. Gen. Elec. Rev., vol. 29, no. 10, Oct. 1926, pp. 716-721, 11 figs. These are useful where space limitations are severe; bare coil construction; arrangement of air ducts; rating and temperature rise; main application to synchronous converters; comparison with oil and water-cooled units.

LOAD-RATIO CONTROL. Two 60,000-kva. Load-Ratio Control Transformer Banks for Philadelphia Electric Company, A. Palme and H. O. Stephens. Gen. Elec. Rev., vol. 29, no. 9, Sept. 1926, pp. 634-638, 6 figs. Three single-phase main power transformers; regulating transformer; mechanism for tap-changing; protective features.

POLARITY MARKINGS. Transformer Polarity Markings, G. W. Stubbings. Elec. Rev., vol. 99, no. 2542, Aug. 13, 1926, pp. 253-254, 3 figs. Gives simple d.c. method of testing.

TAP, CHANGING EQUIPMENT. Transformer Tap Changing Equipments. Nat. Elec. Light. Assn.—Report, no. 256-69, July 1926, 38 pp., 65 figs. Statements by leading transformer manufacturers of equipment available for changing taps in power transformers.

TRANSPORTATION

ROAD-RAIL SYSTEM. The Auto-Rail System (Das "Autobahn" System), L. Tlaskal. Verkehrstechnik, vol. 39, no. 33, Aug. 13, 1926, pp. 523-526, 3 figs. Describes system which combines highway and rail transportation.

TURBO-GENERATORS

80,000-KW. Construction of an 80,000-Kw. Generator, J. R. Taylor. Elec. World, vol. 88, no. 10, Sept. 4, 1926, pp. 465-468, 6 figs. Design details of cross-compound bas-load turbo-generator to be installed by Brooklyn Edison Co. in Hudson Avenue station.

V

VALVES

MOTOR-OPERATED. Motor-Operated Valves Aid Plant Operation. Power Plant Eng., vol. 30, no. 18, Sept. 15, 1926, pp. 1001-1004, 4 figs. Principal details of valves and controls, costs of installing and applications.

VIADUCTS

LOS ANGELES, CAL. Seventh Street Viaduct Over Los Angeles River, H. H. Winter. West. Constr. News, vol. 1, no. 14, July 25, 1926, pp. 31-38, 4 figs. Proposed viaduct is 1,580-ft. long from end to end of approach walls; roadway is 56-ft. wide with 5-ft. sidewalk on each side.

VIBRATION

ELIMINATION OF. Insulation Against Noise and Vibrations (Isolierung gegen Geräusche und Erschütterungen), W. Speiser. Dinglers polytechnisches Jl., vol. 341, no. 11, June 1926, pp. 117-120, 12 figs. Discusses insulating properties of cork and use of "Korfund" sheets of cork wood in iron frames for foundations of various machines to eliminate vibration, also resulting in smoother running.

VOCATIONAL TRAINING

PSYCHOPHYSIOLOGY. Some Experiments in Vocational Psychophysiology, L. Walther. Int. Labour Rev., vol. 14, no. 1, July 1926, pp. 55-71. Author's experiments show practical results which may be expected from judicious application of physiology and psychology to vocational activities; vocational selection and training; application of motion study to industrial work; industrial fatigue.

VOLTAGES

STANDARDS FOR A.C. SYSTEMS. A Proposed Set of Voltage Standards for A.C. Electrical Systems and Equipment. Nat. Elec. Light Assn.—Bul., vol. 13, no. 9, Sept. 1926, pp. 549-553, 2 figs. Records new set of voltage standards for electrical apparatus proposed to supersede present one, namely, those of N.E.L.A. and Power Club.

VOLTAGE REGULATION

REGULATORS. Induction Voltage Regulators for Power Transmission. English Elec. Jl., vol. 3, no. 5, July 1926, pp. 219-228, 15 figs. Advantages of induction regulators and designs developed by English Electric Co.; they are usually oil-immersed and either self-cooled or water-cooled.

VOLTMETERS

FLUX. A Flux Voltmeter for Magnetic-Tests, G. Camilli. Am. Inst. Elec. Engrs.—Jl., vol. 45, no. 10, Oct. 1926, pp. 989-995, 13 figs. Voltmeter for a.c. circuits, voltage indications of which are directly proportional to maximum flux density, regardless of wave shape of voltage; its most important application is to reduction of transformer core-loss measurement to sine-wave basis; new meter makes it necessary to use for reliable results large generators to reduce wave distortion caused by transformer excitation loads, and permits use of any generator that will carry load thermally.

W

WASTE ELIMINATION

INDUSTRIAL. Elimination of Waste in Industry, W. G. Wetherill. Forging—Stamping—Heat Treating, vol. 12, no. 8, Aug. 1926, pp. 271-274. What Department of Commerce has accomplished in elimination of waste in industry; points out that average industrial waste is 49 per cent. Paper presented before Am. Drop Forging Inst.

WATER FILTRATION

SAND. Solving Some Unusual Problems in Sand Filtration, M. E. Dice. Chem. & Met. Eng., vol. 33, no. 9, Sept. 1926, pp. 529-533, 9 figs. Clarifying softened boiler feedwater involved unexpected difficulties due to entrained air that caused precipitate to penetrate into sand surface.

WATER MAINS

LAYING SUBMERGED. Laying Submerged Main at Vancouver, C. Brakenridge. Can. Engr., vol. 51, no. 9, Aug. 31, 1926, pp. 247-250, 7 figs. City of Vancouver lays 36-in. steel pipe across Burrard inlet at Second Narrows to augment water supply; pipe hauled across by donkey engine and system of sheaves and cables; 1,200-ft. submerged course and 1,200-ft of tidal flat.

WATER METERS

MANUFACTURE. Making Meters to Record Flow of Water, A. Murphy. Power House, vol. 20, no. 18, Sept. 20, 1926, pp. 27-31, 11 figs. Meters made by National Meter Co. of Canada at their Toronto plant are of postive-displacement oscillating-piston type; such meters with suitable modifications will also measure other liquids, such as oils and gasoline.

WATER PIPE

CORROSION. The Prevention of Corrosion of Pipe, W. W. Brush. Am. Water Works Assn.—Jl., vol. 16, no. 2, Aug. 1926, pp. 173-176 and (discussion) 177-180, 1 fig. Condition of pipe recently uncovered in Brooklyn portion of New York distribution system illustrates protection of metal and condition that develops with soft corrosive water with inadequate protection of metal.

LAYING. Pipe-Laying Methods, J. W. Toyne. Am. Water Works Assn.—Jl., vol. 16, no. 2, Aug. 1926, pp. 213-215 and (discussion) 215-217. Review of methods showing tendency towards elimination of hand labour and substitution of material and equipment to this end.

WATER POLLUTION

SULPHUR BACTERIA AS INDICATORS. Sulphur Bacteria as Indicators of Polluted Waters, D. Ellis. Engineering, vol. 122, no. 3162, Aug. 20, 1926, pp. 231-232, 2 figs. Refers to blackening of sand in Clyde Estuary; investigation proved that blackening was due to formation of ferrous sulphide as result of interaction of sulphuretted hydrogen and containing constituents of sand. Paper read before Sect. G of Brit. Assn.

WATER POWER

INLAND NAVIGATION AND. Relation Between Water-Power Utilization and Inland Navigation (Die Beziehungen zwischen der Wasserkraftausnutzung und der Binnenschiffahrt), Höbel. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 24, 13 pp.

Utilization of Water Power and Inland Navigation, H. L. Cooper. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 75, 11 pp., 28 figs. Describes Wilson dam in Tennessee River at Muscle Shoals.

NATIONAL ASPECTS. National Aspects of the Study of Water Resources, N. C. Grover. World Power Conference, Sect. Basel Mtg., 1926—Advance Paper, no. 72, 17 pp., 15 figs.

N.E.L.A. COMMITTEE REPORT. Report of Hydraulic Power Committee, 1925-1926. Nat. Elec. Light Assn.—Report, no. 25-26, May 18, 1926, 30 pp., 24 figs. Contains following reports: Reliability of Hydro-Electric Units; Forecasting Water Supply; Vibration in Hydraulic Machinery; Restriction in Flow Due to Vegetable and Animal Growths in Conduits; Manufacturers' Statements Regarding Developments in the Hydraulic Field, 1925. Bibliography.

VALUATION. Some Fallacies in the Valuation of Water Power, A. D. Adams. Eng. News-Rec., vol. 97, no. 12, Sept. 16, 1926, pp. 470-471. Some of contentions frequently made in court to increase award of damage for diverted water.

WATER SOFTENING

ZEOLITES FOR. Data on Zeolite Water Softeners, T. J. Ess. Power Plant Eng., vol. 30, no. 16, Aug. 15, 1926, pp. 888-890, 3 figs. Principles involved; methods of determining quantities of salt and zeolites necessary; design data.

WATER SUPPLY

CROSS-CONNECTIONS. Experiences with Cross-Connections in Chicago, A. E. Gorman. Am. City, vol. 35, no. 2, Aug. 1926, pp. 169-174, 5 figs. Results of systematic survey of cross-connections begun by Chicago Department of Health in 1925 and still in progress. (Abstract.) Paper read before Am. Water Works Assn.

INDUSTRIAL WASTES AND. Progress Report on Recent Developments in the Field of Industrial Wastes in Relation to Water Supply. Am. Water Works Assn.—Jl., vol. 16, no. 3, Sept. 1926, pp. 302-329. Report of Committee No. 6 on industrial wastes in relation to water supply; extracts from Bureau of Mines on stream pollution by acid mine drainage and stream pollution by wastes from by-product coke ovens; extract from paper by R. M. Crawford on elimination and recovery of phenols from crude ammonia liquors; information from report of London Metropolitan Water Board on water examination; progress in stream pollution control in various states; disposal of industrial wastes in England.

MONTREAL, QUE. The Water Supply System of Montreal, Quebec, Canada, F. E. Field. Am. Soc. Civ. Engrs.—Proc., vol. 52, no. 7, Sept. 1926, pp. 1361-1364. Aqueduct canal and supply conduit; filtration works; average results of operation for 1924; new low-level pumping station.

PROVIDENCE, R.I. The Scituate Water-Supply Project for Providence, R.I. Am. City, vol. 35, no. 3, Sept. 1926, pp. 309-312, 5 figs. New water supply known as Scituate Project will furnish city with adequate supply for many years to come; source is large storage reservoir on north branch of Pawtucket River, formed by dam under construction at Kent, R.I.; reservoir will hold 37,000 million gallons and will deliver water by gravity at least 50 ft. higher than now served by Sockanosset reservoir; dam has length of 3,200 ft. at top; purification works; aqueduct and distribution system.

WATER TREATMENT

CHLORINATION. Home-Made Electrolytic Chlorine at Sacramento, H. N. Jenks. Eng. News-Rec., vol. 97, no. 5, July 29, 1926, pp. 170-172, 4 figs. Flexibility of control and economy characterize operation of chlorination direct from chlorine cells.

PURIFICATION PLANTS. Some Small Water Purification Plants, W. A. Hardenbergh and K. W. Grimley. Pub. Works, vol. 57, no. 8, Sept. 1926, pp. 275-279, 11 figs. Well and surface waters of 18 of 35 plants in Jefferson County, Alabama, serving more than 50 persons receive some treatment; details of small filter and chlorination plants.

WATERWAYS

FORMULA FOR. General Formula for Waterways, C. S. Jarvis. Eng. World, vol. 29, no. 2, Aug. 1926, pp. 79-83, 2 figs. Gives graphic representation of selected run-off formulas, including original and modified Myers formulas, and maximum run-off of representative streams.

ELECTRIC. *See Electric Welding; Electric Welding, Arc.*

WATER WORKS

INTAKES. Water Works Intakes of the Great Lakes Region, G. H. Fenkell. Am. Water Works Assn.—Jl., vol. 16, no. 3, Sept. 1926, pp. 267-289 and (discussion) 289-295. Outlines various factors entering into location and design of such intakes and their connecting conduits and cites from information at hand examples covering practice that has been followed in construction of these structures.

SMALL TOWNS. Water Works Systems for Small Towns, H. F. Hunter. Can. Engr., vol. 51, no. 2, July 13, 1926, pp. 123-125. Requirements of various inspection bureaus for water works systems in order to secure adequate fire protection. Paper presented to Illinois Section, Am. Water Works Assn.

TORONTO. Toronto Duplicate Water Works System, Can. Engr., vols. 50 and 51, nos. 22, 6, 7 and 8, June 1, Aug. 10, 17 and 24, pp. 611-615, 197-200 and 237-240, 6 figs. Argument on which recommendations were based for extension of water works system from report by Wm. Gore, of Gore, Nasmith & Storrie, Consulting Engineers, Toronto, and H. G. Acres, of Niagara Falls, Ont. Aug. 24: High-lift pumping plant; location and object of reservoir; recapitulation and estimate; summary of costs.

WATTMETERS

DYNAMOMETERS. The Use of the Dynamometer Wattmeter, E. S. Lee. Am. Inst. of Elec. Engrs.—Jl., vol. 45, no. 8, Aug. 1926, pp. 746-754, 15 figs. For measuring dielectric power loss and power factor of insulation of high-tension lead-covered cables.

WATT-HOUR METERS

PERIODIC TESTING. Periodic Test Schedule for Watt-Hour Meters and Method for Recording Results. Nat. Elec. Light Assn.—Report, no. 256-13, Mar. 1926, 4 pp., 4 figs. Presents value to utility of careful systems of periodic meter testing and maintenance; simple method of recording periodic meter test results, together with sample "step-shart" analyses of these results.

WELDING

ALUMINUM CRANKCASES. Repairing Oil-Saturated Crankcases. Welding Engr., vol. 11, no. 7, July 1926, pp. 37-38, 2 figs. Aluminum castings require careful treatment to remove oil before welding.

ELECTRIC. *See Electric Welding; Electric Welding, Arc.*

PIPE LINES IN BUILDINGS. Welding Pipe Lines in Buildings, H. E. Wetzell. Welding Engr., vol. 11, no. 9, Sept. 1926, pp. 34-38, 4 figs. Points out that welding can make possible saving as great as $40 on single joint.

REFRIGERATING EQUIPMENT. Welding of Refrigeration Equipment, W. F. Scharphorst. Ice & Refrigeration, vol. 71, no. 3, Sept. 1926, pp. 177-178, 4 figs. Author suggests that caution should be observed before plunging into electric or gas welding too promiscuously; describes so-called intermittent system of refrigeration and presents graph showing how three generators operated; illustrations of welded vessels.

STEEL. Welding Carbon and High-Speed Steels, G. L. Walker. Forging—Stamping—Heat Treating, vol. 12, no. 7, July 1926, pp. 255-258, 13 figs. Success in welding high-speed or carbon tool steels depends upon preparation of steel, filler rod, flame characteristics and size of welding tips.

WELLS

CONCRETE. Increasing Supply by Sinking Concrete Well. R. B. Champion. Water Wks. Eng., vol. 79, no. 15, Aug. 1, 1926, pp. 971-972, 2 figs. Account of well-sinking in Holland, Mich., involving construction of concrete well 72 ft. in depth.

WINDING ENGINES

CABLE CONTROL. Control of Cables of Winding Engines (Leràglage des câbles d'extraction), M. Gottrand. Revue de l'Industrie Minérale, no. 134, July 15, 1926, pp. 317-330, 1 fig. Discusses mathematical determination of control factors of cable on drums or reels, and develops formulas for correcting irregularities; biconical drums and reels.

SAFETY APPLIANCES. Overspeed and Overwind Prevention. Iron & Coal Trades Rev., vol. 113, no. 3044, July 2, 1926, pp. 8-11, 10 figs. Description of Norton, Caledonia, Whitmore, Melling, profile and Visor overwind preventers.

OVER-SPEED PREVENTION. Over-speed and Over-wind Prevention. Iron & Coal Trades Rev., vol. 113, nos. 3046 and 3047, July 16 and 23, 1926, pp. 88-90, 124-125, 17 figs. Examples of German practice. Translated from article by H. Hoffman, in Glückauf.

WIRE DRAWING

CONTINUOUS. Continuous Wire Drawing, K. B. Lewis. Wire, vol. 1, nos. 3 and 4, July and Aug. 1926, pp. 79-80 and 99-100 and 116-117 and 140-141, 6 figs. Discusses various types of continuous wire-drawing machinery.

WIRE ROPE

CARE AND MAINTENANCE. Care and Maintenance of Wire Rope. Foundry, vol. 54, nos. 19 and 20, Oct. 1 and 15, 1926, supp. sheets. How to measure wire rope; lubrication. Oct. 1: Foundry data sheet. Oct. 15: How to seize wire rope.

How, When and Why of Wire Rope, W. Voigtlander. Min. & Met., vol. 7, no. 237, Sept. 1926, pp. 389-392, 6 figs. Presents useful hints on care of ropes.

WOOD PRESERVATION

PROBLEMS. Wood Preservation and the Engineer, R. W. Smith. Military Engr., vol. 18, no. 100, July-Aug. 1926, pp. 311-313, 5 figs. Most important property of wood preservative is that it be toxic to decay-producing organisms and wood borers; wood-preserving plants and what they consist of; treatment of railway ties, transmission-line poles, mine timber, etc.

WOOD-WORKING MACHINERY

HIGH-SPEED. High-Speed Wood-working Machines. Engineering, vol. 122, no. 3162, Aug. 20, 1926, pp. 230-231, 3 figs. Details of glue jointer and edge moulder, three-drum endless bed sander, and automatic cut-off saw, manufactured by J. A. Fay and Egan Co., Cincinnati, Ohio.

MODERN. Workshop Experience with Modern Woodworking Machinery, J. Gillrath. Eng. Progress, vol. 7, no. 7, July 1926, pp. 192-195, 7 figs. Advantages of electrically-driven woodworking machines; details of exhibit at Leipzig Spring Fair.

WOOL

ARTIFICIAL MANUFACTURE. Artificial Wool Manufacture, H. Drexler. Paper Trade Jl., vol. 83, no. 13, Sept. 23, 1926, pp. 47-48. Discusses production of new fibre, named artificial wool, which, in appearance, closely resembles natural wool; developed by Italian firm, Snia Viscosa; it is claimed that new product is easy to dye; Xanthogenate process is probably used.

WROUGHT IRON

PROPERTIES. Quality Depends on Base Metal, B. B. Wescott. Iron Trade Rev., vol. 79, no. 7, Aug. 12, 1926, pp. 380-382 and 388, 11 figs. Genuine wrought iron for pipe manufacture is made from muck bars processed from all pig-puddled iron; competent microscopic examination definitely will determine character of material.

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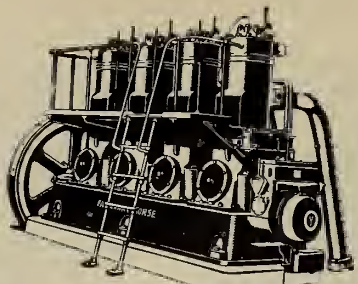

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