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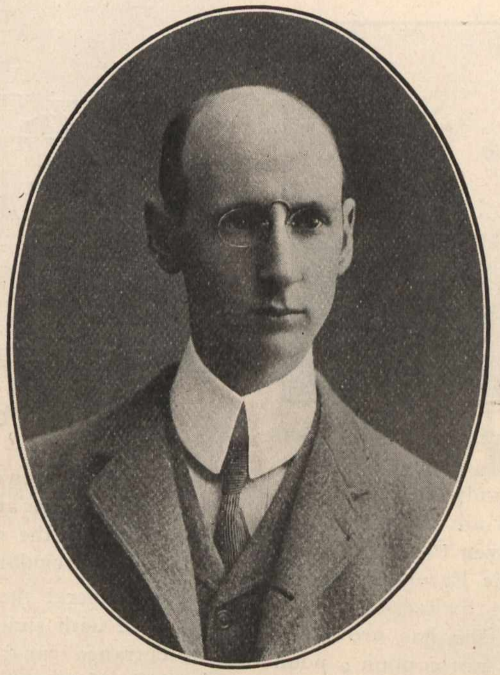
We judge ourselves by what we feel capable of doing; but the world judges us by what we have already done.

Longfellow.



ARTHUR K. SPOTTON,
Chief Engineer, Goldie & McCulloch Co., Galt, Ont.

Canada is fortunate at the present critical stage of industrial development, in having—along the lines of engineering in most demand at the moment: Railroading, irrigation, grain elevator design, hydro-electric development, and steam engineering—men at her call who are the peers of the best designers and constructors in any land. In the branches of engineering indicated, the following names readily occur: Cecil B. Smith, J. S. Dennis, J. A. Jamieson, Charles H. Mitchell, and the able mechanical engineer whose portrait appears above. Toronto University is to be congratulated upon being the Alma Mater of the last two: who are making a place for themselves in the industrial annals of the country. In economic steam engine design and practice, this country has for many years held its own. The large, vertical compound Corliss engines, described and illustrated in "The Canadian Engineer," July, 1906, shows that even in stationary engines of magnitude, and for the severest service, it is not necessary to go outside our borders. These powerful engines were designed by Mr. Spotton, and are only one example of the notable work he is doing in the important domain of steam engineering in Canada. Hence, his inclusion in our gallery of men who have "done things."

Arthur K. Spotton was born March 22, 1874, in Barrie, Ont. He received his scholastic education at the Public Schools and Collegiate Institute of that town. In 1891, he matriculated and entered the School of Practical Science, Toronto University, graduating 1894. The same year he entered the employ of the Waterous Engine Works Co., Brantford, as draughtsman. Here, at the outset of his technical career, he had the advantage of being a pupil of Mr. Joseph Fux, Chief Engineer of that Company, to whom he attributes his early realization of how limited was his foundation knowledge of the technics of "real engineering," and to whose generous treatment and helpfulness at this—the initial stage of his life work—he feels deeply indebted. In 1898, he became chief draughtsman to John Inglis & Sons Co., Toronto, and for four years, had a varied experience in the design and construction of stationary and marine engines. At this place a fortunate circumstance was, his association with Mr. James Smith—now Manager of the Collingwood Shipbuilding Co.—in the building of the machinery for the SS. "Huronic," the largest and fastest of the Northern Navigation Co.'s fleet. Mr. Spotton says: "It was from study of his designs and methods that I became convinced that, in so far as appearance goes, simplicity of outline and absence of decoration are the true bases of good machine design." With the "Excelsior" idea before him, he engaged in 1902 as engine designer with the Goldie McCulloch Co., Galt. After three years of distinction with this Company, he was appointed by them in 1905 as chief engineer, and has been very successful in the designing and installation of some of the largest direct-connected sets in Canada; in fact, he has made a specialty of large engines for direct connection to high frequency alternators. Among the more prominent installations are the Victoria Avenue sub-station of the Hamilton Cataract Light, Heat and Power Co., Hamilton, Ont.; the Winnipeg Street Railway, Winnipeg, Man.; the Power House, Dominion Iron and Steel Co., Sydney, C.B., and the Power House for the Windsor and Essex Rapid Railway—now in course of construction.

Mr. Spotton is still eight years short of the "Osler period"; but in the twelve years of effort in his chosen profession, has achieved a distinction which comes to most men much later in life. The secret of his success has been largely due to the fact, that he did not step out of school into the practice of engineering, with the air of knowing it all; the trait which characterizes so many of our modern University graduates. He was willing to sit at the feet of men of wide experience and trained judgment; hence, has had little to unlearn, and has gone forward conquering and to conquer, until to-day, he is recognized as a high authority in Steam Engine practice in the Dominion of Canada

EUROPEAN HYDRO-ELECTRIC DEVELOPMENT

LOW HEAD SWISS PLANTS.

By Charles H. Mitchell, C. E.

VI.

That Switzerland is the most interesting country in Europe is not a new announcement, nor an extreme statement. To the lover of nature the little republic in the Alps has long been the subject of many journeys, and to the Engineer, who among professional men is the closest to nature, it is beyond doubt one of the most inspiring regions wherein "the forces of nature are turned to the benefit and uses of man."

Fig. 1.— Chevres: General View of Station and Sluice Dam.

Viewed from the hydro-electric standpoint of engineering, Switzerland undoubtedly has led all other countries, and it is there the engineer must go, even to-day, to obtain ideas as far ahead of America as are the European fashions.

It is not the least surprising that Switzerland should maintain this proud position, because she has grown into it by sheer necessity. The country does not contain a pound of coal or other fuel, and it was to be expected that to the glacier fed streams and waterfalls the manufacturer and engineer would turn for his power. The result of this has been the gradual development of the turbine, the increasing of its efficiency, the introduction and adoption of ingenious methods of application and control of water. And when electrical transmission became a settled factor, the Swiss were quick to seize upon its advantages in conjunction with their hydraulic works, with the result that in many respects they are several years ahead of their neighbors.

It is the purpose of this article to describe several of the low-head Swiss installations, as illustrating types, old and new, now in successful operation. The Geneva plant is perhaps the most generally interesting, combining as it does, a famous hydraulic work evolved from long experience and change, with modern electrical equipment to meet a peculiar market, and especially is it of interest because it is one of the few municipally owned plants in Europe, and at the same time is furnishing power at lower rates than most. The Rhinefelden and Rathausen plants are mainly of historical interest, while the Beznau works illustrate the latest practice under these conditions.

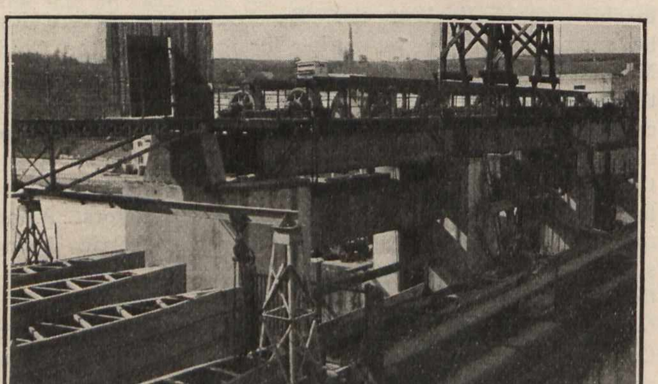


Fig. 2.—Chevres: Stoney Sluice Gates.

The Chevres Plant at Geneva.

The Chevres Plant is situated on the Rhone at a village called Vernier, about four miles below Geneva, which city is at the lower end of Lake Leman (or Geneva). The tributary river Aare, coming from the Alps in the region of Mt. Blanc, empties into the Rhone just above the works, and introduces an element of fluctuation into the head water, which, however, in the main river, is controlled by works at Geneva at the outlet of the lake. The latter works were built in the eighties, and are provided with ingenious rolling slat regulator gates.

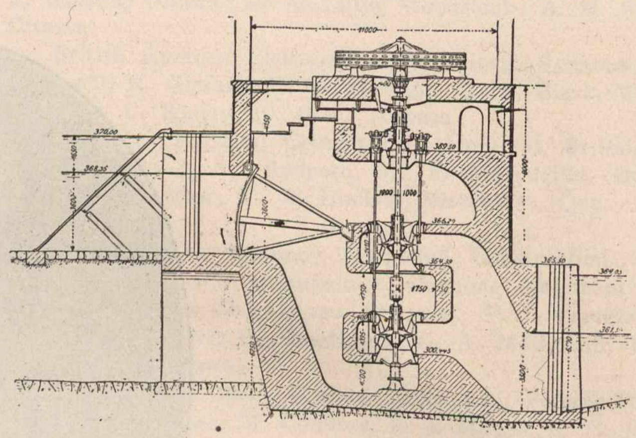


Fig. 3. Chevres: Section Through Unit.

In general the power works consist of a main dam provided with sluices for immediate control of head water, an entrance canal and intake service extending upstream from the dam and a generating station parallel to the river, extending down stream, having the water introduced on the shore side of the house. Fig. 1 shows a general view.

The sluice weir has six gates of the Stoney type, each 33'-0" wide and 28'-0" high, built between piers, each of which is 56'-0" long and 10'-0" thick. The Stoney gates are of structural steel, counterbalanced and actuated with small hoists located on an overhead bridge, so adjusted that two men can raise or lower them by hand. Each gate weighs fifty tons, and has three hundred and sixty tons water pressure against it when closed. Fig. 2 shows the general arrangement of these gates, and on the left hand are shown steel stop logs, to be used for closing off the head and tail water from any one gate, when necessary for repairs.

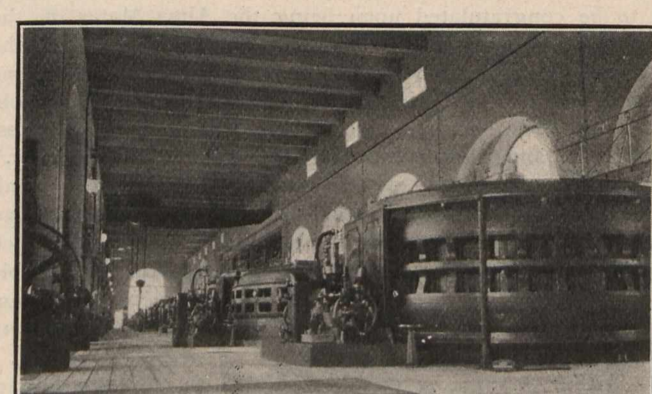


Fig. 4.—Chevres: Interior of Station.

The dry weather flow of the Rhone at this point is about 4,200 sec. ft., occurring in winter, at which time there is a head of 28'-0"; in summer the flow is as high as 32,000 sec. ft., when the head is reduced to 15'-0".

In the original design it was found, in operation, that there were many defects, due doubtless, to meagre experience, at the time, in the requirements. One of the principal changes made in recent years was the construction of a wall from the upper end of the station upstream about 1,000'-0", forming with the shore a canal about 100'-0" wide, the upper end terminating at an intake provided with gates, thus permitting of the unwatering of the turbine inlets. In the same manner a training wall was inserted in the lower river, parallel with the station and about 50'-0" distant, forming a separate tail race. In order to further increase the head in the summer by slightly lowering the tail water, the ingenious scheme was adapted of placing the openings in this wall and creating an outward draft toward the main river, due to the high velocity of the latter.

By the new intake arrangement the first line of defence against ice, debris, etc., is now far upstream from the

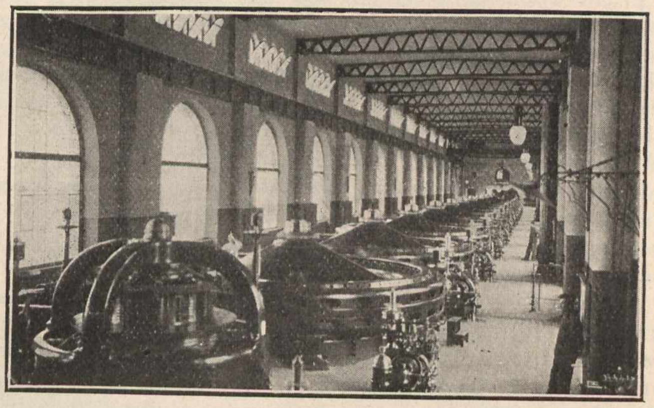


Fig. 5.—Beznau: Interior of Generating Station.

power house, instead of in a congested forebay in front of the building, an arrangement which has contributed in a large measure to the recent success of the plant, in securing continuous operation.

The generating station is 450'-0" long, and 41'-0" wide, and accommodates 15 vertical type power units and three exciters, as well as a complete oil pumping and filter plant, a workshop and offices. All the building foundations and other works are built of concrete, resting upon sandstone ledge.

Of the fifteen units, ten are of relatively modern design, having been installed in 1899. The turbines, by Escher Wyss & Co. and the generators by Brown, Boveri

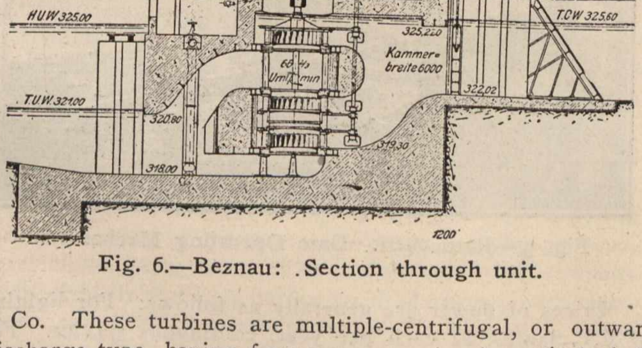


Fig. 6.—Beznau: Section through unit.

& Co. These turbines are multiple-centrifugal, or outward discharge type, having four runners on each vertical shaft, specially designed for the high speed of 120 R.P.M. to obtain from 900 to 1,200 H.P., depending on head. They are designed so as to secure the best distribution of available water at any time by the variations of water areas, and are moreover arranged so that five of them will be used with the high winter head, and the other five with the low summer head. These turbines have ordinary thrust bearings, three in number, and a foot bearing, all undue weight being supported by water pressure acting on the turbine wheels themselves. Regulation is done by oil pressure governors, actuating cylinder gates through vertical rack and pinion mechanism. Fig. 3 shows a section through one of these units.

With the five turbines of earlier type, however, when there is a high head, that is when tail water is low in winter, only the lower pair of runners is in operation, which when full open, develops 1,200 H.P. In summer with high tail water level and low head, both pairs are in operation, when each delivers 400 H.P. These turbines run at 80 R.P.M., and are conical in general shape with three guide rings to ensure even distribution of water to runners. The

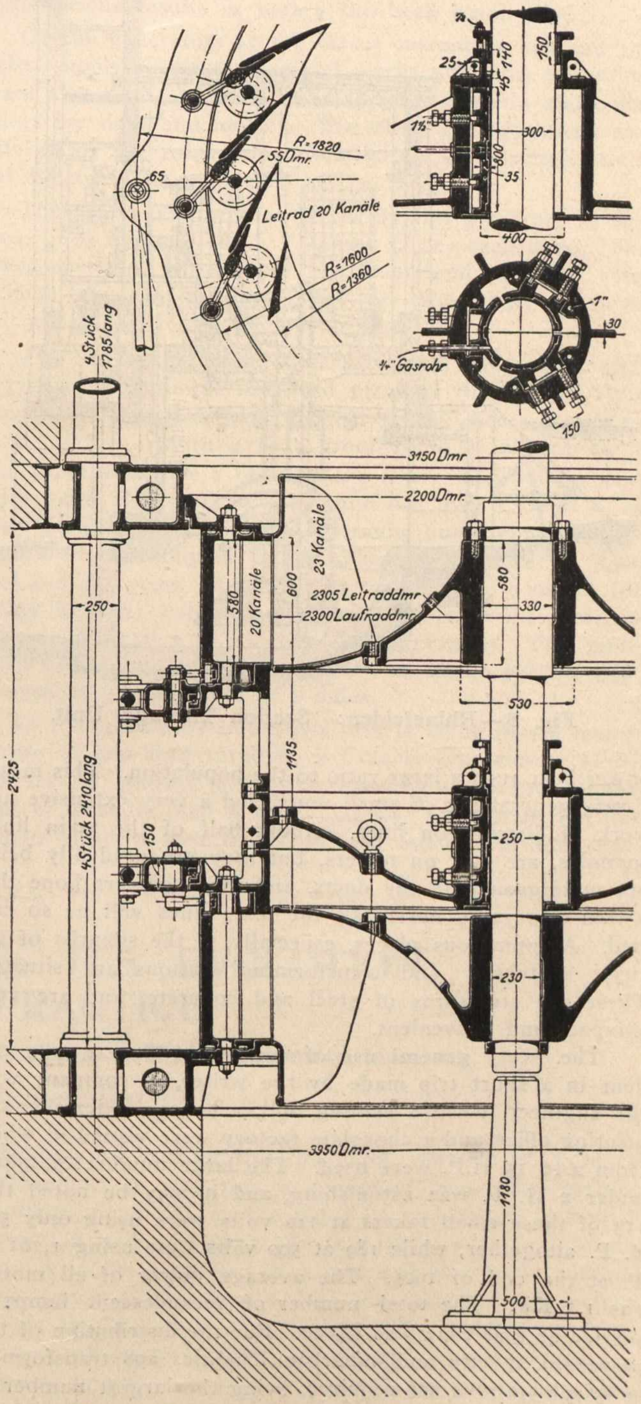


Fig. 7. Beznau:. Details of Turbine Unit.

weight of the revolving parts is balanced by high pressure oil acting on the collar thrust bearings.

A peculiarity of these turbines is in the method of governing by a hydraulic servo motor, which provides that when the upper pair of wheels is not working, only the lower gates are operated, and when both pairs are working, regulation is obtained by the gates of the upper pair only. The wheel gates are moved in a rotary direction about the shaft by means of rocker and link motion.

The electric generators installed at the different times are of the same general umbrella type, but are of various windings. Eleven units are two-phase, 750 Kw., 2,750 volts at 45 cycles, five of which (earlier) have fixed fields, and six have revolving fields. Three units are two-phase, 5,000 volts, and one is a continuous current machine of Thury 12 pole type, supplying current to an electrochemical works nearby at 208 volts, owing to the small space originally allowed in the station for switchboards, etc., the switching devices are very crowded, so much so that several years ago a serious burn-out occurred; this has recently been remedied by additions to the building.

Perhaps the most interesting features of this plant are in connection with the distribution and use of the current. In no city in Europe does the number of consumers of

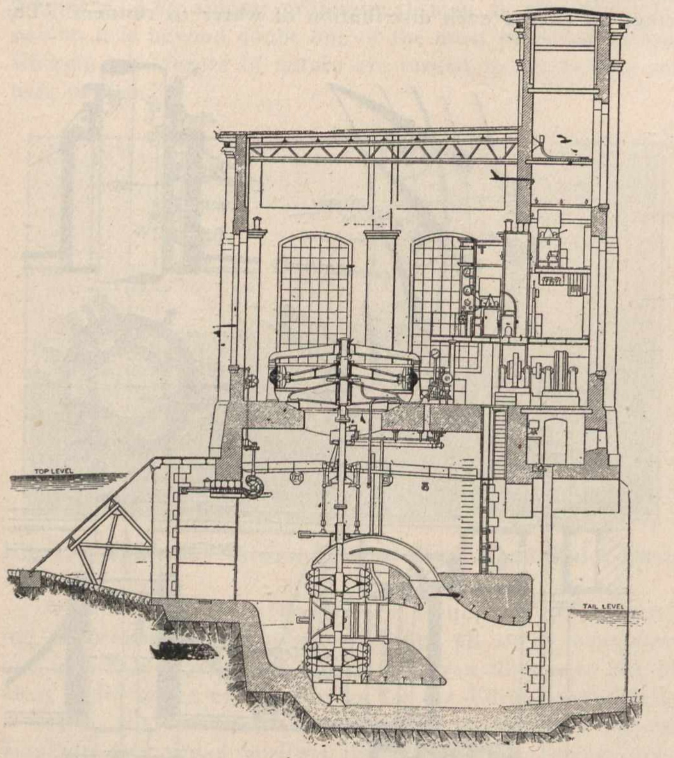


Fig. 8.—Rhinefelden: Section Through Unit.

power bear such a large ratio to the population. This means a very general use of small units, and a very extensive network of distribution lines. About half of the main lines, 90 miles, are still on towers, but they are gradually being put underground in tile ducts, and the engineers hope that within two years nearly all the main lines will be so carried. At numerous places, especially in the suburbs of the city, switching and transforming stations are situated. These are structures of steel and concrete, and are very compact and convenient.

The very general use of current in Geneva was evident in a short trip made by the writer, in company with the engineer, when a planing mill, a bakery, a jeweller's, a printing office and a chocolate factory were visited in which from 2 to 15 H.P. were used. The large number of takers under 2 H. P. was astonishing, and it may be noted that 113 of these small takers at 110 volts were using only 50.6 H. P. altogether, while 189 at 500 volts were using 1,261 H. P. at the end of 1905. The average power of all motors was 1.2 Kw. The total number of incandescent lamps in service at that time was 85,000. For the distribution of this power to 27 city and suburban localities 698 transformers in 83 sub-stations are required, being the largest number of any plant in Switzerland.

Prices charged by the city of Geneva are as follows: For lighting: 16 C.P. lamps (70 watts) one cent per hour, or 16 cents per Kw. hour, with large discount for a considerable number of lamps. For power: On flat rate, 1 H.P. at $64 per H.P. year; 10 H.P. at $43 per H.P. year; 20 H.P. at $32 per H.P. year; 50 H.P. at $28, and 100 H.P. at $22.40. These figures are based upon a ten-hour day with full advantage of the discount. A 24-hour day would increase the amounts by 50%. Coal for steam power is about $7.00 per ton.

The Beznau Plant, River Aare.

One of the most interesting low-head plants in Switzerland to-day is that situated on the Aare River, near Baden, known as the Beznau Station. In it are constituted all the most recent improvements in the application of the water to the wheels, and in the wheels themselves are embodied the results of the experience of the past ten years, with plants operating low-heads with large variations. This plant was completed and put into operation in 1904, and was quickly loaded up with consumers in the surrounding country.

The water is obtained by cutting across a bend in the river with a canal about three-quarters of a mile long and the generating station is placed across the lower end. A removable series of screens is provided, and also commodious spillways, although all ice and debris is deflected at the headworks. The generating station below the floor line is built of concrete, the superstructure being of stone.

The available fall varies between 10 and 15 feet, and, owing to this variation, the vertical turbine units consist of three runners 7′-6″ diameter. One pair of runners is at the bottom, right and left, and the third above, discharging downwards into the draft chamber of the upper runner of the pair, see Fig. 6. At a medium head of 13′-0″ 1,000 H. P. is obtained on each unit at 67 R.P.M., using 890 sec. ft. of water. The whole unit is supported by hydraulic pressure beneath a disc, so as to reduce the weight on the step bearing, and the small inequalities of this are further balanced by oil pressure from special pumps.

Regulation is secured by an oil pressure governor geared to the main shaft, standing on the station floor, to which is attached to the gate shaft. Links from the latter are connected up to the gate rings surrounding the distributor of each runner: to the gate rings are linked the swivel gates, which, by rotating the ring, open and close on the fixed vanes of the distributor, thus admitting water as required to the runners. These details are shown in Fig. No. 7. The turbines are built by Theodor Bell & Co., of Kriens, near Lucerne.

The power secured in these units varies between 7,000 and 11,000 H.P. for the whole installation of nine units.

The generators are of the umbrella revolving field type, 800 Kw. each, three-phase, wound to 8,000 volts at 50 cycles, and were built by Brown, Boveri & Co., of Baden. Local distribution is at the generating voltage, while long distance is at 25,000 volts up to 20 miles. The latter voltage was the highest in transmission operation in Switzerland at the end of 1905. The total length of transmission lines of this plant in 1905 was 70 miles, the number of localities served was 61, the population, 250,000, the number of transformers 60, and stations 31, while the average power of motors served was 100 Kw., in which respect this plant stands third in the country.

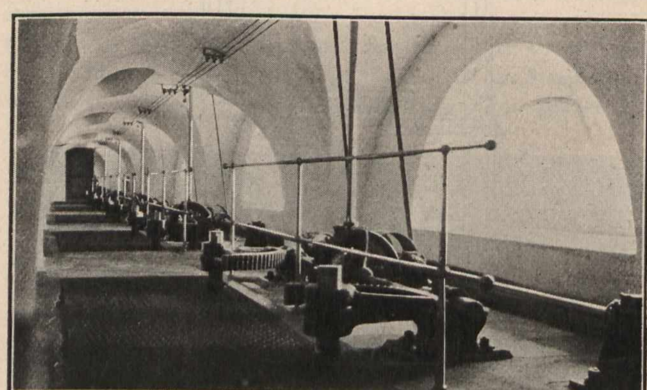


Fig. 9.—Rathausen:. Gate Operating Mechanism.

Prices of power are generally as follows: For lighting 16 C.P. lamps, $4 each per year, continuous service. For motors on 10-hour basis flat rate, 1 H.P. at $43; 10 H. P. at $39; 50 H.P. at $34, and 100 H. at $32. For 24-hour basis, 1 H.P. at $56; 10 H.P. at $49; 50 H.P. at $44, and 100 H.P. at $41.

Rhinefelden and Rathausen Plants.

A description of any low-head plants in Switzerland, however brief, would not be fair without some mention of the historical Rhinefelden and Rathausen plants, the former on the Rhine about 60 miles from Zurich, and the latter on the Reuss, near Lucerne.

The Rhinefelden installation, built in 1897, is still counted as one of the largest in Europe, being about 17,000 H.P., comprising 20 units under a head variable between 10.5 and 15'-0". The vertical shaft was adopted. Each unit has two turbines, consisting of a pair of runners, thus characterizing the whole as a quadruple wheel unit, running at 55 R.P.M. The general arrangement is shown in Fig 8. In these turbines the weight of the rotor is borne by oil pressure from special pumps, and the regulation is effected by sluice rings, like the American cylinder gate, worked by an oil pressure governor. They were built by Escher Wyss & Co.

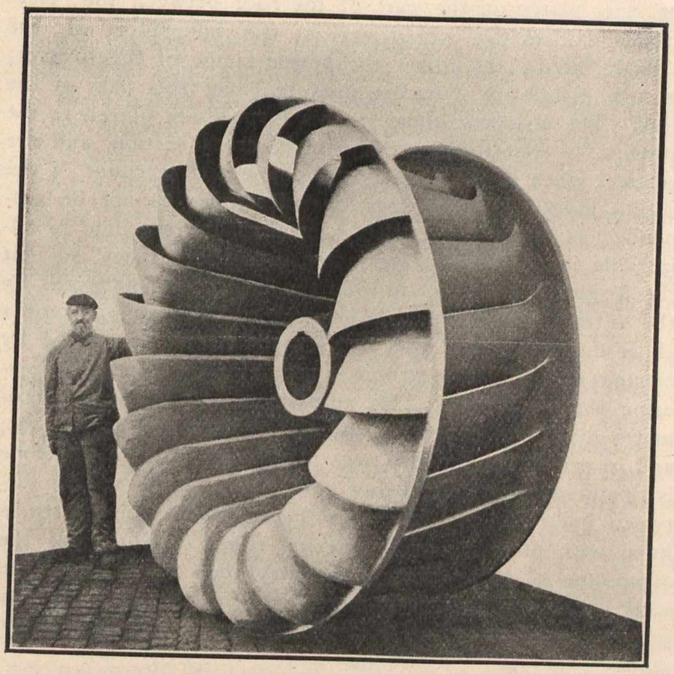


Fig. 10.—11'-0" diameter Runner for 9'-0" head.

The headworks and station layout of the Rhinefelden plant is generally the same as the Chevres, in fact the exterior appearance of the station is quite similar, and the crowded condition of the interior is even more marked than in the Geneva plant. This in comparison with more recent installations illustrates how the ideas of designing engineers, as to space required, have developed within the past twelve years. The head for these works is obtained by means of a sluice dam, about 1,000 ft. upstream from the station to which water is carried by means of a canal passing in front of the inlets in the same manner as at Chevres. The troubles due to ice and debris here are quite aggravated, in the spring especially, as there is no adequate relieving spillway. Upon the writer's visit to these works in May there were three shifts of twelve men each, raking grass and weeds from the screens, a condition which presents serious results in such a low-head plant.

Of the generators 11 are direct current at 140 and 155 volts, supplying electrochemical works adjacent; the other 9 are alternating at 6,800 volts for transmission short distances for light and motors. The electrical equipment was installed by the Allgemeine Elektricitats Gesellschaft (General Electric Co.), of Berlin.

The prices obtained for power by this plant are as follows: For lighting, 16 C. P. lamps $4 per each lamp. For power, metered, ½ cent per Kw. hour, and on a flat rate, 10 hour basis, up to 4 Kw., $40 per Kw. year; 40 to 80 Kw. at $30, and 160 to 300 Kw. at $24.

The Rathausen plant of early design, built about 1896, is typical of a simple low-head plant of the general style common in America, with vertical shafts, direct connected to generators. With a head from 12 to 16'-0" fed by a head canal alongside a rapid in the river. The station generates 1,600 H.P. hydraulically, and has also 1,400 H.P. in steam plant. There are five hydraulic units, consisting of single runners coupled to two-phase generators at 3,300 volts and 40 cycles. A feature of this plant is a device for closing butterfly valves in the turbine inlet flumes, two in each, an illustration of which is shown (Fig. 9). This plant serves 18 localities and a population of 22,000 people, with a maximum transmission of 8 miles.

To illustrate what one Swiss firm is doing in the manufacture of low-head turbines, a Francis type runner 11'-0" diameter is shown in Fig. 10, seen by the writer in the shops of Theodor Bell & Co. This was for installation under 9'-0" head, to give 600 H. P., and was cast in one piece.

THE ELECTRIC FURNACE: ITS EVOLUTION, THEORY AND PRACTICE

By Alfred Stansfield, D. Sc., A.R.S.M., Professor of Metallurgy in McGill University, Montreal.

Article V.—Production of Iron and Steel in the Electric Furnace.

Iron is employed in the mechanic arts in combination with variable amounts of carbon and other metalloids and metals, as wrought iron, cast iron, or steel. These terms cover a wide range of different materials.

Cast iron, or pig iron, is the form in which the metal is usually obtained from the ore, and contains from 2% to 4½% of carbon, from ½% to 4% of silicon, and small but variable amounts of manganese, sulphur and phosphorous; the remainder being iron. The carbon and other elements are absorbed by the iron during its production in the blast-furnace, and make it more easily fusible than if it were pure; the melting temperature of pure iron being 1505°C. or 2740°F., while that of cast iron varies from about 1027°C. to 1275°C., or from 1880°F. to 2327°F., depending upon its composition. The fusibility of cast iron makes it suitable for use in the foundry, but the presence of a large amount of carbon and other metalloids renders it far less valuable mechanically than the purer forms of wrought iron and steel.

Wrought iron consists of nearly pure iron, retaining only small amounts of carbon and other metalloids, together with a small amount of admixed slag. It is made by melting pig iron in the "puddling" furnace in contact with a cinder or slag rich in oxides of iron. The carbon and other metalloids in the pig iron are largely removed by reaction with this slag, and the nearly pure iron forms in grains in the furnace, being too infusible to be melted. These grains of iron are welded together, but still retain some of the slag from the furnace. The puddled iron, after being rolled into bars, is cut into short pieces which are made into bundles or "piles," reheated and rolled into bars or other shapes. The operation of "piling" removes some of the slag, and improves the quality of the iron. A good deal of so-called wrought iron is made of piling pieces of mild steel.

Steel is a very comprehensive term, and includes (a) Crucible Steel, which is made from carefully selected varieties of wrought iron or steel; has been melted in crucibles, and contains from about ¾% to 1½% of carbon, together with enough manganese and silicon to produce a sound casting; (b) Bessemer and Open-hearth Steels, which include all the products of these furnaces, and may range from the hardest of tool steels to a material which is practically pure iron, and only differs from wrought iron in having been fused, and being in consequence nearly free from slag, and in the presence of a little manganese, added to ensure a sound casting.

The production of iron and steel in the electric furnace may be considered under three heads:

I. The production of steel by melting steel scrap, either alone or with the addition of pig iron, iron ore, etc., in an electric furnace.

II. The production of pig iron by heating iron ore with carbon and fluxes in an electric furnace.

III. The production of steel by heating iron ore with carbon and fluxes in an electric furnace.

The first is in commercial operation, the second will probably be employed to a limited extent, while the third has been experimented with by Stassano, but appears less promising than the other two.

I.. Production of steel from scrap, pig iron and iron ore.

The furnaces used are electrically heated melting furnaces, in which the scrap, pig iron, etc., can be melted and kept molten until its composition has been adjusted, when it is tapped or poured and cast into moulds. A steel corresponding to any product of the Crucible, Bessemer or Siemens furnaces can be produced in this way.

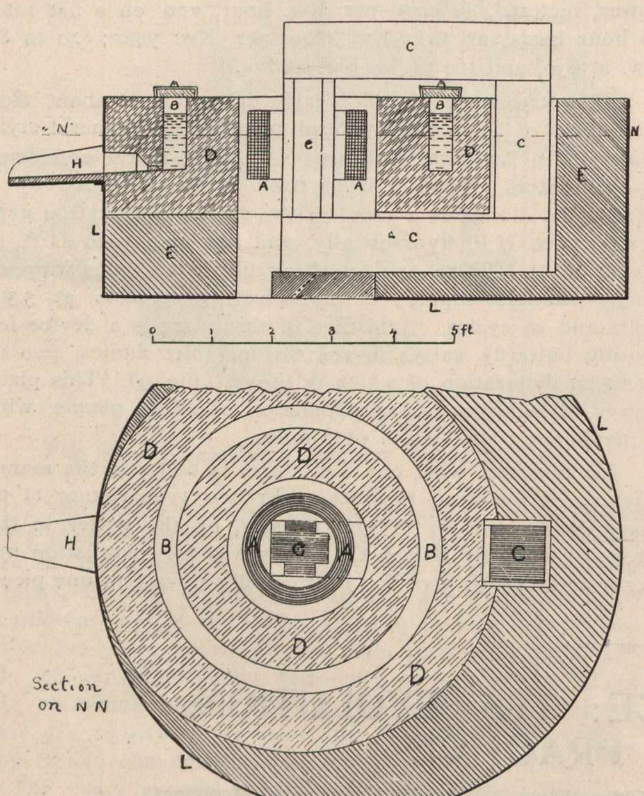


Fig. 27.—The Kjellin Steel Furnace.

The operation may be merely a melting one, in which pure steel scrap is melted and cast into ingots after small additions of pure pig iron, ferro-manganese, etc., or the charge may consist largely of pig iron, in which case considerable additions of iron ore are necessary to remove the excess of carbon and other constituents of the pig iron. The presence of phosphorous or sulphur in steel is objectionable, and when these are found in more than traces in the charge, they must be removed before the steel can be cast, thus prolonging the operation.

Three types of electric furnace have been employed for this kind of steel making, the Héroult furnace, Fig. 25, p. 326; the Kjellin furnace, Fig. 27, and the Gin furnace, Fig. 28.

The Héroult Steel Furnace, Fig. 25, resembles a Wellman tilting furnace from which the gas and air ports have been removed, with the addition of two vertical carbon electrodes, CC, for leading the current into the furnace. In the figure, B is the lining of the furnace, which is constructed of dolomite bricks and crushed dolomite. A is the roof, and M is the molten steel, which is covered with a layer of slag, S, as in the ordinary gas-fired furnace. The furnace is built in a steel case or jacket, and, unlike the open-hearth furnace, the roof, A, is also covered with steel plates, and is provided with eyes, not shown in the figure, by which it may be lifted off the furnace. The weakest part of the roof is around each electrode, and this part has been strengthened by water jackets, which enable a closer fit to be maintained round the electrode, and so reduce the loss of heat and prevent the exposed parts of the electrodes from becoming red hot, and wasting in the air. As an alternating current is used, it is not desirable to have the iron or steel plates on the part of the roof between the electrodes CC, as this would increase the inductance of the electric circuit and lower the power factor of the furnace; bronze plates are therefore used to cover this part of the roof. The charging doors in this furnace are placed at the ends. The electrodes are square in cross section, and are vertical when the furnace is upright, but on account of the tilting motion of the latter, the electrodes cannot be suspended as in the ore-smelting furnaces, but are held in adjustable holders which are fastened to the furnace, so that the height of each electrode in the furnace is unaffected by the tilting movement. The lower end of each is kept a short distance above the slag, as the heat is produced by electric arcs, and the current is regulated by raising or lowering the electrodes. This adjustment is effected by automatic machiney controlled by the voltage of the furnace; and in order that the two arcs may be equal, each electrode is operated separately, being controlled by the voltage between itself and the metal in the furnace. The hearth is lined with dolomite or magnesite, either of which has the advantage of being more refractory than silica brick, as well as allowing strongly basic slags to be used for the purpose of removing phosphorus and sulphur from the steel.

The Héroult furnace is very much smaller than the usual open-hearth furnace, the one at La Praz being about 7′-0″ by 4′-0″, internally, and taking a charge of only 3 tons, while the furnace at Kortfors was a little larger than this. For products like crucible steel the small size of the furnace may be no disadvantage, but if it is desired to turn out structural or rail steel, larger furnaces would have to be employed to compete with the 50-ton open-hearth furnaces.

The Haanel Commission saw the process of making both low and high carbon steel in the furnace at La Praz, by melting miscellaneous steel scrap, purifying it by repeated additions of iron ore and lime, and then making suitable additions to obtain the required percentage of carbon, manganese and silicon. The scrap contained 0.055% of sulphur and 0.22% of phosphorus, while the final steel contained only 0.02% of sulphur and 0.009% of phosphorus, the carbon being 0.08% and 1.0% in the two steels. The scrap was melted with some ore and lime, and when fusion was complete the slag was poured off and a second slag was made by adding lime with a little sand and fluor spar as fluxes. The second slag was poured off and a third slag made in the same way before the final additions were made to the steel. This repeated addition of fresh slag-forming materials will purify the steel more completely than by adding the whole amount at once. In making the low carbon steel some ferro-manganese was added in the furnace and a little aluminium in the ladle, while in making the high carbon steel there was also added in the furnace some "carburite," which is a mixture of iron and carbon, and some ferro-silicon.

The electrical power employed was about 350 kilowatts in each operation, the voltage was 110, and the current, which was not measured, would probably be about 4,000 amperes. The electrical energy per 2,000 lbs of high carbon steel was 0.153 horse-power years. The low carbon steel would require about 0.10 horse-power years per ton. At $10.00 a horse-power year the cost for power would be $1.53 and $1.00 respectively. The time required for a charge of of 3 tons was 5 hours for low carbon steel, and eight hours for the high carbon steel. During the first part of the operation before the steel scrap is melted, the current fluctuates violently, and is regulated by hand; but after the steel has melted around the electrodes the current becomes more steady, heating by an arc beneath each electrode, and automatic regulation can be employed. The full power was not employed until about an hour after the start. Mr. Harbord states that the high carbon steel is as good as corresponding grades of crucible steel, and there appears to be no reason why, in localities where water power is cheap, this furnace should not replace the crucible furnace and open-hearth furnace for the manufacture of tool steels and other special varieties of steels in which quality rather than quantity or cheapness is aimed at.

With regard to the possibility of making structural steel in the Héroult furnace, it should be remembered that the material of the charge would be largely pig iron and ore, as there would not be sufficient scrap available, and this would increase the time and electrical energy required for the operation, on the other hand the pig iron could be charged molten, and the purification of the charge need not be carried so far as was necessary for tool steel, while the larger scale of the furnace would also reduce the consumption of electrical energy per ton of product. A 50-ton furnace might be expected to require about 5,000 kilowatts, or about 25,000 amperes at 250 volts.

The cost of making structural steel in a 50-ton Héroult furnace, if a furnace of this size could be successfully operated, would probably, with electrical energy at $10.00 a horse-power year, be about the same as in a gas-fired open-hearth furnace using coal at $3.00 a ton. Assuming that the general cost of operating the two furnaces was the same, there remains for the Héroult electric furnace the cost of electric energy, which, at 0.10 horse-power years per ton would be $1.00 per ton, and the cost of electrodes, which are stated to cost 20 cents per ton, while for the open-hearth furnace there is the cost of coal, which at 700 lbs. per ton would be $1.00 and the cost of operating the gas producers and checker chambers, which would more than balance the cost of electrodes. Until larger furnaces have been built, it is not worth while to attempt to estimate in detail the cost of operating them, but the figures given are enough to show that under favorable conditions, large electric furnaces might be expected to compete with gas-fired furnaces for the manufacture of structural steel.

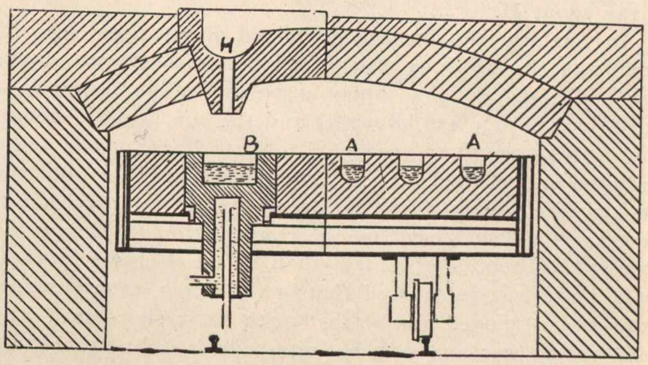
A Héroult furnace for the production of 50 tons of steel a day has been installed in the plant of the Halcomb Steel Co., in Syracuse, and it is likely that this will lead to further developments in size and efficiency. The furnace is being used in conjunction with gas-fired furnaces, and is charged with molten superoxidized steel from a Wellman furnace, the operation of refining being finished in the electric furnace.

Mr. Héroult has proposed an electrically heated steel mixer of 500 or 600 tons capacity, to receive the steel from a number of open-hearth or Bessemer furnaces, thus ensuring a uniform product, and allowing a more perfect deoxidation of the steel and separation from the slag than by the usual process of casting. Prof. Richards has suggested the use of electrical heating as an auxiliary in an ordinary open-hearth furnace for raising the temperature of the steel through the last 100° or 200° C before tapping, as a little electrical heat for reaching the highest temperature would sometimes save a good deal of time and fuel.

Keller Steel Furnace. This is substantially the same as the Héroult steel furnace and need not be further described.

The Kjellin Steel Furnace, Fig. 27, is of the induction type, and resembles a step-down transformer. In the figure, A is the primary winding to which an alternating current of 90 amperes at 3,000 volts is supplied. B is a circular trough containing the molten steel, and corresponds electrically to a secondary winding of one turn. C is the magnetic circuit which passes through both the primary and the secondary windings. The alternating current in the primary windings induces an alternating current in the ring of molten steel, the current being estimated at 30,000 amperes and 7 volts. This furnace has the great advantage of requiring no electrodes, which is not only a gain as regards trouble and expense, but avoids any contamination of the steel by the material of the electrode. The heat is generated uniformly throughout the steel, which is contained in a closed receptacle, under conditions which resemble those of the crucible steel furnace. The electrical furnace has, however, the advantage of holding as much steel as many crucibles, and of being quite free from furnace gases which are liable to enter even a closed crucible.

Compared with the Héroult furnace, the Kjellin furnace has the objection that the annular groove containing the steel is very long in comparison with its cross section, which will cause the loss of heat to be excessive and the weight of steel to be small for a furnace of a given size. The furnace does not form a very efficient transformer, and it appears to be limited in size, the power factor becoming smaller as the furnace becomes larger, unless the frequency of the current is correspondingly reduced. On the other hand the current can be used at high voltages of 3,000 or even 5,000 or 6,000 volts which would permit of the gener-



Section at X. Y.

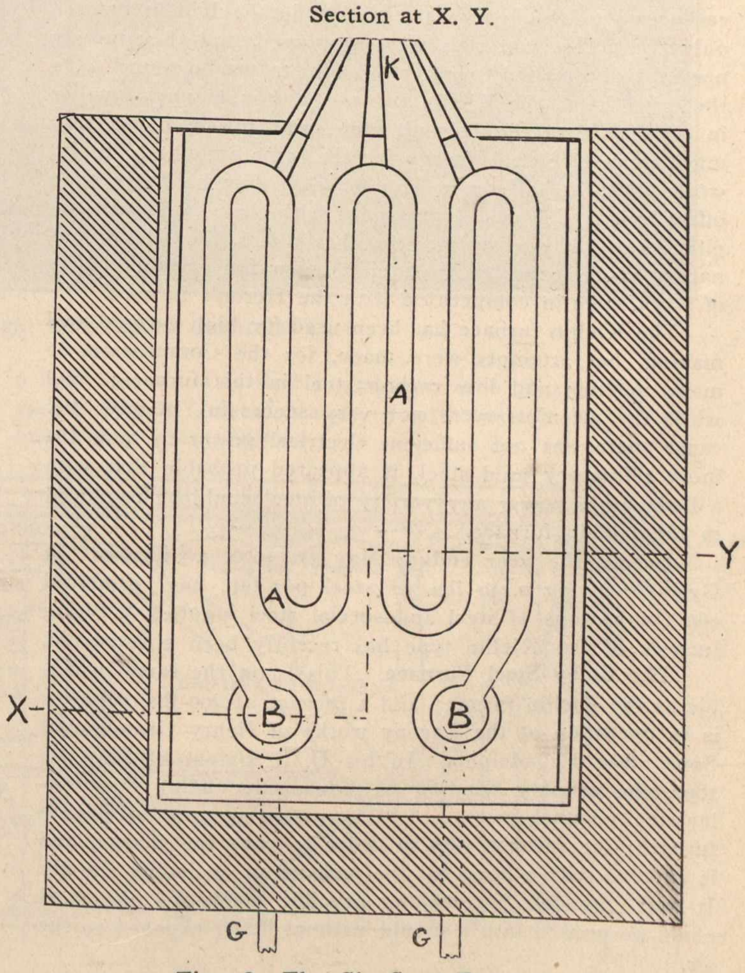


Fig. 28 The Gin Steel Furnace.

ation of the current and its transmission over moderate distances without the use of a step-down transformer at the furnace.

The Kjellin furnace was in operation at Gysinge, Sweden, when visited by the Commission in 1904, and was usually making a high class of tool steel from pure pig iron and scrap steel, for which purpose it seems particularly adapted. In operating the furnace the molten steel from one run is not tapped out completely, but about one third of it is left in the groove to act as a conductor to carry the current at the beginning of the next run; the fresh charge of charcoal, pig iron and pure iron or steel scrap is added to the superheated steel as fast as it can take it without chilling. No refining is attempted in this furnace, the operation being merely one of melting a metallic charge, made up in correct proportions to give a steel of the right composition.

The furnace is built in a circular iron casing LL, which is lined with fire brick at EE; the trough B is surrounded with more refractory material, DD, for which either magnesite or silica bricks can be employed. The open space in the middle of the brick work, serves to cool the primary winding by the current of air passing through it; water jackets are also employed to protect the winding from the heat of the furnace. The groove B is covered by a series of movable lids to retain the heat as far as possible, and any of these can be removed for charging the furnace. At the end of the operation the steel is tapped from the furnace by the spout H.

In one run the furnace contained about 1,500 lbs. of steel from the previous charge and the fresh charge of pig iron and scrap weighed about 2,300 lbs.. The power employed was nearly 150 kilowatts and the run lasted 6 hours. The energy consumed amounted to 0.116 horse-power years per 2,000 lbs. of steel ingots. The power factor at full load was only 0.635 with a current frequency of 13½ cycles per second. It will be seen that the consumption of energy for 2,000 lbs. of tool steel is less than in the Héroult furnace, but it must be remembered that in the latter, miscellaneous scrap was employed and washed with basic slags until free from phosphorus and sulphur, after which it had to be recarburized to obtain tool steel, while in the Kjellin furnace only the purest materials were employed, and they merely needed to be melted together in order to produce steel. On the other hand, the Kjellin furnace, although much smaller in capacity than the Héroult, does not appear to use very much more electrical energy for the same amount of useful work, and the difference in efficiency may be more than offset by the absence of electrodes with their regulating appliances and heavy cables. In other words, the Kjellin furnace may be expected to hold its own for certain classes of work, even in competition with the Héroult furnace.

The Kjellin furnace has been used for high carbon steel making, but attempts were made, for the Commission, to make medium and low carbon steel in this furnace; and while the attempts were not very successful, mainly because there was not sufficient electrical power to melt the more refractory mild steel, it appeared probable that with a little more power any variety of steel could be produced in the Kjellin furnace.

During the year ending May 31, 1906, a furnace at Gysinge, giving 2,240 lbs. of steel per tap, has produced 960 (long) tons of steel and special steel ingots. A tilting furnace of the Kjellin type has recently been constructed.

The Colby Steel Furnace. This is on the same principle as the Kjellin furnace, and a furnace of 200 lbs. capacity is in operation at the Tacony works of Henry Disston and Sons, near Philadelphia. In his U. S. Patent of May 20, 1890, the primary winding is shown surrounding the circular steel channel, instead of being within it as in the Kjellin furnace; the furnace tilts in order to pour the charge, and is covered with a hood for the purpose of excluding the air. It was intended for making crucible steel, and the steel could be poured into a mould without being exposed to the air.

The Gin Steel Furnace, Fig. 28, resembles the Kjellin furnace in generating the heat by the passage of the current through a groove containing molten steel, but it differs from it in the method of introducing the current. In the Gin furnace the induction method is not used, but the current is led into the ends of the canal by water cooled steel electrodes, which enter from below and form part of the furnace lining. In the figures, A is the groove or canal containing the molten steel, a portion of which, as in the Kjellin furnace, may be left in after each operation to start the current for the next run, and B B are the water-cooled steel terminals. On account of the low resistivity of molten steel, the trough or canal containing it should be of great length and small cross section, in order to avoid the use of excessively large currents. This was advisable in the Kjellin furnace, but it is even more necessary in the Gin furnace, because the current must be developed in a transformer and led to the furnace by cables, all of which are more expensive, for equal power, as the current is larger in amount, and the transformer and cable losses are also very large with enormous currents at low voltage. In the Gin furnace the trough A is consequently made long and narrow and, in order to secure compactness, with attendant economy of heat, it is folded backwards and forwards, like the filament in an incandescent lamp, the ends, BB, being brought to the same end of the furnace.

For convenience in repairing the hearth, it is mounted on a carriage which stands in a furnace consisting of three walls and an arched roof, the fourth side being closed during the working of the furnace by a movable door. H is one of the two spouts through the roof for introducing molten pig iron. The pig iron can be converted into steel by dilution with scrap steel or by additions of iron ore, as in the Héroult furnace. When molten pig iron is employed there is no need to leave any steel in the furnace from the previous run. The steel is tapped from the furnace by means of the spout K, three channels, one from each loop of the canal, leading the steel to the spout. The cables for leading in the current are connected electrically by the bars GG, to the lower part of the water-cooled terminals BB. A 700 kilowatt furnace would have a canal nearly 30′ 0″ long, 9¾″ wide and 19½″ deep; it would contain 8,550 lbs. of steel and would require a current of 60,000 or 70,000 amperes at 15 volts.

The construction and maintenance of the furnace hearth will probably be a matter of considerable difficulty, the adjacent branches of the canal being near together any leak of metal from one to the next would lead to a shortcircuiting of the current and a rapid enlargement of the leak, while the addition of iron ore in the channels will lead to a corrosion of the walls. The best material for the construction of the hearth would probably be chromite, as this is very refractory and only slightly affected by either silicious or irony slags.

The Gin process was not inspected by Dr. Haanel, as the experimental furnace was then dismounted. Mr. Gin gives a full account of his process in Dr. Haanel's Report, and a modified furnace is described in the Electrochemical and Metallurgical Industry, Vol. III., p. 298, but no experimental results are given, so it will be well to suspend judgment. The Gin furnace has, however, been installed at the Plettenberg Works, Westphalia.

Errata.

Page 323. The text refers to the Héroult Ore-Smelting Furnace, Fig. 22.

Page 324. The first column of text refers to the Keller Furnace, Fig. 23.

Page 325. The two foot-notes should be interchanged.

Page 359. Under "Resistivity of Graphitized Coke Powder" for "Red hot & weighed" read "Red hot and weighted."

Under "Restivity of Solid Carbon" the correct values are approximately one half of the figures in the table.

WORLD'S MARCONI STATIONS.

The wireless telegraph stations of the world have been located and catalogued by the Bureau of Equipment of the Navy Department of the United States, and the lists will shortly be published in book form. The number of stations in each country are:—Belgium 1, Denmark 4, Germany 13, France 6, Great Britain and Ireland 43, Holland 8, Spain 4, Portugal 1, Gibraltar 2, Italy 18, Malta 1, Montenegro 1, Norway 1, Austria-Hungary 2, Roumania 2, Russia in Europe 8, Sweden 3, Turkey 6, Argentina 5, Brazil 5, Canada 5, Chili 1, Costa Rica 1, Mexico 2, Panama 2, Uruguay 1, United States 88 (10 of which are located in the United States possessions), Trinidad 1, Tobago 1, Andaman Islands 2, Burma 1, Hong Kong 1, China 5, Hawaii 5, Japan 2, Dutch East India 5, Russia in Asia 1, Egypt 2, Morocco 2, Mozambique 2, and Tripoli 1.

MODERN CONCRETE BRIDGE BUILDING

[We are indebted to our enterprising contemporary, "Engineering" (London, England), for the following valuable particulars of a concrete-steel bridge recently built on the other side of the globe—Queensland, Australasia. In view of the important part cement and concrete are playing in modern structural engineering, we purpose devoting considerable space to this subject henceforth.—Editor.

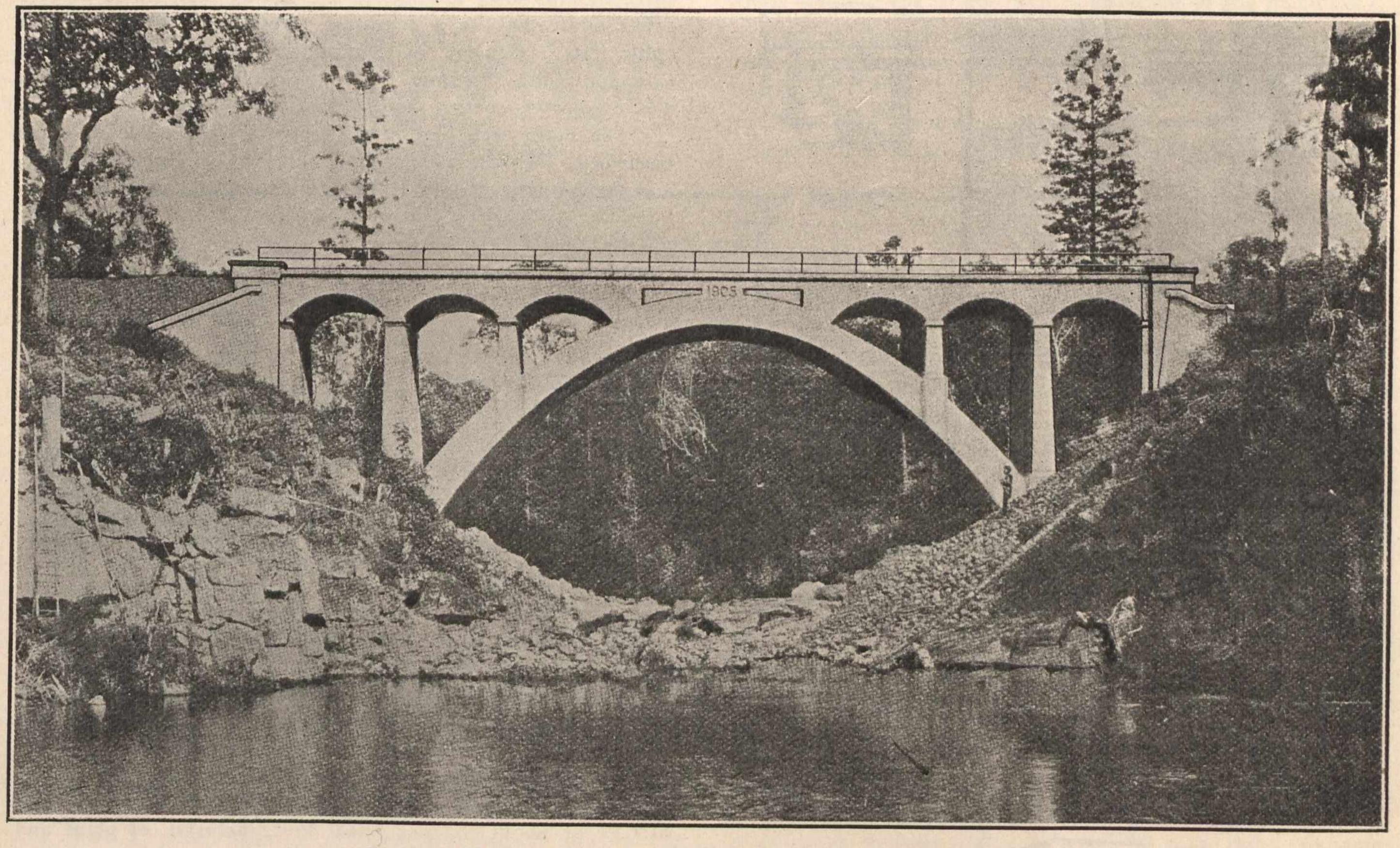


Fig. 1.—Modern Concrete Bridge: Queensland, Australasia.

In accordance with its "closer settlement policy," the State of Queensland, Australasia, has of late been rapidly extending its system of railway lines. From Mungar Junction—154 miles north of Brisbane, on the North Coast Railway—a branch 66½ miles in length runs inland in a westerly direction to a town named Degilbo, and beyond.

The extension of 21 miles beyond Degilbo was undertaken by the State, after the repurchase and cutting up of the Wetheron and Ideraway runs, **for the encouragement of the closer settlement of these districts.** The branch consists of a light railway of 3 ft. 6 in. gauge; rails of 41½ lbs. per yard laid on a firm substratum of earth ballast, the cost per mile being, about $9,700.

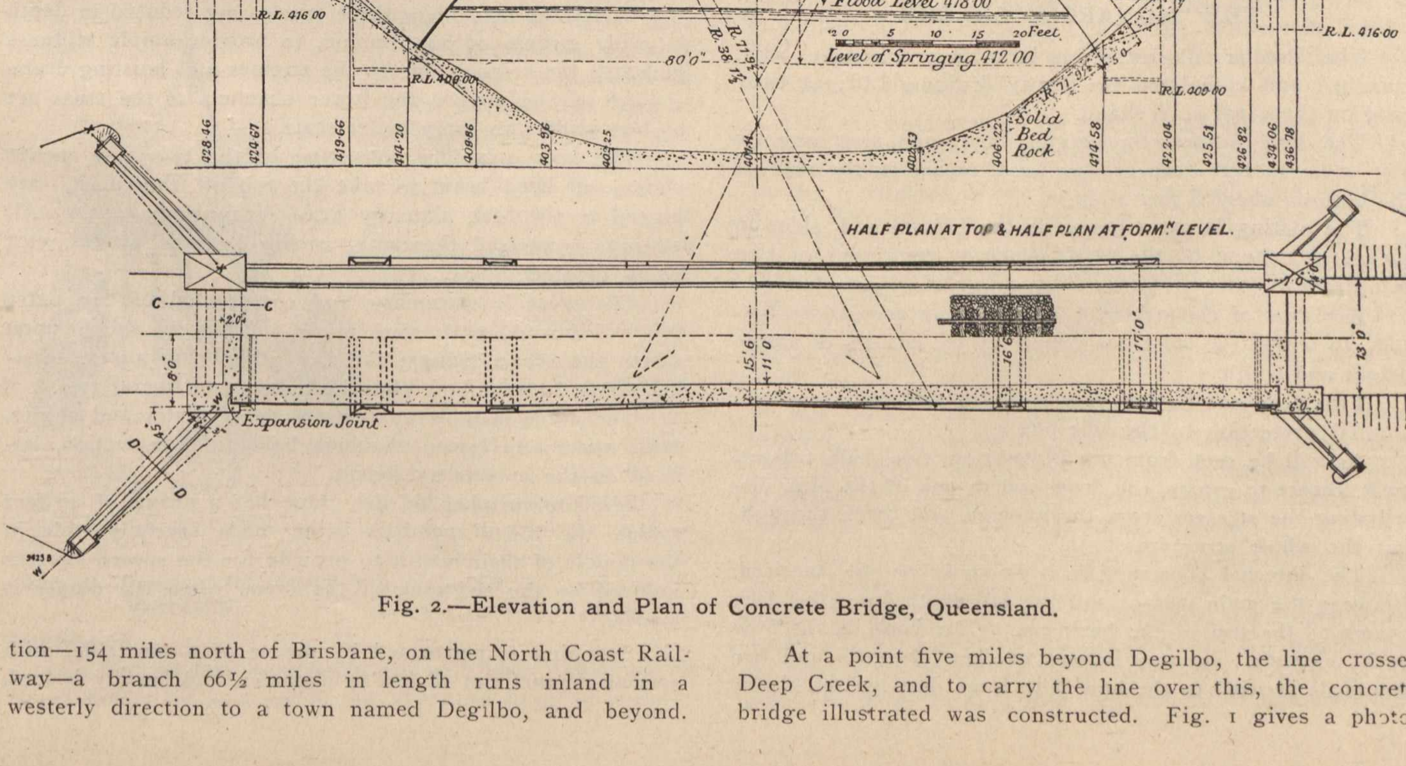


Fig. 2.—Elevation and Plan of Concrete Bridge, Queensland.

At a point five miles beyond Degilbo, the line crosses Deep Creek, and to carry the line over this, the concrete bridge illustrated was constructed. Fig. 1 gives a photographic view of the completed bridge; Fig. 2 shows elevation and plan of the general structure; while Figs. 3 to 5 give drawings of various sections and details, from all of which the design and construction will be clearly understood.

The arch is struck with three circular radii, and approaches the parabolic form. From mere consideration of

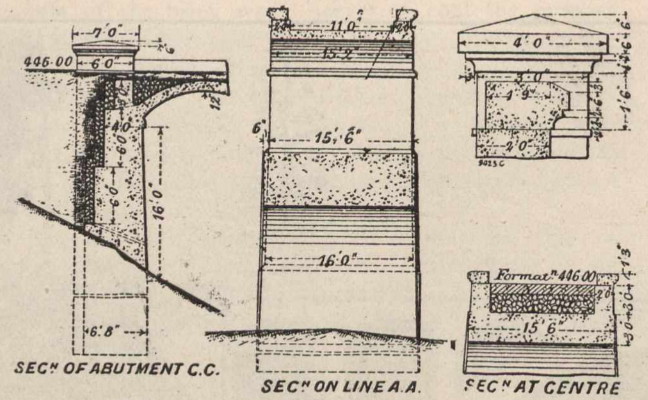


Fig. 3.

the questions of loading, a rather more irregular curve than that adopted would have been the more correct. The calculations were worked out in accordance with Professor Cain's elastic theory. A live load of 1.875 tons per lineal foot of bridge was taken, this being nearly 20 per cent. in excess of the heaviest engine load in use.

The main span is 80′-0″, the arched member being 3′-0″

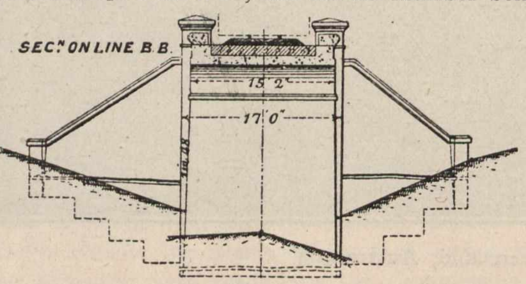


Fig. 4.

thick at the crown, and 5′-0″ at the springings. It has a rise of 28′-0″, and is 15′-6″ in width. The spandril arches are 13′-0″ span, with a rise of 3′-0″, and 12″ thick at the crown. A temperature range of 48° Fahr., was allowed for in the design. The excellence of the material at hand: in the shape of stone, sand, and abundance of water, led to the use of concrete. A comparative estimate for reinforced work was made, and found to be slightly higher than for simple concrete. The proportions in which the concrete was mixed were 1.3.6.—the stone being broken to 2″ gauge. Tests blocks 9″ cubes of concrete, mixed in the same proportions as that used in the construction, on being subjected three months after mixing, to a crushing test, failed at 95½ tons: equivalent to a crushing strength of 170 tons per cubic foot. Cement of Australian manufacture, by the Commonwealth Portland Cement Co., Ltd. (Union Brand), was employed, costing $19.40 per ton, delivered at the site.

The main arch centreing supports were made of local hardwood, the bracings of bush timber of light scantling, and the lagging of 9″ x 2″ hardwood planks, cut at a neighboring sawmill. Much of this timber was used over again in the construction of other bridges, drains, etc., on other portions of this line.

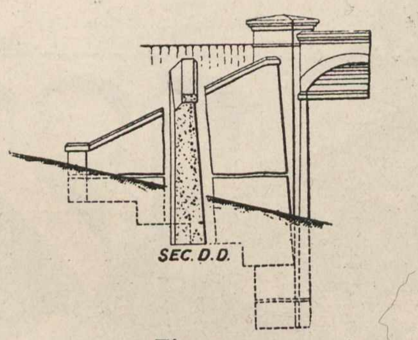


Fig. 5.

The main arch was allowed to set one month after its completion before the centres were struck. Levels taken after striking showed no deflection; neither was any deflection observed when running traffic over the bridge.

The work took seven months to complete, and cost $10636, or about $82 per lineal foot, inclusive of plant and supervision. The average cost of all concrete, amounting to a total of 860 cubic yards, came out at $10.98 per cubic yard. The rock excavation cost $2.09 per cubic yard. Rates of wages were as follows:—Laborers, $1.56; carpenters, $2.04 to $2.40 and $2.52 per diem of eight hours.

The bridge was designed and constructed under the supervision of Mr. W. Pagan, Chief Engineer of the Government Railways of Queensland, whom we congratulate upon this excellent example of modern bridge building.

DREDGE BUILDING AT WELLAND

By Robert L. Hamilton.

THE "MONARCH" DREDGE.

The dredge illustrated is the first of two built, launched and completed by Beatty & Sons, Ltd., at their yard on the canal at Welland.

The hull is steel throughout, being 100 feet long, 36 feet wide, 10 feet deep at bow, and, owing to the rake of the bottom, about 8 feet at stern.

The plating is extra heavy on the bottom and sides in the neighborhood of the bow, which is composed of two ⅞″ plates.

Keelsons of channels and I beams run across the bottom, to which the sides are connected by gussets of ample height and width.

Two deep oak fenders traverse each side, affording substantial protection to the side plating.

As will be seen from the illustration, two main trusses, 29 ft. centre to centre, run from end to end of the hull, distributing the stresses from the anchors and crane throughout the whole structure.

The internal construction is specially to be noticed. Between the main trusses and the full depth from the deck beams to the top of the keelsons, as far back as the bow deck extends, are two trusses of deep channels and bar diagonals secured to the bow with large deep gusset plates.

Under the machinery these trusses are reduced in depth to wide girders of box section, to provide ample stiffness and take the stresses due to the engines and hoisting drum.

Aft of the engine, the lower channels of the truss act as box girders to carry boiler seats.

The bow structure consisting of the two bow anchor slides and head beam to take the top of the mast, are braced to the bow plate by heavy channel diagonals. All castings connected therewith. anchor keepers, hinges, etc., being of steel.

The mast is stationary, and constructed of two extra heavy I beams, with steel upper and lower ends, upon which the crane swings; the foot step being a steel casting secured to the bow plate by a flange of liberal area.

The crane is built up throughout of plates and angles, both upper and lower members being of box section, latticed on the outside as shown.

The top member of the crane has a swing of 40 feet radius, the lower members being made specially wide in the middle of their length to provide for the severe stresses induced by the swinging of the crane when the dipper is loaded.

Swinging is performed by means of a turntable, with special channel rim 18 feet in diameter, and heavily braced.

The dipper handle is 50 feet long, each timber being plated on four sides, and provided with steel racks. Dippers of 3 and 5 yards capacity are provided.

Timber bow anchors 35x35" sides and 50'-0" long, protected by steel strips with sheaves at top and bottom can be seen in the picture.

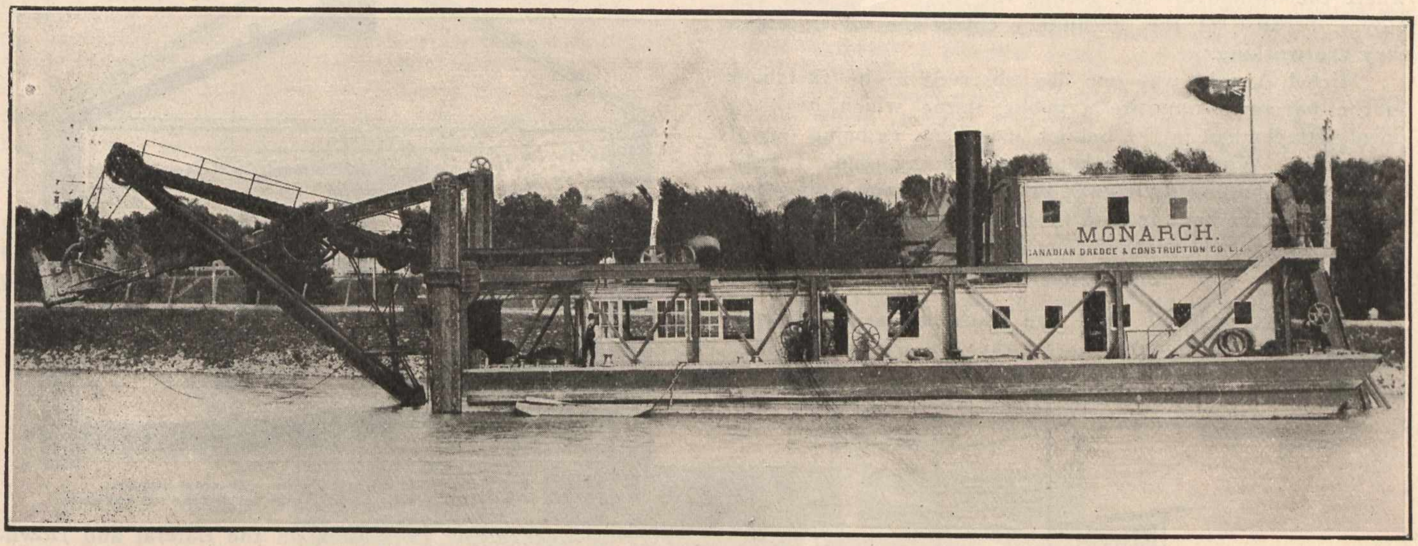
A pair of engines with cylinders 15" diameter and 15" stroke, of extra heavy type, are provided for the hoisting, which is done on a grooved taper drum, with a 1¾" crucible cast steel wire rope. This is driven from the 8'-0" main gear by a friction belt secured thereto, the belt being attached to the drum flange by means of a toggle, actuated by a steam ram on the main shaft bearing.

The after hand wheel operates a brake belt to hold the drum rope and anchor in place, and a special engine drives the capstan treads shown forward, while a two-cylinder reversing, compound geared engine, is used for swinging.

The levers are set close to the front end of the machinery cabin, thus giving the engineer a clear view of the whole front of the dredge and full control of the machinery.

Ample steam capacity is provided by a scotch marine boiler, 9'-0" diameter and 11'-0" long, designed to carry 125 lbs. steam pessure.

The stern anchor is used to move ahead, being provided with a rack. A special self-contained reversing en-



The "Monarch" Dredge. Built by Beatty & Sons, Ltd., Welland, Ont.

Handling the bow anchors for pinning up the dredge, etc., demands very powerful gearing.

The 2" steel cable is endless, winding off and on the drum, one end forward over the top of the anchor; the other forward and down round the sheave at the foot: being fastened with the adjusting bolts to the anchor keepers.

The anchor rope drums are driven from the main engine by means of a line shaft; an extra wide friction belt taking the motion from the drum gear.

This belt is actuated by a toggle worked from the forward hand wheel on the stand outside the machinery cabin.

gine, set on deck, operating it through a set of steel gears.

Electric lights are used throughout: the electrical energy being derived from a special 16 c. p. light dynamo and engine combined.

The crews quarters are fitted with bath-room wash basins, hot and cold water taps, also lavatories having all the best fittings and latest plumbing.

The "Monarch" has been working at Midland in the Georgian Bay district, for some months past, making a splendid record, digging in the worst kind of hard pan, and proving satisfactory in every respect.

A HETERODOX VIEW OF VENTILATION

By the Editor.

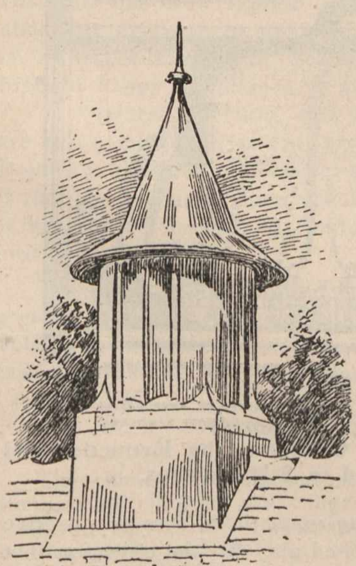


Fig. 1.—Patent "Air Pump" Ventilator.

It is no uncommon thing, even in these days of enlightenment, to hear "ventilating engineers"—so called, declare, that because carbonic acid gas is 52% heavier than air, that, therefore, ventilation in a room should be by a downward current, and not an upward one. Believing this theory to be based on an altogether erroneous induction from the observed facts of nature, and its practical application in the ventilation of schools, offices and factories a prolific cause of ill-health, we propose to show (1) wherein the down-draft system is wrong, and (2) to set forth what we conceive to be a rational system of ventilation.

So that we may not be charged with Quixotically tilting at windmills we have taken the following from an authoritative article in "Technics," vol. 1, p. 285, written by W. W. F. Pullen, A.M.I.C.E., M.I.Mech.E., Whitworth Scholar, and entitled "The Heating and Ventilation of an Educational Building." He says:—

> In the best system for heating and ventilating by hot air, the heated air is propelled into the room through a large grating eight or nine feet from the floor. (See Fig. 2.) The grating is situated in one of the inner walls, and preferably in the one opposite to the outer wall and containing the windows. The hot air tends to move slowly across the room, and on reaching the wall becomes slightly cooler and descends towards the floor. It then steadily returns to the outlet grating, which is at the floor level, and in the same wall as the inlet grating, after leaving the room, the air passes up flues in the walls into the atmosphere above the roof.

On sight, the mechanical system described, seems reasonable; and if it were intended for empty rooms might work very well. But introduce human beings into the room, as shown in Fig. 3, and the system becomes almost criminal, in its violation of the laws of hygiene.

Had the inventors searched the whole realm of ideas for a system designed to hinder the mental processes, by artificially inducing drowsiness, languor, and stupidity they could not have achieved greater success. No wonder public school teachers have to be incessantly poking up their pupils to keep them awake. No wonder draughtsmen doze over their drawing boards, and artisans move languidly at their work: subjected as they are day by day to an atmospheric bath of vitiated, polluted air.

The famous authority on hygiene, Dr. Parkes, has well said, that

> Statistical enquiries prove beyond a doubt that, of the causes of death which are usually in action, impurity of the air is the most important.

And since self-preservation is the first law of nature, it is manifestly **instinct** which impels the young to "watch the clock," and crave fretfully over their books for a breath of "fresh" air.

There are thousands of offices and factories to-day where the owners are not getting the best out of their employes, because of the unsanitary conditions under which they are working.

Michel Angelo was one day observed to be sketching on the pavement opposite a public statue which he had openly condemned in the School of Athens, as being out of proportion. When asked what he was doing, said, "I criticize, not by finding fault only, but by doing something better." So far we have treated the subject negatively, we now proceed to show—

The Better Way.

The popular belief that the carbonic acid gas and organic impurities contained in the watery vapours dis-

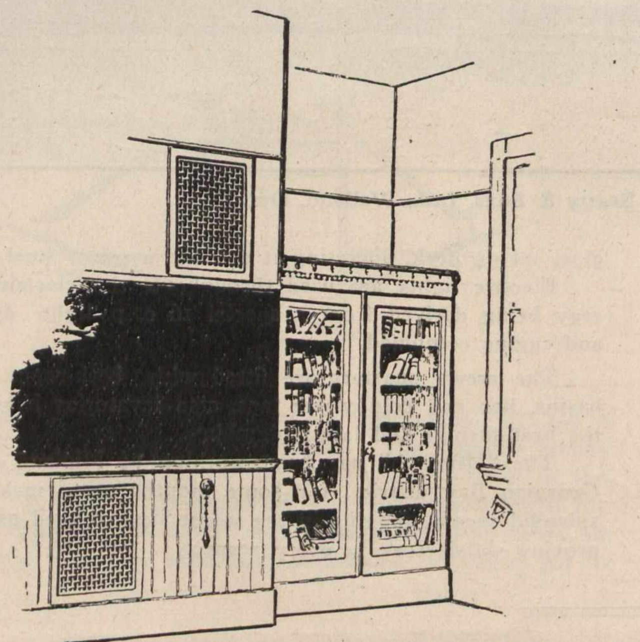


Fig. 2.—"Mechanical" System of Ventilation.

charged from human lungs in an occupied room, descend naturally toward the floor—due to being heavier than air—is refuted by the experience of every smoker who has seen the blue smoke from his pipe curling up towards the ceiling. It is a scientific fact, that air discharged from human lungs is, at the moment of exhalation, equal in weight to pure air at a temperature of 90° Fahr. Until these products of respiration have parted with so much heat as to become heavier than pure air at this temperature, they will ascend, not descend, in a normally pure atmosphere.

In making the foregoing statement of facts, we are sure of our ground, and, hence, affirm that the only rational method of ventilating an occupied room or building is by introducing fresh air in near the floor, and letting the foul air out near the ceiling—as shown in Fig. 4.

This method is not new, for it was propounded more than fifty years ago by Robert Boyle—the co-worker with Professor Michael Farraday—the founder of modern electrical science, and has been perfected into a complete scientific system by his lineal descendants. Yet in spite of the eminence of the inventor; and notwithstanding the convincing logic of the arguments in its favor, backed by the beneficial results which have accrued wherever the Boyle system has been applied, we see the opposite system being installed by architects and engineers on every hand. Truly some superstitions die hard.

Boyle's contribution to the science of ventilation was principally his invention of the unique "air pump" ventilator, shown in Figs. 1, 4 and 5:—

> It consists of an arrangement of metal plates at certain angles enclosing a central chamber, from which the air is exhausted through a series of protected openings, by the movement of the external air through annular spaces and deflected across the openings at given angles in a compressed form, creating an induced current and also a partial

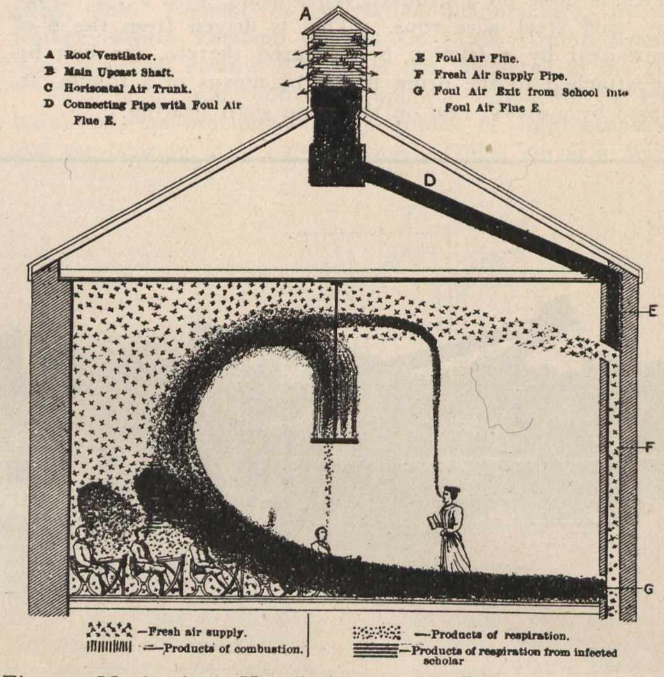


Fig. 3.—Mechanical Ventilation on the Lateral and Downward Principle, by Impulsion, as Applied to a School.

> vacuum by exhausting the air from the top of the shaft. The foul air of the room being ventilated immediately ascends the shaft to take the place of the air exhausted, a continuous and powerful upward current being maintained.
>
> It is not a rule-of-thumb device, made to depend upon wind currents, but is constructed on sound scientific principles and operates in strict accordance with nature's laws. The different parts are so nicely adjusted, that the gentlest

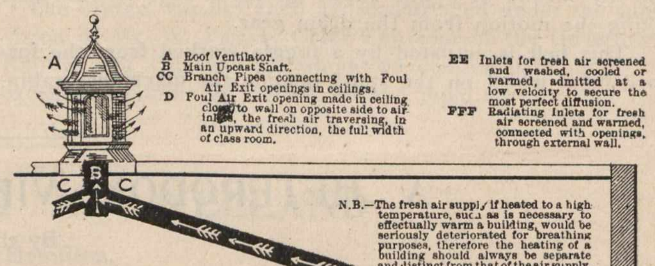


Fig. 4.—Natural System of Ventilation by Extraction and Diffusion, Applied to School-rooms.

> movement of the air impinging upon them, acts as a motive power for exhausting the vitiated air. To the objection that such a device must be ineffective in a "still" atmosphere, we cannot do better than quote Dr. Parkes again:—
>
> Incessant movement of the air is a law of nature; we have only to allow the air in our cities and dwellings to take share in this constant change, and ventilation will go on uninterruptedly without our care. In this country (Eng-

land) and, indeed, in most countries, even comparative quiescence of the air for more than a few hours is scarcely known. Air is called 'still' when it is really moving one or one-and-a-half miles an hour. Advantage, therefore, can be taken of this aspirating power of the wind to cause a movement of the air up a tube.

In mechanical engineering, few names stand higher than that of Professor Macquorn Rankin. After twelve months testing, he says:—

There is no time throughout the whole year, but when there is a sufficient movement in the atmosphere to cause the "air pump" ventilator to act.

And Lord Kelvin reports:—

I have seen several different forms of Mr. Boyle's "air pump" ventilator in actual operation, and have much pleasure in testifying to their efficiency. They thoroughly realize the favorable anticipations which I formed from experiments on models shown to me by Mr. Boyle.

We thus see that not only should the ventilation of rooms be produced by an upward current, but that science has provided an effective natural appliance by which this can be done with complete success.

That the German Houses of Parliament, Berlin; British Houses of Parliament, London; and capitol at Washington, U.S.A., are fitted with the "natural" system of ventilation is evidence that it is worthy of serious investigation by every engineer and architect in Canada. Interesting is the fact, that after two years' trial of a costly "mechanical" system of down-draft ventilation in the German Parliament it was thrown out, and a "natural" upward current system installed in place thereof.

We understand that the "Boyle" system of ventilation (natural) has been applied to over 100,000 buildings. The abundant evidence in our possession goes to show that it is in accordance with Science, common sense, and has brought happy experience to all who have tried it.

If "natural selection" and the "survival of the fittest" are the dominant forces in evolution, then this system of Boyle's is destined to become universal. All that is needed is that the principles upon which it is based be made known. It has carried health and comfort wherever it has been put into operation.

Inasmuch as the children in our public schools are the greatest sufferers, from the "sins of ignorance" of the architects, we conclude with a valuable general statement of the case for schools by the present Mr. Robert Boyle, of London.

Ventilation of Schools.

The efficient ventilation of school-rooms where large numbers of children are congregated, for hours together, is of the very first importance. Healthy bodies make healthy minds, and children who pursue their studies in a pure atmosphere, free from draughts and not overheated, make much greater progress than children who are confined in badly ventilated, overheated, and draughty rooms.

The greatest care should be taken to prevent down-draughts in cold weather, such as proceed from the adjustable ventilators, which are commonly fixed in the upper parts of the windows, and which permit a large body of cold air to blow directly into the class-rooms and descend upon the heads of the children, cooling and returning the expired and vitiated air to be re-breathed. This is one of the most pernicious forms of ventilation that could be employed in cold weather, and is not only a source of discomfort to the children and the teachers, but is a prolific cause of illness and disease.

When windows are utilized for the admission of air, it should enter through protected openings at the lower parts and be deflected upwards. This will not only minimise draughts but will ensure more complete diffusion.

A still safer and more satisfactory method of admitting air in cold weather is the employment of air inlet brackets or tubes (Fig. 4) fixed round the walls at suitable distances from each other and fitted with regulating valves to control the supply. The velocity of the air should not exceed 2'-0" per second if draughts are to be avoided. Ventilating radiators placed in the window recesses not only heat the room but admit a plentiful supply of fresh air warmed to a healthy temperature.

Hot air should never be used for the purposes of ventilation, which is only employed to heat the room, as air raised to a temperature such as is required to effectively heat a building is thereby greatly deteriorated, the oxygen being to a certain extent destroyed and the bracing and tonic qualities of the air reduced.

The authorities on the subject are unanimous in condemning this method of heating as undesirable and injurious to health.

Radiant heat is the healthiest form of heating, as with it the walls can be more effectually warmed than with hot air, and the fresh air supply raised to a comfortable temperature without in the slightest degree injuring it. In warm weather window openings may safely be employed to supplement the ventilation, as there is then not the same danger from draughts as in the winter, when special ventilating arrangements are most required and are, indeed, an absolute necessity.

When the temperature of the air in a class-room is 60° to 65° F., the air is expelled from the lungs at a temperature of from 85° to 90° F., and along with the heated exhalations from the body ascends with considerable velocity to the upper parts of the room from whence it should be drawn off and not permitted to return to be reinhaled.

The extraction should, therefore, always be from above, which can easily be affected by the utilization of the natural forces which are always at work, through the never ceasing movement which exists in the atmosphere, and without the aid of costly mechanical appliances, which are quite unnecessary, and which have not been found in actual practice to be so efficient or reliable as natural ventilation when properly applied. Great care should, however, be taken in the selection of ventilators, as much depends upon their correct construction. The most dangerous form of ventilation is where the air is admitted at the higher parts of the room and forced downwards by mechanical propulsion, as the ascending vitiated air is thereby returned—in opposition to the laws of nature, which govern ventilation—to be re-inhaled along with the products of combustion and other deleterious matter contained in the air. A high authority justly describes this method of ventilation as "a standing menace to the health of society." When fans are employed for the extraction of the foul air, intolerable draughts are set up: they are, therefore, not to be recommended.

In a subsequent issue we intend giving a practical exposition of this important subject; accompanied by graphic illustrations of how to heat and ventilate a home, and a drawing office in a dusty city.

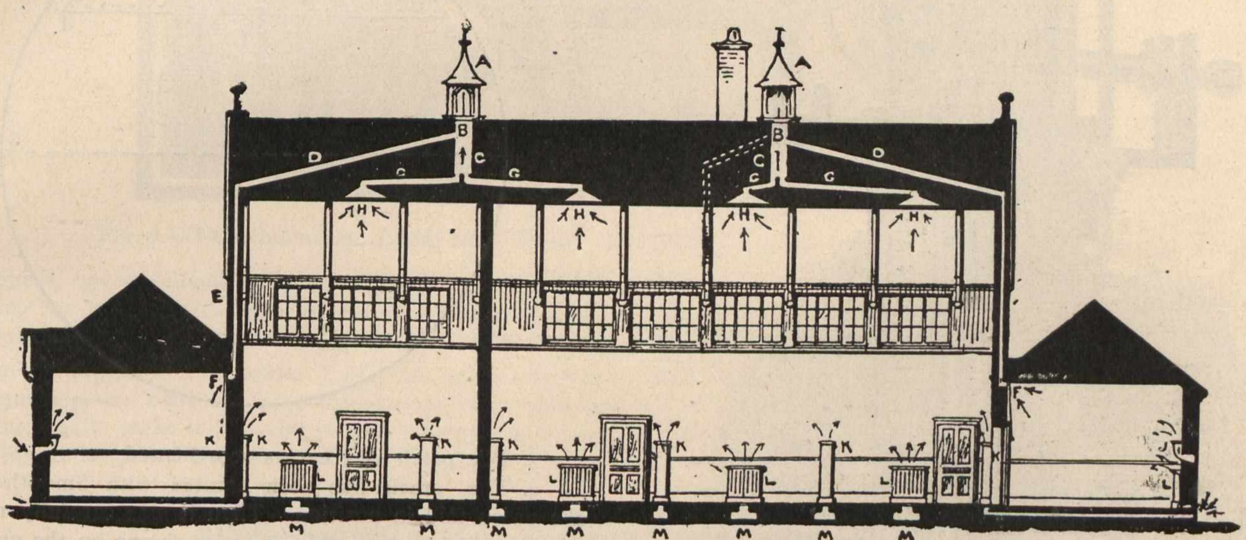
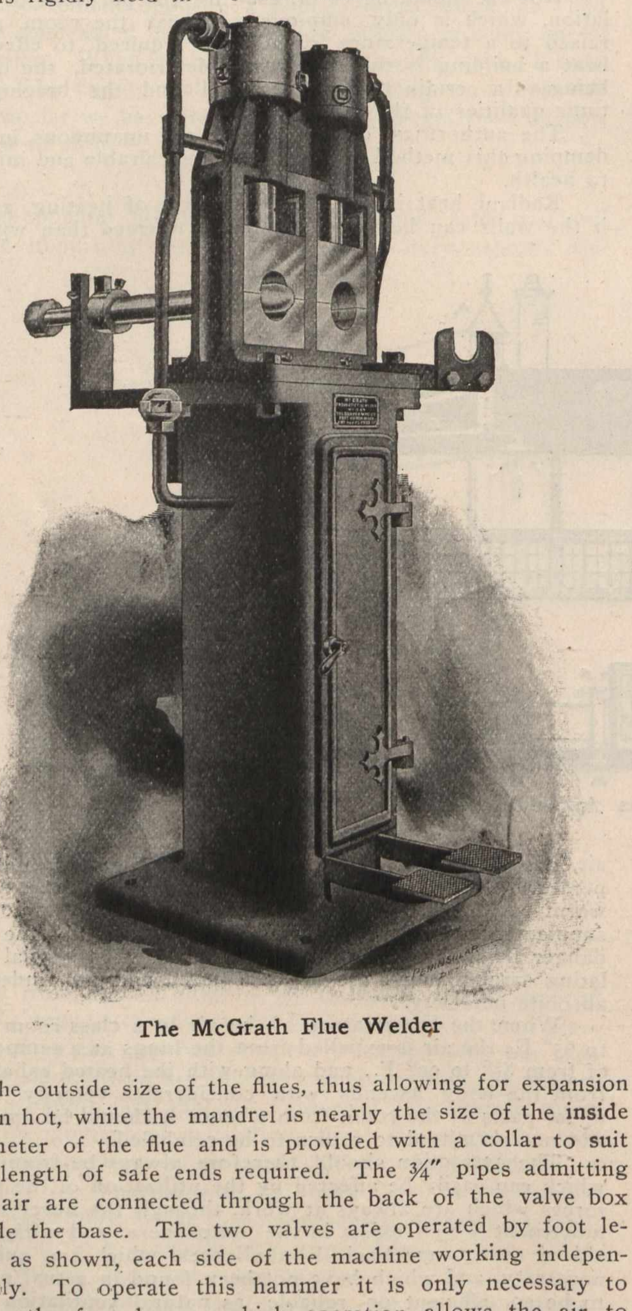


Fig. 5.—The "Boyle" System of Ventilation as Applied to a School with Central Hall.

PNEUMATIC FLUE WELDING.

The pneumatic flue welder, which we are enabled to illustrate through the courtesy of the Draper Manufacturing Co., Port Huron, Michigan, was designed to expedite and lessen the cost of welding and swadging locomotive boiler flues. The machine consists of a double cylinder pneumatic hammer, set on a base occupying less than two feet square of floor space, and standing about 4'-6" high. The pistons are 3 1-16" at their largest diameter, made of solid tool steel and hardened and ground to fit the cylinder. They are tapered 6° on each side, being parallel to the cylinder sides for 1½". Below the head, they are shouldered down to 2⅝". The lower end is attached to the top die and is held with a key. The lower die is rigidly held in the steel frame. The dies are bored



The McGrath Flue Welder

to the outside size of the flues, thus allowing for expansion when hot, while the mandrel is nearly the size of the inside diameter of the flue and is provided with a collar to suit the length of safe ends required. The ¾" pipes admitting the air are connected through the back of the valve box inside the base. The two valves are operated by foot levers as shown, each side of the machine working independently. To operate this hammer it is only necessary to press the foot levers, which operation allows the air to exert pressure under the shoulder of the piston, thus forcing it up. When the piston is up it pushes back the small valves, which project into the cylinder, thus admitting air above the piston, and as its area is larger than below the shoulder, it is pushed down until the dies come together. The exhaust occurs through the small holes, shown in the piston, as soon as they come below the cylinder. Immediately after the blow is delivered the piston is again carried up by the air pressure, which is always under the shoulder when the foot-valve is open. The piston will deliver 2,000 or more blows per minute, with 100 lbs. pressure, and as the top die and piston together weigh about 40 lbs., the hammer will strike upwards of 40 blows per second, which is amply sufficient to weld flues. It is claimed that a tube can be welded and swadged in five seconds. The machine will weld flues up to 4½" diameter, and there is no practical limit to the length of ends that may be welded. This machine may have one side equipped for scarfing flues, if desired.

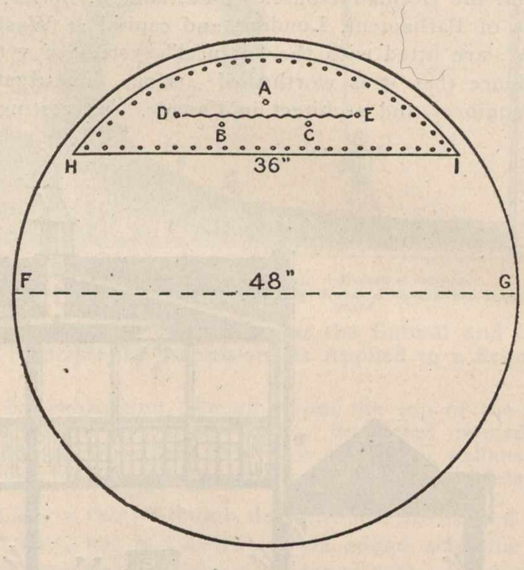
REPAIRING A CRACKED CYLINDER.

The method for repairing a cracked cylinder head as herein described was brought to our notice recently by the Smooth-On Manufacturing Co., of Jersey City, N. J.

The repair was made as follows:

1. While the cylinder was hot a partial vacuum was created in it and Smooth-On Elastic Cement was painted over the crack. The vacuum drew the cement in and this operation was continued until the crack would take up no more cement.

2. Holes were then drilled and tapped at the end of the crack, D and E. and bolts put in to prevent a further extension of the crack.



3. The patch was cut as represented.

4. The crack was then painted with Smooth-On and the patch laid in position. Then it was carefully removed. The imprint of the crack was now shown on the under side of the patch—the Smooth-On sticking to it. The patch was then dished along the line of the imprint to make a recess to hold sufficient cement.

5. The plate was then warmed, and a compound composed of Smooth-On Iron Cement No. 1 and Smooth-On Elastic Cement, mixed half and half, applied to the warm plate with a small trowel, making a thin, even coating.

6. Then the patch was laid in position. The three centre bolts, A, B and C, nearest the crack were brought up (just taut). Then the outside bolts were brought up tight as possible, which forced the cement into the crack. The steam was turned on and the crack was tight.

A SUBSTITUTE FOR CELLULOID.

A discovery of a complete substitute for celluloid, which is not yet patented nor on the market, it is stated overcomes all shortcomings, while retaining all the desirable qualities of celluloid.

The substitute is but little dearer than glass, which is much cheaper than celluloid, and of about the same weight. The new material is very elastic, absolutely non-inflammable, and very easy to work by the turner. By a simple method a lasting polish can be put on all articles made from it, which is a great advantage over celluloid. The material is absolutely without smell. The inventor is a young chemist who has made exhaustive trials of the material with the best results, especially as to durability in heat and permanency of color under sunlight, and in water.

It should be mentioned that the material is a non-conductor of electricity, and can be used for insulation. The invention promises to be of great importance to the whole celluloid industry. Patents have been applied for, and the inventor is sanguine of practical results.

ELECTRIC ARC LAMPS FOR SUBMARINE WORK.

The new Yale submarine lamp, which we are enabled to illustrate through the courtesy of the Electric Marine Manufacturing Co., of New York, has satisfactorily solved the difficulty of securing a powerful electric light, efficient and safe, for use in diving operations. Hitherto a cluster of incandescent lamps has been the only possible method of obtaining light either under water, or in an explosive atmosphere, but the illuminating power of this arrangement has been far from satisfactory. Until the invention of the Yale submarine lamp many efforts had been made to produce an arc lamp for work under water, but no satisfactory high candle power lamp has been constructed, the condition being such as to make it difficult to obtain efficient operation.

Comparatively few persons have ventured to put on the diver's armor, and descend below the surface, consequently an air of mystery has come to enshroud the work of the diver. In the shadow of a ship's hull, an obstruction, or at depths of fifty feet or over, there exists an impenetrable gloom even with fairly clear water, while in the usual dirty harbor the sun's rays never reach the bottom. The Yale submarine lamp enables the diver to explore, or work in a most brilliant, clear light, better than the best average street arc lamp. When in use the diver may carry the lamp by means of the circular guard handle, set it down, or suspend it in a convenient manner directly by the cable, no ropes being required. Its weight under water is only a few pounds—just enough to keep in position in a current or tideway.

An outfit for general use, shown in Fig. 2, gives an idea of its compactness when stowed in chest ready for shipment or instant service. The lamp, submarine cable, switch, connection box, wrenches, spare parts and supplies are all included in one chest. The Yale submarine electric lamp consists of water-tight metallic case enclosing a mechanism and regulator arranged so that when the lamp is submerged it will give forth from the glass chamber at its lower end perfect ease, for it will light up a space the size of a large room, making it as light as day.

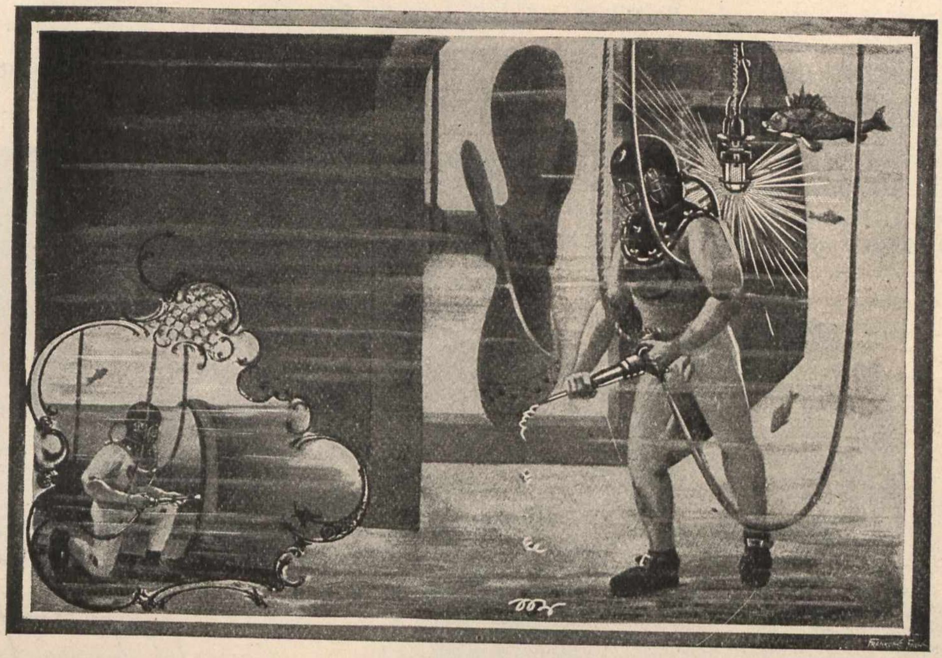


Fig. 1.—Yale Submarine Lamp and 'Boyer" Chipping Hammer Operating 20'-0" Under Water.

Fig. 2.—Submarine Electric Lamp and Accessories: Packed for Transport.

The submarine cable conducting the current to the lamp leads to the surface and thence to a combined junction and switch-plate controlled by the diver's attendant. From this plate connection is made to a neighboring electric circuit, storage battery, or small generator outfit supplying the electric power. Compact, of few parts and simple in operation, these submarine outfits afford means for use aboard ship, about a dockyard, mine, waterworks, engineering construction—in short, wherever a perfect light for use under water or in a gaseous atmosphere is desired.

These lamps can be used, not only for the inspection of dock-gates and harbor work generally, but also for the examination of ship bottoms, and the carrying out of repairs while ships are afloat, which, although small, frequently necessitate the docking of the ship, in order that the work may be done satisfactorily, but which with illumination of the arc lamp just described, could no doubt be effected while the ship is unloading and loading her cargo.

MACHINE SHOP NOTES FROM THE STATES

By Charles S. Gingrich, M. E.

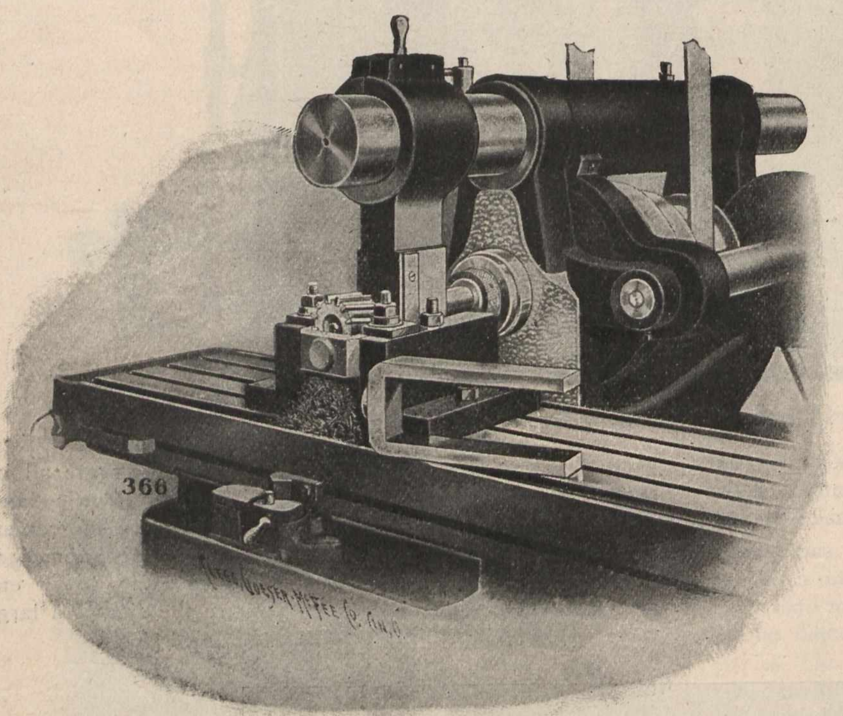
XXX.

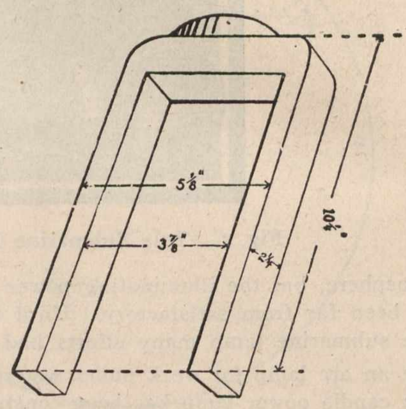
STEAM ENGINE WORK.

Below is shown the last operation of finishing connecting rod straps, the three preceding operations having appeared in former issues. The one shown herewith consists of finishing the inside end of the strap. This is done by a high speed steel cutter with adjustable inserted blades, so that its size can be maintained after grinding. It is held on an extension arbor, and supported from the overhanging arm as shown. The surface finished is approximately 20 sq. in., and removes about ¼″ of metal. The cutter is 3⅞″ diameter. The power vertical feed of the machine (a No. 3 Plain "Cincinnati" Miller) is used, feeding .012″ per turn of cutter.

This operation is completed on 12 straps per hour.

The total time required for the four successive operations, that is, milling the ends, milling the sides, milling the edges, and milling the inside, is 43¾ minutes per strap.





Those who have this sort of work to do, will find the above compares more than favorably with what can be accomplished by the older methods of shaping or slotting, and is only another instance of the advantage of using a modern miller on a great variety of machine shop work.

DETROIT RIVER TUNNEL.

Mr. Mountain, the chief engineer upon the plans of the Detroit River Tunnel Company, which have just been approved by the Canadian Railway Commission, states that it is the most complete tunnel scheme he has ever seen. The project, which is to cost between $7,000,000 and $10,000,000, provides for the construction of two parallel tubes of iron to rest 65 feet below the surface of the water on beds of concrete, and to be flanked by concrete walls. These will give double tracks to enable the Michigan Central and Canada Southern trains to cross beneath the Detroit River.

The tunnel proper is to be 20′-0″ in diameter, and its roof will be 40′-0″ below the water, and the tracks will be laid upon huge beds of cement. The approaches on either side will be 18′-0″ high by 16′-6″ wide, while the width of the portals will be about 60′-0″. The length of the tunnel actually under the river will be 2,625′-0″. On the east side there will be an approach of 3,200′-0″ of tunneling and 3,300′-0″ of half tunneling. The west approach will consist of 2,135′-0″ of tunneling and 1,540′-0″ feet of half tunneling. There will be a 2 per cent. grade on the west side and 1½ per cent. on the east. It is intended to sink the iron tubes in sections, and then rivet them together and pump the water out. The trains running either way through the tunnel will be propelled by electric motors, which will prevent gases from generating and simplify the problem of ventilation. The tunnel will run from the Michigan Central Station at Detroit, cross the river at the old ferry slips, and connect at Windsor with the Canada Southern Railway.

WHOLE TOWN TRAVELS FREE.

The town of Lauenburg, in Schleswig-Holstein, enjoys a privilege which is probably unique in the world—that of free transit by rail to and from the neighboring town of Buchen. As the inhabitants number about 5,500 and the distance is about nine miles, the costliness of the privilege to the railway companies is great.

The queer exemption, according to the London "Globe," dates from 1844, when the Berlin-Hamburg line was built. The Lauenburgers made great sacrifices to secure that the line should touch their town, but the physical difficulties were so great that the engineers abandoned the idea and took it through Buchen, to which town the Danish Government afterward constructed a branch from Lauenburg, giving to the Lauenburgers in perpetuity the right of free transit for themselves and their baggage.

HOW TO IMPROVE TELEPHONY.

A Lecture Delivered Before the Royal Institution, London, England, by W. Duddell.

In my discourse to-night I propose to strictly limit the word "Telephony" to the art by means of which sounds and speech are electrically transmitted to a distance. The loudness and articulation or clearness of the transmitted speech, and the distance over which it can be transmitted, are the main directions in which improvement is required. The questions how Mr. A. in London shall get connected to Mr. B. in Glasgow with a minimum of loss of time and temper, and how to find the number of the person you wish to communicate with when his entry in the directory, in

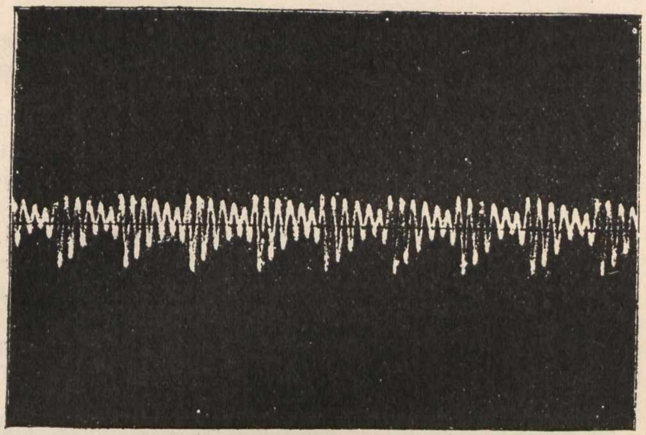


Fig. 1.—Vowel a in Ma.

small type, is sandwiched in between two advertisements, are questions with which I do not propose to deal—not that there is any lack of room for improvement in these directions.

Before proceeding with our subject it will be necessary to consider briefly what constitutes sound, and more especially articulate speech, so as to form a clear idea of what we want to transmit. The sensation of sound, as is well known, is produced by the vibration backwards and forwards of the particles of air about their position of rest, and the character of sound depends on the quickness and the form of the vibrations. Thus, in the case of a musical note, the air particles vibrate in a perfectly regular manner, and the number of complete vibrations in the second,

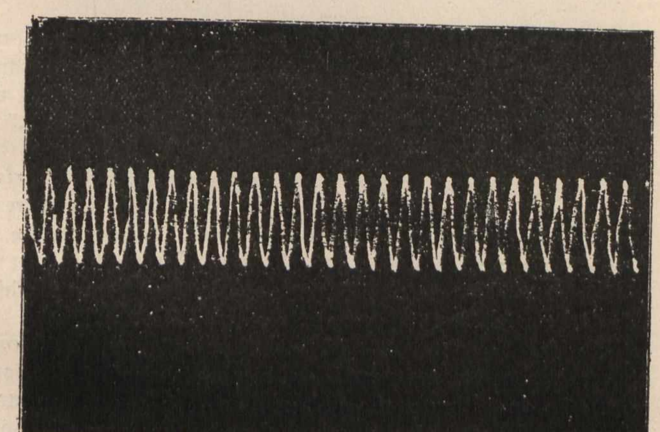


Fig. 2.—Simple Form of oo Sound in Coo.

or the frequency, determines the pitch; and the amplitude, or distance the air particle moves from its position of rest, determines the loudness of the note. In speech, however, the vibrations are very complex, and in order to form any clear mental idea of their character, it is necessary to represent the movements as curves, which I will call sound patterns. Various observers have made records of these patterns; amongst the earliest and best are those obtained by Fleeming Jenkin and Ewing (Edinburgh Phil. Trans.), who magnified the impression obtained on the cylinder of a tin foil phonograph. Figs 1-6 are some typical sound patterns obtained by another method, to be explained later, which illustrate how very complex the movements of the air particles become in the case of speech.

The problem in telephony is the accurate reproduction at a distance of these complex vibrations of the air; the more nearly the movements of the air at the receiving point correspond to those at the transmitting point, the better will be the quality of the telephony. If the movements at the receiving stations are similar in pattern but of less amplitude than those at the transmitting station, then we have simply attenuation of the sound; if, however, the sound pattern at the receiving point is distorted, then loss in articulation takes place. It happens very luckily that the ear has a wonderful power of recognizing the sound pattern even when considerably distorted; if it were not for this latitude, as we may call it, in transmitting our sound pattern, telephony would not be practicable over anything like the distance already attained.

Let us now come back to electric telephony, and examine what takes place between the original air movements and their final reproduction at a distance. The movements of the air are first converted into movements of the diaphragm, which movements are again mechanically transmitted to the carbon grains in a microphone, thus altering its electrical resistance. The varying resistance of the microphone causes the current through it, and the connected transformer to vary, and so induces varying currents in the secondary of the transformer. This secondary is connected to the line, so that the currents are conveyed to the receiver at the distant place. The currents are here transformed into a varying magnetic field which acts on a diaphragm and causes it to vibrate, and thus start the air around it in movement.

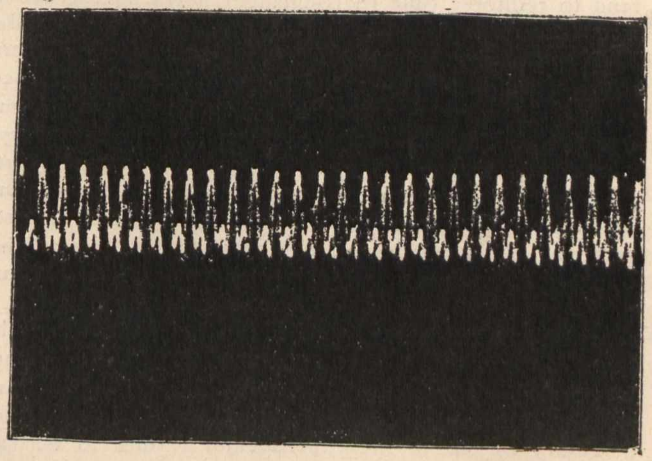


Fig. 3.—Complex form of oo sound in Coo.

In all this long train of transmission and transformations the character of the original sound pattern must be preserved sufficiently well to enable the ear to recognize it in its final form. When we consider that at every one of these steps distortion and loss of energy must take place it is not surprising that there are difficulties in the way of telephony. In fact it is a matter for wonder that electric telephony is possible at all.

Telephony has already reached a very high degree of excellence. How can it be improved? At every step in the long train of transformations we must inquire: What are the losses? What are the distortions introduced? How can we avoid them? Answers to these questions can only be given by systematic accurate measurements and experiments. If one consults the literature on telephony, one is surprised how little quantitative data are available on any given point in comparison with that in any other branches of engineering. Experimenters of late seem to have avoided telephony; dozens of investigations are published on the efficiency of induction motors, and hardly one on the efficiency of telephone induction coils; yet while the former are made in thousands, the latter are made in millions. Telephone engineers are not wholly to blame for this state of affairs: the difficulties of making the measurements and the lack of suitable apparatus have largely contributed to it. In what follows I propose to draw attention to some existing apparatus and methods which can be applied to this purpose.

An investigation has recently been made by Prof. P. E. Shaw on the amplitude of the movement of a telephone diaphragm by means of an extremely sensitive micrometer which he has devised. I will cite one result as showing how extremely small are the quantities with which we have to deal in telephony. He finds that the movement of the diaphragm corresponding to a just comfortably loud impulsive sound is only one twenty-thousandth part of a millimetre, and that something less than one-fiftieth of this is still just audible. The diaphragm has a frequency of vibration of its own which in ordinary receivers may be about 500 complete vibrations per second; it will therefore tend to reinforce (due to resonance) notes having the same frequency as itself—i.e., about the octave above middle C. This leads to the very unpleasant accentuating of certain notes when music is transmitted telephonically. It seems as if this might be overcome by applying some form of damping to the diaphragm, or by making its frequency of vibration very much higher. To test the electrical part of the apparatus, we require some means of measuring small alternating currents of fairly high frequency and also some method of producing these currents. At first sight it would seem comparatively easy to construct an alternator to produce these currents, as the highest frequency does not exceed about 2,000 periods per second, and alternators have been constructed to give very much higher frequencies. The real difficulty is to obtain a machine which will give a strictly sinusoidal current under all conditions. This is necessary to enable the experimental results to be easily compared with theory.

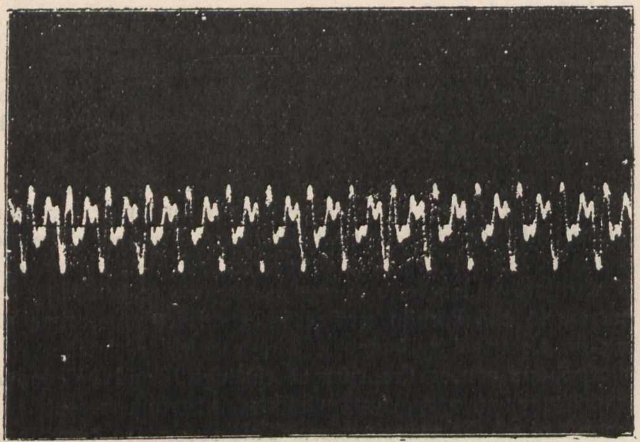


Fig. 4.—Vowel o in Ho.

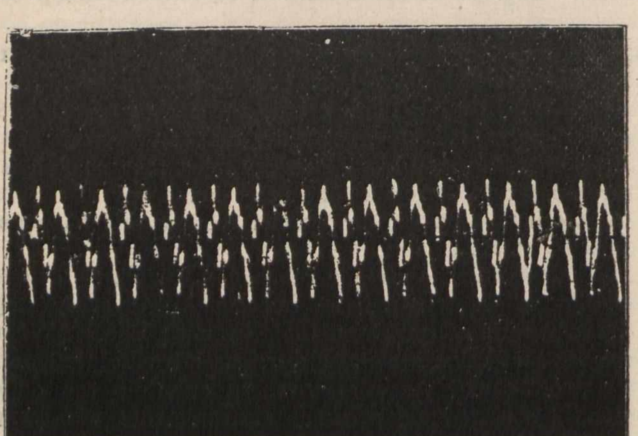


Fig. 5.—Vowel e in Me.

There are other methods of producing high-frequency currents, such as: (1) the humming telephone; (2) the musical arc; (3) the musical vacuum tube, which is produced by shunting a vacuum tube, supplied with high-voltage direct current, with a condenser and self-induction in series in a similar way to the musical arc; (4) the vibrating bar of Mr. Campbell which works in a manner analagous to the electrically maintained tuning-fork, except that the contact is replaced by a small microphone. This latter apparatus gives a very constant frequency and current. Although electromagnetic instruments such as dynamometers have been constructed sufficiently sensitive to measure telephonic currents, the relatively high self-induction of these instruments have prevented their general application. Practically all the instruments which are at present being applied to the measure of high-frequency currents are thermal instruments, that is to say, they depend for their action on the heating produced by the current when it flows through a suitable small high-resistance conductor. These instruments may be broadly divided into three classes, according to whether the rise in temperature of the conductor and consequently the current is measured by (1) the expansion of the conductor; (2) the change in its resistance; (3) the E.M.F. of a thermocouple either forming part of or near to the heated conductor. The first method—viz., the use of the expansion of the conductor as a measure of the current—has not up to the present lent itself to the production of very sensitive instruments. The second and third methods above have each given instruments of high sensibility such as the "barretter" employed by Dr. Kennelly, and the thermogalvanometer. From the point of view of ultimate sensibility there is very little choice between these two instruments, but the simplicity and ease of standardisation of the thermo-galvanometer make it the more convenient in practice.

Some very interesting results have been obtained by Dr. H. V. Hayes on the attenuation of the current through cables and long overhead lines, and on the improvement that can be obtained by adding self-induction to the line. These experimental results amply bear out the theoretical conclusions of Heaviside as to the great advantage of increasing the self-induction, or "loading" the line for long-distance transmission. The great importance of avoiding reflection of the current at the terminal apparatus, and the means of reducing it by the use of a "terminal taper," is also very clearly shown. It is greatly to be hoped that these investigations will be actively pursued, and a satisfactory design of loading coil will be developed, as increasing the self-induction of the circuit gives great promise of successfully increasing the length (now limited to about 50 miles) of subterranean or submarine cable through which telephony can be commercially accomplished.

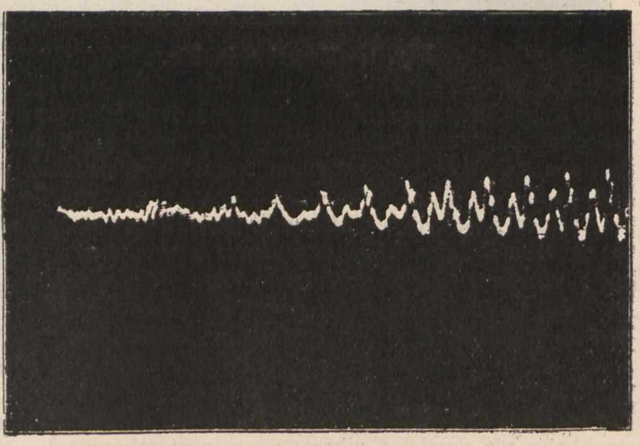


Fig. 6.—K and First Part of e in Key.

So far the methods of measurement dealt with only give the root-mean-squared or heating value of the current. To investigate the distortion in the sound pattern when translated into a varying electric current as it flows along the line and through the different pieces of apparatus, we require to be able to record the current at every instant and also at two or more points in the circuit. This can be easily accomplished by means of an oscillograph, and the sound patterns given at the commencement of this discourse were thus recorded. Mr. A. Blondel, and the engineer-in-chief of the Post Office, Mr. Gavey, have published many results obtained in this way.

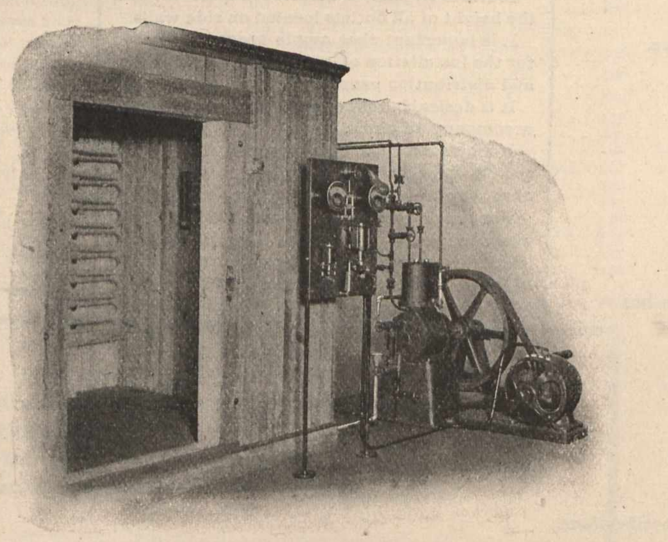
A most complete insight into the distortion produced by different parts of the apparatus and line can be obtained by gearing small mirrors to both the transmitter and receiver diaphragms, so that records can be obtained simultaneously of the movement of the transmitter diaphragm, the current flowing into the line or cable, the current flowing out of the line, and the movement of the receiver diaphragm.

[With the above apparatus the effects produced by resistance, capacity, and self-induction, both separately and in combination, and also distributed, in the form of an artificial cable, were demonstrated at the discourse.] There still remains much work to be done in devising new methods of measurement, and in improving the present apparatus; nevertheless the existing methods and apparatus are already sufficiently perfect to enable a large number of investigations to be successfully undertaken.

If the necessarily brief reference to the complex problems of telephony and the résumé of the methods of measurement available to attack them which I have given to-night should inspire any of our engineers or scientists to undertake systematic quantitative measurements with a view to improving the transmission of sounds and speech, then this discourse will have accomplished its aim, and, I think, justified its title—"How to Improve Telephony."

AUTOMATIC REFRIGERATING MACHINERY.

The automatic system of refrigeration, as designed by the Automatic Refrigeration Co., Hartford, Conn., uses ammonia as the refrigerant. This is an entirely self-controlled system, regulation being effected by a sensitive laminated blade thermostat placed in the refrigerator. By this means a switch controlling the motor that drives the ammonia compressor is opened and closed, as may be required to keep the desired temperature in the cooling boxes; all other automatic devices being dependent upon the operation of the compressor. This system eliminates the cost of skilled attendants. It is made in small sizes, and thus enables persons operating small industries, where the services of a skilled engineer could not be afforded, to have their own refrigerating plant. The general view shown



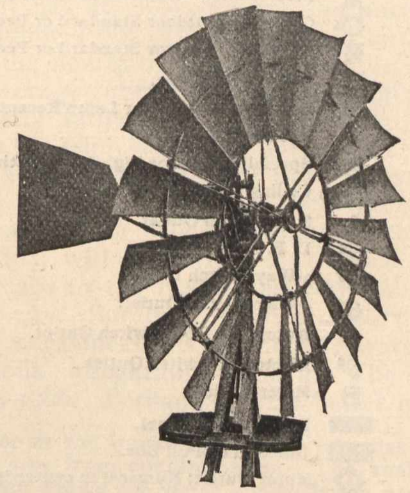
Automatic Refrigerating Plant.

shows the motor, compressor and controlling device, also the interior of a cold storage compartment, in which can be seen the controlling thermostat, and the crisply frosted expansion pipes. By the use of this system a great saving of space is effected, the cooling coils occupying only about 2" of space on the walls of the boxes; ice bunkers are done away with, or converted into cooling boxes, resulting in a saving of about one-third the total space. There is also a natural circulation of air in the boxes, which reduces abnormal humidities and preserves the product in a much better condition than is possible with ice, and there is no accumulation of moisture and filth, such as result when ice is used.

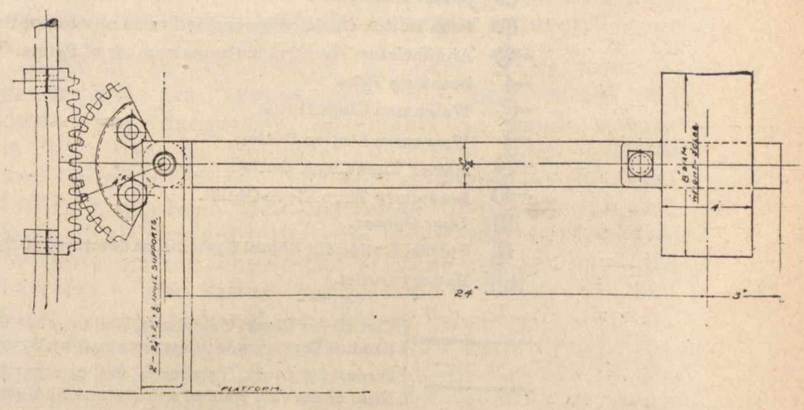
WIND POWER ON BOARD SHIP.

Uncertainty in amount, and the variable speed of the motor itself, are the chief objections to wind power, and, therefore, wind power cannot be included as a resource in the great power situation, even on a small scale. It is probable that the wind may be relied upon in agricultural communities, but for power production on a large scale it cannot be considered important.

There is one place, however, where the windmill may be used to advantage, and this is on board sea-going sailing vessel, not equipped with steam or gasoline engines. The Howell Bilge Pump Company, of New York, are manufacturing a windmill and bilge pump for use on such vessels, and the first one to be installed was placed on the barge "Pacific," owned by P. Dougherty and Company, Baltimore, Md. Taking into consideration the cost of gasoline pumps, the windmill pump has the advantage, as the first cost is



only half, or even less than half the cost of the former. Again the windmill costs nothing to operate, and requires no attention, with the exception of lubrication. Another very desirable feature is the absence of vibration and noise which accompanies the gasoline engine, making it impossible for the officers or crew to obtain sleep where the engine is located near the sleeping quarters. With a windmill driven pump there is absolute safety, as there are no complicated parts to get out of order, and with a little care it will not need any repairs for years. The windmill illustrated is so arranged as to be self-trimming, and being fitted with a rudder, always remains head to the wind. It is so constructed, that if struck by a squall it will luff up into



the wind, and cease to revolve. By the use of the windmill bilge pump the danger which attends the use of gasoline is eliminated, and time spent in securing and storing same is saved. The smallest outfit made will raise 1,500 to 5,000 gallons per day, according to the velocity of the wind, and will operate with a four-mile breeze. The device is absolutely automatic, and will last as long as the vessel. The windmill bilge pump is intended for all classes of wooden sea-going vessels, but more particularly for lightships, sailing ships, barks, brigs, schooners, coal, lumber and oil barges, and for houseboats, canal boats and scows.

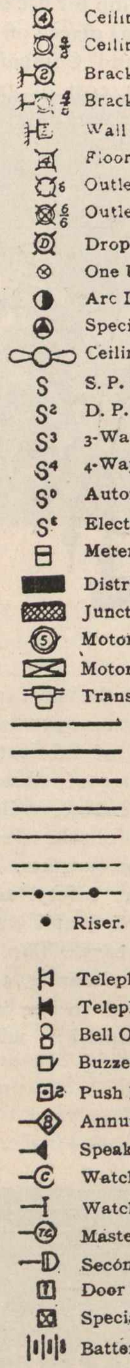
An engineer, with sleeves rolled up, happened to get his arm against the piston rod. He ran for the throttle, shut the engine down, and said to the chief: "The piston rod is hot."

EXTRACTS FROM AN ENGINEER'S NOTE BOOK

STANDARD SYMBOLS FOR WIRING PLANS

AS ADOPTED AND RECOMMENDED BY

THE NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES.



- Ceiling Outlet, Electric only. Numeral in center indicates number of standard 16 C. P. Incandescent Lamps.
- Ceiling Outlet; Combination. $\frac{4}{2}$ indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners.
- Bracket Outlet; Electric only. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.
- Bracket Outlet, Combination. $\frac{4}{2}$ indicates 4-16 C. P. Standard Incandescent Lamps and 2 Gas Burners.
- Wall or Baseboard Receptacle Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.
- Floor Outlet. Numeral in center indicates number of Standard 16 C. P. Incandescent Lamps.
- Outlet for Outdoor Standard or Pedestal; Electric only Numeral indicates number of Stand. 16 C. P. Incan. Lamps.
- Outlet for Outdoor Standard or Pedestal; Combination. $\frac{6}{6}$ indicates 6-16 C. P. Stand. Incan. Lamps; 6 Gas Burners.
- Drop Cord Outlet.
- One Light Outlet, for Lamp Receptacle.
- Arc Lamp Outlet.
- Special Outlet, for Lighting, Heating and Power Current, as described in Specifications.
- Ceiling Fan Outlet.
- S. P. Switch Outlet.
- D. P. Switch Outlet.
- 3-Way Switch Outlet.
- 4-Way Switch Outlet.
- Automatic Door Switch Outlet.
- Electrolier Switch Outlet.

Show as many Symbols as there are Switches. Or in case of a very large group of Switches, indicate number of Switches by a Romin numeral, thus; S^{1} XII; meaning 12 Single Pole Switches.
Describe Type of Switch in Specifications, that is, Flush or Surface Push Button or Snap.

- Meter Outlet.
- Distribution Panel.
- Junction or Pull Box.
- Motor Outlet; Numeral in center indicates Horse Power.
- Motor Control Outlet.
- Transformer.
- Main or Feeder run concealed under Floor.
- Main or Feeder run concealed under Floor above.
- Main or Feeder run exposed.
- Branch Circuit run concealed under Floor.
- Branch Circuit run concealed under Floor above.
- Branch Circuit run exposed.
- Pole Line
- Riser.

- Telephone Outlet; Private Service.
- Telephone Outlet; Public Service.
- Bell Outlet.
- Buzzer Outlet.
- Push Button Outlet; Numeral indicates number of Pushes.
- Annunciator; Numeral indicates number of Points.
- Speaking Tube.
- Watchman Clock Outlet.
- Watchman Station Outlet.
- Master Time Clock Outlet.
- Secondary Time Clock Outlet.
- Door Opener.
- Special Outlet; for Signal Systems, as described in Specifications.
- Battery Outlet.

- Circuit for Clock, Telephone, Bell or other Serviee, run under Floor, concealed. Kind of Service wanted ascertained by Symbol to which line connects.
- Circuit for Clock, Telephone, Bell or other Service, run under Floor above concealed. Kind of Service wanted ascertained by Symbol to which line connects.

NOTE—If other than Standard 16 C. P. Incandescent Lamps are desired, Specifications should describe Capacity of Lamp to be used.

Suggestions in connection with Standard Symbols for Wiring Plans.

Indicate on plan, or describe in specifications, the height of all outlets located on side walls.

It is important that ample space be allowed for the installation of mains, feeders, branches and distribution panels.

It is desirable that a key to the symbols used accompany all plans.

If mains, feeders, branches and distribution panels are shown on the plans, it is desirable that they be designated by letters or numbers.

For the convenience of those making wiring plans the National Electrical Contractors' Association have provided and will furnish sets of marking stamps of these standard symbols. These will be found of great assistance to those preparing wiring plans and will be furnished for $ per set (cost of making) on application to the Secretary, Utica, N. Y

WIRE TABLE.

The following table gives the circular mils of each size wire commonly used in wiring construction:—

Wire No.		Wire No.	
0000 =	211,600 circular mils.	9 =	13,594 circular mils.
000 =	167,805 circular mils.	10 =	10,381 circular mils.
00 =	133,079 circular mils.	11 =	8,234 circular mils.
0 =	105,592 circular mils.	12 =	6,529 circular mils.
1 =	83,694 circular mils.	13 =	5,178 circular mils.
2 =	66,373 circular mils.	14 =	4,106 circular mils.
3 =	52,634 circular mils.	15 =	3,256 circular mils.
4 =	41,742 circular mils.	16 =	2,582 circular mils.
5 =	33,102 circular mils.	17 =	2,048 circular mils.
6 =	26,250 circular mils.	18 =	1,624 circular mils.
7 =	20,816 circular mils.	19 =	1,252 circular mils.
8 =	16,509 circular mils.	20 =	1,021 circular mils.

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ESTABLISHED 1893.

With which is Incorporated

THE CANADIAN MACHINE SHOP

ISSUED MONTHLY IN THE INTERESTS OF THE

CIVIL, MECHANICAL, STRUCTURAL, ELECTRICAL, LOCOMOTIVE, STATIONARY, MARINE, MINING, METALLURGICAL, AND SANITARY ENGINEER, THE SURVEYOR, THE MANUFACTURER, THE CONTRACTOR AND THE MERCHANT IN THE METAL TRADES.

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Editorial matter, cuts, electros, and drawings should be sent whenever possible, by mail, not by express. The publishers do not undertake to pay duty on cuts from abroad. Changes of advertise ments should be in our hands not later than the 10th of preceding month.

Edited by SAMUEL GROVES.

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TORONTO, CANADA, NOVEMBER, 1906.

CONTENTS OF THIS ISSUE.

ANNOUNCEMENTS.

CIVIL ENGINEERS' TOUR.

An inquiry from a well known engineer has just come to our desk, asking if the illustrated account of the Civil Engineers' trip through the North-West can be preserved in pamphlet form. We appreciate the confidence of our friend. What do others think?

BOOK REVIEWS.

Owing to lack of space, we have been unable to review a number of very valuable books which have come to hand recently: on Metallurgy of Iron and Steel Modern Foundry Practice; Wireless Telegraphy; Railroad Construction; Practice of Surveying; Blacksmithing; Stationary Engineering; Machine Drawing and Construction; Field Engineering; Batter Tables, etc. This omission we very much regret, since the reading season is upon us; and some of these works would be profitable text books for our subscribers in the Universities. In December we purpose devoting considerable space to this department of our Journal.

VITAL CITY PROBLEMS: SEWAGE DISPOSAL AND WATER PURIFICATION.

An eminent authority on sanitary science* has recently said that

> The ordinary function of a sewage works is, to produce without nuisance an effluent that itself is not liable to cause a nuisance when mixed with the waters into which it is discharged. . . . . . . ; and that it is the province of a waterworks to purify water taken from rivers.

The City of Toronto in its existing waterworks system does not comply with the last named condition, for it has no provision for the purification of the water pumped out of Lake Ontario and delivered direct into the homes of the people; while if the daring new sewerage scheme of the City Engineer—now before the city fathers—is adopted (which proposes to discharge the triple-screened, untreated sewage into the lake at a point near one of the popular pleasure resorts, and to burn the coarse screenings on the spot), then, altogether new conditions, in the form of water pollution, will be introduced; which will be a constant menace to the health and physical wellbeing of the whole city. Surely, it is not necessary to add to the existing uneasiness about the city water, caused by the serious allegation made in "The Globe" of August 21st, 1906. Perhaps we had better quote:—

> **The water at the intake out in the lake has been kept comparatively free from contamination.. The analysis made from day to day shows the water generally, so near to pure, that it is safe for all domestic uses. Such bacteria as are detected, however, were found on about 40 of the 365 days in 1905 to be due to sewage contamination. This pollution, though harmless in extent, (sic) may be attributed to the sewers opening directly into the lake, or to the overflow or current from the bay through the gaps.**

If this be a true statement of the facts, then the city has not only to face the necessity of supplementing the proposed simple sewage disposal scheme with modern apparatus for destroying effectively the disease germs in the effluent, prior to its discharge into the waters of the lake; but have to face also, the need of a purification plant at the source of the municipal water supply. Recent science has made it possible to accomplish both these means of protection in a most effective and comparatively economic manner.

First, as to sewage disposal. The foremost sanitarians are agreed that the best means for destroying dangerous organisms in crude sewage is the use of chemical oxidizers, like chlorine and chlorine oxides. The only objection to their use, hitherto, has been their costliness; due to the inherent fault of all oxidants, that the larger part is consumed by inert matter before the reagent can act upon the bacteria. The latest suggestion, however, is that these reagents should be used as "finishers," after the organic matter in the effluent has been lowered to reasonable limits. At the Guildford Sewage Works (England) a series of experiments were made along these lines: electrolytic chlorine, or "oxychloride" being used. The treatment proved entirely practicable.† Now inasmuch as in the disposal of Toronto sewage organic purity is of less importance than the destruction of pathogenic germs, this method of treatment is worthy of serious consideration. It would not conflict with the City Engineer's scheme for triple-screening, and the burning of the coarse solids; but can be engineered in at the third screening stage without seriously increasing the estimated cost.

Now as to water purification. One of the signal triumphs of modern science is the discovery that ozone generated by electricity is a comparatively cheap and yet perfect means for the destruction of the most virile disease germs in polluted water. As far as we

* "Pollution of Estuaries and Suggested Remedies," by Samuel Bideal, D. Sc., Lond, F.I.C. See "Times Engineering Supplement," Aug. 8, 1906.
† See Journal of the Sanitary Institute, Aug 1905.

can glean, three practical systems for sterilizing water by ozone are in vogue in Europe: Siemens and Halske at Wiesbaden, Germany; the de Frise, at Saint-Maur, France; and the Otto, at Nice, Italy. The Frise plant is installed near Paris, and the water undergoing treatment is taken from the river Marne, either in its original condition, or clarified by deposition and filtered through sand. The following data are taken from "'The Times' Engineering Supplement:"—

The apparatus consists of a 45-H.P. engine, centrifugal pumps, capable of lifting 33,000 gallons of water hourly to a height of 49.2 ft., a dynamo furnishing an alternating current of 100 periods, a transformer to raise the current to a tension of 40,000 volts, together with separators, dessicators, large and small ozone generators, sterilizers, and pumps for various purposes. In working the plant the water is driven through the sterilizer at a uniform rate of flow, the air, after being impregnated with ozone, is brought into contact with the water, and the excess of ozonized is regenerated by special treatment. The ozone is generated on the system of the de Frise. The electrified air is cooled to below 25 deg. C., which is the temperature most favorable to the production of ozone. Very excellent results are stated to have been obtained by means of this moderate treatment, and the energy consumed in dealing with about 22,000 gallons of water hourly amounts to 3.5-K.W., or, say, 4.8-H.P.

The main facts are contained in a report addressed by Dr. Miquel, Chief of the Micrographical service of the Mont Souris Observatory, to the 6th commission of the Paris Municipal Council. Experiments were undertaken with water filtered through sand at various speeds in order to test the extent to which the bacteria present were destroyed by exposure to air containing very slight admixtures of ozone. From 50 up to 100 cubic metres of filtered water were dealt with per hour, and each set of tests lasted for five hours. The filtered water in very many cases contained germs of the bacillus coli, but after the water had been subjected to the de Frise process these bacteria were invariably destroyed. These experiments confirm the results obtained in a previous set of trials carried on during the first three months of 1905. Dr. Miquel reports that the process has been found capable of eliminating a large proportion of the bacteria present in water of various descriptions, and of permanently destroying with certainty the germs of bacillus coli, which possessed greater resisting power than the Eberth bacillus and the cholera spirillum. The cost of this treatment is stated, in dealing with large volumes, to be about 1½ centimes per cubic metre, say 1½c. per 1,000 gallons.

Now that Toronto is to have electrical energy at a reasonable price from Niagara Falls, there is no reason why one of these ozone water sterilizing plants should not form part of the city waterworks system. It is worth while for the Mayor and corporation to look into the matter.

IRISH INTERNATIONAL EXHIBITION.

In another column will be found particulars of the Exhibition to be held in Dublin, Ireland, May to October, 1907. Is the "Emerald Isle" destined to be an important industrial country in the 20th century? The present period has been named the "electric age;" but how many know that the first electric street car was run at Portrush, in the north of Ireland? The Irish linen industry is famous the world over; while in shipbuilding Belfast rivals the Clyde; but with the exception of these special industries, and something in woolens, Ireland has not been a commercial nation. Thénard's law seems to be universal in its application "That you may judge of a nation's advancement by the perfection at which it has attained in the working of iron." Had iron and coal been found in Ireland a hundred years ago it would have made all the difference between stagnation and progress. Within the last year or two, however, extensive deposits of iron ore of commercial value have been discovered; and since Wales across the Bristol Channel can supply cheap coal in abundance—instead of letting it go to Germany—who knows what the future has in store for the dear ould spot, which Tom Moore, aphostrophised as:—

"The first gem of the land,
The first Isle of the Sea."

Sir Wilfrid Laurier has declared himself publicly as being in favor of "Home Rule." That is **theoretical** sympathy. **Practical** sympathy would be, to see to it that Canada has a worthy exhibit at the International Exhibition to be held in May, 1907.

EDITORIAL NOTES.

Independent Telephony in Quebec.

On October 22, we received the following communication from Dr. J. F. Demers, the strenous champion of Independent Telephony in the East:—Levis, P. Q. October 20, "We have the pleasure to let you know that our franchises have been definitely granted last night to our satisfaction by the Quebec City Council." (Signed) "La Compagnie De Telephone, De Bellechasse (Limited)."

To the uninitiated this may look like a very simple statement, but to those who know of the bitter struggle which has been going on for years past against the Bell Telephone monopoly it is the presage to ultimate victory for Independent Telephony. Multiplicity of systems is not the most desirable thing in the world, since many will be constrained to install more phones than one in order to do business. That will be Nemesis. When it becomes intolerable, as it surely will, then the outcome will be federal ownership of long distance telephones and municipal ownership of local exchanges.

Dr. Stansfield on Technical Education.

In an interesting letter on page 416, the learned Professor of Metallurgy at McGill University, takes strong exception to what he describes as our "sweeping criticism" (October) of the metallurgical equipment at McGill. We notice that he utilizes the opportunity to saddle us with a view of technical education, the premises for which are not to be found in our article. Setting up a straw man, because of the facility with which it can be knocked down again, has worked well many a time. ....Our practical knowledge of the iron foundry, steel works and blast furnace prevents us from fooling with the silly notion that the iron-founder, the steel worker, and the blast furnace man should be taught their trade in a manual training school, technical college, or university. So with your kind permission, Doctor, we will cut that part out of the discussion entirely, and keep to the point at issue. The case we made out was as follows:—

It is as certain as sunrise in the east to-morrow that, the day is not far distant when an electric furnace steel cutlery and fine tool trade will be established in Hastings County, or thereabouts in Ontario; for rich magnetic ore deposits abound in close proximity to water-power and railways. And kindred steel industries are sure of development in other parts of the Dominion. How necessary it is, therefore, that our youth should be well trained technically to meet the demand. But the equipment at McGill for **practical training in electric furnace work** is of the most miserable description. All the electric energy available from the existing equipment for liberation in the miniature furnace is 6 or 7 kilowatts! What useful object-lesson in electric furnace practice do thimblefuls of steel made in this way serve?

It now appears from Dr. Stansfield's courteous and luminous letter that we somewhat understated the amount of available electrical energy for furnace work; there is actually 25 kilowatts. We humbly apologize to the authorities of McGill University for this slight error in our facts; but can not withdraw our specific allegation, that the electrical energy available for furnace work is miserably deficient. Dr. Stansfield's letter emphatically confirms this. He says:—

> Even 30 kilowatts is, however, too little for a satisfactory test on the electrical production of crucible steel, and a transformer of at least 50 kilowatts fitted for delivering the current to the furnace at a suitable voltage would be needed.

Of a truth, this is evidence "strong as holy writ," that our criticism and plea was well timed.

When wealthy men in Canada are looking around for a worthy object on which to place a rich endowment, we can point to one, that would bring forth fruit a thousand fold, namely, the metallurgical department of McGill University, Montreal.

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Important Foundry Enterprise at Fort William.

In March we closed our biographical sketch of Mr. T. J. Drummond, "the leading pioneer in the enterprise of iron-making in the Dominion," as follows:—

> "We are on the threshold of great things in iron and steel, and, reasoning from the known to the unknown, we fear not to predict, that Thomas Joseph Drummond—whose worthy business record we have briefly told, will play an important part in the industrial development of Canada."

On Tuesday morning, October 4, Mr. Drummond, as Vice-President of the Canadian Iron & Foundry Company, turned the first sod at Fort William, Ont., for the erection of large modern foundries for the manufacture of railway car wheels and general castings: including cast iron, water, and gas pipes. At a recent meeting of the Engineers' Club, Toronto, we openly declared that one of finest openings out west was for a modern pipe founding plant; and lo, here comes the announcement, that one is to be built straightway at the "gateway of the west!" The promoters are to be congratulated upon this fine stroke of industrial policy. The time is most opportune, and the place selected ideal: cheap electric power from Kakabeka Falls, 16 miles away, and pig-iron from the fine modern blast furnace now in course of erection at Port Arthur, near by, while as a distributing centre for the west it is the most strategic point in the Dominion.

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BOOKS RECEIVED.

Bentley Publishing Company, Halifax, England.
By Wallace Bentley, M. I. Mech. E.

Machine Shop Companion.—Comprising practical notes, rules and tables for everyday workshop use, with chapter on screw-cutting. Size 3¾ x 5¾, pp. 98. (Price, 1s.) net.

Practical Workshop Mechanics.—Size, 3⅞ x 5⅞, pp. 50. (Price, 6d. net.)

Questions in Applied Mechanics.—With answers and illustrations. Size, 4¾ x 7⅛, pp. 36. (Price, 6d. net.)

Questions in Machine Construction and Drawing.—For the use of students preparing for engineering examinations, etc. Size, 4⅞ x 7⅛, pp. 41. (Price, 6d. net.)

Rules and Definitions.—Specially arranged for the use of students in engineering subjects. Size, 4⅝ x 7⅛, pp. 42. (Price. 6d. net.)

Sketches of Engine and Machine Details.—Size, 5¾ x 8½, pp. 103. (Price, 3s., net.)

The Economics of Railroad Construction.—By Walter Loring Webb, C. E., New York: John Wiley & Sons. Size, 5¾ x 8¼, pp. 339.

The Principles and Practice of Surveying.—By Charles B. Breed and Geo. L. Hosmer, Instructors in Civil Engineering, Massachusetts Institute of Technology, New York: John Wiley & Sons. Size, 6¼ x 9¼, pp. 526. Price, $3 net).

Problems in Surveying, Railroad Surveying and Geodesy, with an appendix on the adjustment of the engineer's transit and level. By H. C. Ives, and H. E. Hilts, University of Pennsylvania, New York: John Wiley & Sons, 1906. Size, 4¼ x 7, pp. 136. (Price, $1.50 net).

American Stationary Engineering.—Facts, rules and general information gathered from thirty years' practical experience as running, erecting, and designing engineer. By W. E. Crane, New York: The Derry-Collard Co., 1906. Size, 5¾ x 8, pp. 285. (Price, $2 net).

Reed's Iron and Steel Founding.—By Claude Wylie, London: Thomas Reed and Co., Limited. Size, 5 x 7½, pp 376. (Price, $1.10 net).

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NEW PUBLICATIONS.

The Electrical Plant of the Ontario Power Co. being a paper presented by V. G. Converse, at the 16th annual convention of the Canadian Electrical Association, Niagara Falls, June 19-21, 1906. The paper deals principally with the electrical features of the Power Company's plant. Size, 6¾" x 9¾", pp. 24.

Street Railway Journal.—This year's Convention Souvenir is one of the handsomest and most noteworthy issues of a technical paper that has ever been published. It contains over 500 pages ,and weighs some 5 pounds. The occasion celebrated is the Annual Convention of the American Street and Inter-urban Railway Association at Columbus, Ohio. Published by the "Street Railway Journal," 114 Liberty St., New York.

American Mining Congress.—The papers and addresses of the eighth annual session of the American Mining Congress, held at El Paso, Texas, 1905. Published by the Congress, at the Office of the Secretary, Denver, Col. Size, 6" x 9¼", pp. 214.

Michigan College of Mines.—The year book of the college for 1905-06 has just been issued. It contains all particulars in connection with the college, and gives a report of the season's work. Accompanying this is a book of very excellent views taken at the college. Copies may be obtained by addressing the Michigan College of Mines, Houghton, Mich. Size, 5¼" x 7¼", pp. 132.

Zinc Resources of British Columbia.—The report of the Commission appointed by the Dominion Government to investigate the zinc resources of British Columbia, and the conditions affecting their exploitation, has been published at Ottawa, by the Mines Branch of the Department of the Interior, under the direction of Eugene Haanel, Superintendent of Mines. Size, 6¾" x 10", pp. 399.

Automobile Manufacturers.—Bulletin No. 18, published by the Association of Licensed Automobile Manufacturers; gives the new standard for hexagon head screws, castle, and plain nuts, as adopted by the Association, in order to overcome the confusion, inconvenience and expense that has been caused by the use of various standards. Copies may be obtained from the Association at 7 East Forty-second Street, New York, N. Y. Size, 8¼ x 10¾, pp. 14.

Canadian Society Civil Engineers.—Vol. XIX., part I., of the transactions of the Canadian Society of Civil Engineers from January to June, 1905. Size, 6 x 9, pp. 248.

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CATALOGUES AND CIRCULARS.

Water Wheel Governors.—The Lombard-Replogle Engineering Co., Akron, Ohio. Bulletin "A" presents the water-wheel governor manufactured by this company, the Bulletin sets forth the general principles of the governor, and gives particulars of the various types and sizes manufactured. Size, 6 x 9½, pp. 4.

Padlocks.—Yale & Towne Manufacturing Co., 9 Murray St., New York, N.Y. "Suggestions for selling Yale padlocks" is the title of a booklet, which gives many bright ideas that may be used by the retailer of the above company's goods. It describes and illustrates the different kinds of stationary which they are always pleased to send out to their customers. Size, 3½" x 7¾", pp. 30.

Arc Lamps.—Packard Electric Company, St. Catharines, Ont. A neat circular received this month describes the Jandus Interchangeable Arc Lamp, for public and private arc lighting. It is suited to all circuits and is perfectly interchangeable. Size, 3½" x 6", pp. 2.

Direct Current Dynamos and Motors.—Canadian Westinghouse Co., Limited, Hamilton, Ont. Circular No. 1,068, July, 1906, sets forth, by description and illustration, type S, Dynamos and Motors, for direct current. Size, 7" x 10", pp. 14.

Steel Sheet Piling.—United States Steel Piling Co., 135 Adams St., Chicago, Ill. The design of, and the uses to which United States steel piling may be put are graphically described and illustrated in the October issue of their catalogue. Size, 5½" x 8½", pp. 24.

Locomotives.—The American Locomotive Co., 111 Broadway, New York, N.Y. A pamphlet published by this company describes and illustrates a large number of consolidation locomotives built for various railroads. The pamphlet includes only consolidation locomotives weighing less than 175,000 lbs. Photographic reproductions of the locomotives are included. Size, 9" x 6", pp. 72.

Nernst Electric Lamps:—"Lux" is the title of a miniature magazine of "light" literature, published by the Nernst Lamp Co., of Pittsburgh, Pa. The first number has just come to hand, and the Nernst people are certainly to be complimented on their production, as it contains many valuable hints on lighting. Size, 3" x 5", pp. 15.

Engineering Work.—The Wellman Seaver Morgan Co., Cleveland, Ohio, act as consulting engineers in Mechanical, Civil, Electrical, Mining and Hydraulic Engineering. They work out new and special engineering problems, and furnish plans, reports and estimates for contemplated work. Some of the plants they have designed are shown in a fine catalogue, entitled, "Section A," Size, 9" x 12", pp. 12.

CORRESPONDENCE.

"One man's word is no man's word,
Justice needs that both be heard."

APPRECIATIONS.

Wrightville, Hull, Que., Sept. 30, 1906.

"The Canadian Engineer":

Sir,—Enclosed find $1, renewing my subscription to what I consider one of the most up-to-date publications of mechanical instruction published in Canada, or any other country, for the money.

Yours truly,
(Signed), JAS. JOHNSTON.

Thurnby, near Leicester, England, Sept. 27, 1906.

The Editor, "The Canadian Engineer":

Dear Sir,—It is no use buying more papers than you can read, but I feel I must make time to read "The Canadian Engineer." A year's reading of it has shown me more of Canada's possibilities and aims than all the books that have come my way from school time until now, and of those possibilities I must confess we are almost as ignorant as you paint us.

And as to the subject matter of the paper—the engineering news—the great charm to me is the contrast between our small-world schemes and well-worn methods and your gigantic undertakings on original lines. It is pleasant to breathe the atmosphere of a larger world for even a short half hour.

Perhaps the information is not of immediate use, for we can never hope to have that class of work, but it is nice to read about it. I do not ever remember such interest and pleasure in reading any technical article (largely contributed to by the style in which the article was set out) as in reading the description of the Ontario Power Co.'s under taking at Niagara in your March number.

No romance in the twentieth century! Keep telling them of Canada!

If I might add a "personal" word: your paper breathes a pride in the British Empire and British character. In dealing with your critics and contemporaries in controversy adopt the British method rather than the American. It isn't quite so "brave" in appearance, but let that go and **gain your enemy.**

Yours faithfully,
N. P. LAIRD.

San Lorenzo, Porto Rico, West Indies, Sept. 24, 1906

"The Canadian Engineer":

Gentlemen,—Enclosed find $1 to renew my subscription for another year. I am so pleased with your journal that I can say it is worth more than three times the price.

Yours very sincerely,
J. DE POOL OSSEN KOPF.

McGILL UNIVERSITY METALLURGICAL LABORATORY EQUIPMENT. DR. STANSFIELD REPLIES.

The Editor, "The Canadian Engineer":

Dear Sir,—In the editorial in your September issue you make a plea for the further endowment of metallurgical teaching in Canada, which I should be the first to endorse, but I cannot allow your sweeping criticism of our equipment at McGill to pass without comment, although the laboratories scarcely need any defence from me, as they are generally admitted to be among the best equipped in North America, or, for the matter of that, anywhere.

Your criticism raises a far larger question than that of the number and sizes of the furnaces and other plant contained in a laboratory. Is the College Laboratory the correct place in which to teach Practical Smelting? I think not, and I believe that most Metallurgists are of my opinion, and hold that the practical details of smelting can be far better acquired in the Works than in the College.

The Metallurgical students at McGill make extended visits to works during the Summer School between their third and fourth years, and generally spend at least one summer vacation in a metallurgical works before starting their fourth year at College, and the experience they gain in this way entirely prevents any danger of their acquiring a defective sense of proportion by experimenting with small sized furnaces in the College laboratory.

By far the greater part of a student's time at College is necessarily occupied with the mathematical, chemical and engineering studies, which form the ground work of his technical education, and the total number of days that he can devote to metallurgical laboratory work is consequently not very great, and can be employed to better advantage, as well as at far less expense, with small scale laboratory appliances than in running a small steel works plant in a College laboratory. In addition to fire-assaying, which takes a considerable proportion of his time, the student learns to determine the temperatures of furnaces, the calorific power of fuels, the analysis of furnace gases, the microscopic structure of steel and alloys, as showing the heat treatment to which they have been subjected. He also learns something of the tempering of steel, the effect of overheating and burning steel, and how to restore over-heated steel, the melting and casting of metals, and the mixing of metals to make alloys, the chemical and physical changes that take place in the roasting and fusion of ores of copper or lead. All these and a great many more operations can be performed in the laboratory with the aid of small scale furnaces and appliances, and my difficulty has always been to find time for the work.

The laboratories at McGill are, however, quite well equipped with furnaces for roasting and smelting copper and lead ores on a sufficiently large scale for the operations to be thoroughly "practical." The 21-inch water-jacketed blast furnace will smelt some two tons of copper ores in the college day, and enables the calculation of charges and all the operations of actual smelting to be illustrated on a scale which is, I am sure, as large as it is desirable to attempt in a college, unless, indeed, it were so situated that it could be run economically, or even commercially, as a testing plant for determining the best treatment for extracting the values from ores, while the teaching of students might be considered as a bye product merely.

The remainder of our equipment, although it is not nearly as good as I should like, is still a good deal better than your editorial would suggest; thus we can at present draw some 250 amperes at 110 volts for furnace work, or, say, 25 killowatts, and hope to be able to further increase this in the near future. Even 30 kilowatts is, however, too little for a satisfactory test on the electrical production of crucible steel, and a transformer of at least 50 kilowatts, fitted for delivering the current to the furnace at a suitable voltage, would be needed. Among other apparatus I am just completing the construction of a small gas-producer, which may be run with a steam jet or by suction, and which will illustrate the methods of making and cleaning fuel gases, as well as furnishing the laboratory with a convenient fuel.

Having said so much in defence of our present teaching equipment, I may say that I fully agree with you as to the desirability of further endowment for metallurgical education. The laboratory should be so equipped that students who have already graduated, and practical metallurgists who have difficult problems to solve would find at McGill, even more than they already do, an opportunity for working the problem out themselves, with every appliance at hand, or if they could not spare the time, of having it worked out for them by the teaching staff. More funds are needed for the purchase of new appliances if the laboratory is to be kept up to the times, and for obtaining ores and other materials to experiment upon, and for the general maintenance of the laboratory.

Signed ALFRED STANSFIELD.

A NEW IDEA FOR THE WEST.

Sand Lime Brick.

(From our Special Correspondent.)

Vancouver, B. C.

A Sand-lime Brick is composed of from four to six per cent. of good lime, and ninety-four to ninety-six per cent. of good, clean, sharp sand, as free from impurities as possible, and containing not less than seventy per cent. of silicic acid.

To make perfect Sand-lime Bricks, thorough mixing of the lime and sand, and the absolute and instantoneous hydration of all of the lime, are essential. The thorough mixing of the sand and lime is comparatively simple, but the problem of instantaneous and thorough hydration of all the particles of lime throughout the brick has baffledmany experts.

The Steger system is the only system which has solved this important problem. From the machine in which it is first pulverized the lime is conveyed under dust-tight housing until it falls info an adjustable measuring apparatus, into which the sand is also conducted in like manner. This apparatus can be adjusted so that it will accurately measure from 94 to 96 parts of sand and 4 to 6 parts of lime. In the required proportions the sand and lime falls thence into the apparatus wherein it is automatically steamed and thoroughly intermixed and conveyed through a series of manifold tubular chambers, en-route to the press. As discharged from the press the bricks are run on iron cars into a long steel cylinder, 6 x 66'-0"; which, when filled to its capacity of 20,000 bricks, is hermetically sealed, and chemically treated steam to the high pressure of from 120 to 150 pounds to the square inch is applied to the brick continuously for from ten to twelve hours.

In this process the hydratic lime and the silicic acid of the sand combining in a silicite of lime, results in a compact product, harder, with greater resistance, less moisture absorption, atmospheric proof, better, than the best natural sand-stone. Moulding pressure, 15,000 pounds per square inch; steam pressure, 150 pounds per square inch; temperature, 185°. Time exposed to steam, ten hours.

Strength and durability.—Crushing strength, after hardening, 7,740 pounds to the square inch. Tensile strength after hardening, 437 pounds to the square inch. Crushing strength after freezing, 9,007 pounds to the square inch. Tensile strength after freezing, 371 pounds to the square inch.

Cost of manufacture, and question of profit.—It is estimated that after a plant with a daily capacity of 40,000 bricks has been installed, the brick can be made for $4.50 per thousand, to which add $1 per thousand for delivery, or $5.50 per thousand. Common clay bricks are sold in midsummer for $9.25 per thousand, delivered. Selling our superior lime brick at the same rate would leave us a profit of $3.75 per thousand.

Forty thousand bricks per day at $3.75, $150 profit.

Yearly product, 280 days, at 40,000 bricks per day, 11,200,000 bricks.

11,200,000 bricks at $3.75 per thousand, $42,000 profit.

The estimated cost of machinery for a Sand-lime Brick plant, $45,000.

Note:—Whereas $9.25 per thousand is quoted above as the price of common clay brick in Vancouver, the present price as a matter of fact is from $10 to $11 per thousand for extremely inferior brick, while the price of ordinary clay press brick is $45 per thousand, even these cannot in any respect compare with the bricks made by the Steger process.

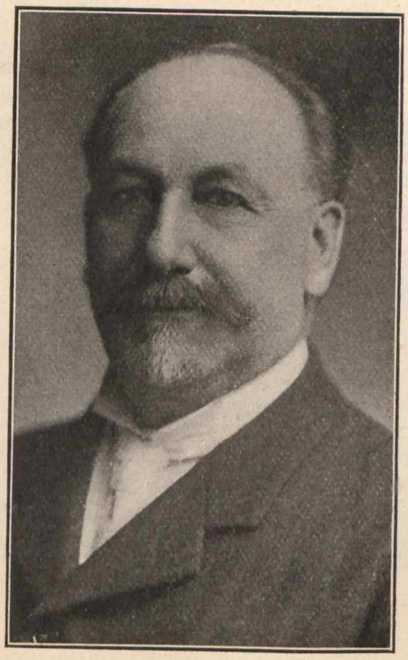
For further particuars apply to the British Columbia Agency Corporation, Limited, 405 Hastings Street, W., Vancouver.

THE LATE W. T. JENNINGS, C. E.

(Obiit. Oct 24, 1906.)

In the death of the Dean of the Civil Engineers of Canada, the engineering profession has lost its most distinguished member, and the Dominion a worthy citizen.

William Tyndale Jennings was born in Toronto May 19, 1846. His professional career began in 1869—at the age of 23—when he commenced field work on the drainage improvement of the Crown Lands of Ontario, under Mr. T. N. Molesworth, Engineer of Public Works—brother of the compiler of Molesworth's Engineers' Pocket Book. From that time until now, his business record is practically the history of Civil Engineering in the Dominion. On the occasion of his election to the Presidency of the Canadian Society of Civil Engineers in 1899—at the age of 53—"The Canadian Engineer" published an elaborate two column account of his lifework. As we calmly read that interesting story of "things done" we were simply amazed at the work crowded into those thirty years. His work as resident engineer to the Great Western Railway, 1873-1875—during which he surveyed the Detroit River. His work under Sir Sanford Fleming, on the C.P.R., 1875 to 1879; during which time in British Columbia he located the present line through the canyons of the Fraser River, and other formidable sections. How, as chief engineer of construction in 1883, he superintended the building of 350 miles of railway from the Pacific coast eastward. How, in 1885, as consulting engineer for C.P.R., he built the lines from Woodstock to London, from London to Detroit, the Wingham Extension, the eastern entrance to Toronto, the Guelph Junction, made various locations of surveys, and laid scarfs of the C.P.R. from Yonge Street westward. How in 1890, he became City Engineer of Toronto, and was responsible for the Sherbourne Street bridge, Carlaw subway, King Street subway, Island ferry slips, etc., and was instrumental in bringing about a settlement of the dispute as to occupancy of the water front. His specifications—under which the street railways were leased—are recognized as a model, and have formed the basis of many like franchises—even in great cities of the United States. How in 1891 he went into private practice in Toronto, and built the Niagara Falls Park and River Railway, also the Galt, Preston and Hespeler Electric Railway, and others of importance. How, from 1892-1895, he was chief engineer to the famous Crow's Nest Pass Railway, which he examined and located so as to open up to best advantage the enormous coal deposits, in that region; which are such an important asset in the development of the Pacific Coast Province. In 1897, he was commissioned by the Dominion Government to report upon the feasibility of a navigable route from Fort Wrangle on the Pacific Coast over the eastward chain of lakes and rivers



The Late W. T. Jennings.

from this point, and then by rail through the series of passes ending with the Chilcoot. This report is now an important State paper. In 1898, under the auspices of the Toronto City Council Special Commission, he explored and reported on the country between North Bay and James Bay: embracing Lakes Temiscamingue and Temagami, and the Blanche, Montreal, and Wahnapitae rivers, etc., having in view a railway from Toronto to Hudson Bay. This was the first revelation of the rich heritage Ontario has in her wonderful northland. Among the other notable things he did, was his report to the Dominion Government on the Louise Basin at Quebec. He also made expert examinations of the Halifax and Esquimault dry docks.

His chief work of late years, has been in connection with the electrical power railway projects of the Electrical Development Co., for which he was retained as Consulting Engineer.

An economic engineering project Mr. Jennings had hoped to see realized in his lifetime, was a line of railways along the lake shore between the Don and Port Union, to avoid the stiff haul over 'Scarboro' Bluffs. But now this problem will have to be solved by others. To glance over the thirty-seven years of noble work achieved in the engineering which we have briefly sketched, is an inspiration. Mr. Jennings died universally respected, not only for his great technical ability and achievements, but for his sterling integrity and uprightness of character. This was evinced at the Engineers' Club of Toronto, on October 24th—

when, on the motion of Mr. M. J. Haney, C.E., seconded by Professor Galbraith, principal of the School of Practical Science, Toronto University, it was resolved to purchase two floral offerings, as tributes of respect from the Canadian Society of Civil Engineers, and the Engineers' Club of Toronto. A committee, consisting of M. J. Haney, C.E.; Professor Galbraith; A. W. Campbell, Deputy Minister of Public Works, and S. Gagne, was appointed to prepare resolutions of condolence and sympathy; and never did a Canadian committee of Civil Engineers have a nobler work to perform.

THE IRISH INTERNATIONAL EXHIBITON.

Ireland's forthcoming International Exhibition, which will be open from May to October, 1907, will be the biggest undertaking of its kind ever organized by Irishmen, completely dwarfing any of the expositions previously held. So favorably had the enterprise been received that more than 1,000 guarantors have subscribed to the Guarantee Fund, which now exceeds $900,000, and is constantly growing. Work on the exhibit buildings has gone on so rapidly that they will be finished some months before the day set for opening, May 1st, 1907. Machinery Hall is already completed. It is believed that 3,000,000 people will attend the exposition during the time it is open.

Foreign countries, recognizing the opportunities which the exposition will afford, are making active preparations to send exhibits. France is preparing a French section which will equal that at the exposition at Liege; Russia has appointed an agent to make necessary arrangements for a large exhibit; Italy, Canada, and Australia and other countries will be well represented.

Exhibits will be classified in nineteen sections as follows:—

- Irish Industries.
- History and Education.
- Fine Arts, including Photography, Engraving, etc.
- Arts and Crafts.
- Liberal Arts.
- Manufactures and Textiles.
- Engineering and Shipbuilding.
- Civil Engineering and Transportation.
- Electricity.
- Motors.
- Gas Lighting, Heating and Cooking.
- Agricultural Implements and Chemical Industries.
- Horticulture and Arboriculture.
- Sport and Fishing.
- Mining and Metallurgy.
- Hygiene.
- Women's Section.
- Agriculture and Food Products.
- Cottage Industries.

In the Transportation and Machinery Section many notable firms and companies will be represented. Among these are the Great South Western Railway Co., the Dublin, Wicklow and Wexford Railway Co., the Great Western Railway Co. of England, Messrs. Harland & Wolff, the White Star Line, the Royal Pacific Steam Packet Co., the Cunard Steamship Co., and many others, including Messr. Babcock & Wilcox, Coombe & Barbour, of Belfast, and the British Westinghouse Company is sending dynamos.

Opposite the main entrance will be the principal building, consisting of a central octagonal court, 215 feet in diameter, surrounded by a corridor capable of accommodating 7,000 people. The corridor will open into four radial wings, each 164 feet long and 80 feet wide, with a combined area of 5,200 square feet. The total area of the central building will exceed 100,000 feet. Around this will be grouped the pavilions for the British, foreign and colonial exhibits. The Machinery Building will be 900 by 100 feet, giving a floor area of 92,000 square feet. The fine art gallery, one of the features of the exposition, will have 30,000 square feet, and several other buildings, ranging from 10,000 to 50,000 square feet, are in course of erection. Altogether, the exposition will cover 52 acres of ground.

The Exhibition site at Herbert Park, Dublin, is particularly well adapted to the purposes of the exposition. It is situated in the best residential quarter of the city, within a mile and a half of its business centre. It is close to the famous horse show grounds of the Royal Dublin Society, whose shows have an average attendance of 55,000 people. Three lines of tramway will connect the exposition with all parts of the city and with the termini of the various railways running from Dublin to the north, south and west of Ireland. Transportation for exhibits is readily obtainable, and the Executive Committee expects to obtain from the various railroads, steamship companies and carriers special terms for the conveyance of goods to and from the exposition. Motor power will be supplied to exhibitors at a moderate price.

The charge for space will be $1 per square foot, with a minimum of $25. A sliding scale of rebates on space rents will be allowed in order to accommodate large exhibitors. The rebates will be 10 per cent. when the total rent space amounts to $200; 15 per cent. when $300; 20 per cent. when $500, and 25 per cent. when $1,000. Forms of application for space and power may be obtained from the secretary, Mr. James Shanks, Ballsbridge, Dublin, Ireland.

CONDITIONS OF FAN-BLOWER DESIGN.

The velocity with which air escapes into the atmosphere from a reservoir is dependent upon the pressure therein maintained and upon the density of the air. The pressure per unit of area divided by the density per unit of volume gives the head, usually designated as the "head due to the velocity." The velocity produced is that which would result if a body should fall freely through a distance equal to this head. In the case of the flow of water such a head always exists, as, for instance, when a standpipe is employed to produce the requisite pressure. Suppose the head of water to be 50'-0" and its weight per cubic foot to be 62.5 pounds, then the pressure per square foot will be $50 \times 62.5 = 3,125$, and that per square inch $3,125 \div 144 = 21.7$ pounds. Its theoretical velocity of flow from an orifice at the bottom of the standpipe would be 56.7 feet per second, as determined by the formula for falling bodies, which is $v = \sqrt{2gh}$, in which

v = velocity in feet per second.
g = acceleration due to gravity.
h = head in feet, here 50'-0".

In the case of air, however, an actual homogeneous head never exists, but in its stead we have to deal with an ideal head, which can only be determined by dividing the pressure by the density. As the density of air is so much less than that of water, it is evident that for a given pressure the head will be far greater in the case of air. But the velocity of discharge is dependent only on the distance fallen, which is represented by the head, whether real or ideal. As a consequence, air under a stated pressure escapes at vastly higher velocity than water under the same conditions. Calculated in the same manner, the velocity of escaping air under a pressure of 21.7 pounds per square inch is 1,626'-0" per second. By the employment of formulæ based upon this theory the elaborate basis tables published by the B. F. Sturtevant Co. have been calculated.

From the preceding discussion it is evident that the pressure created by a given fan varies as the square of its speed; that is, doubling the speed increases the pressure fourfold. The volume of air delivered is, however, practically constant per revolution, and, therefore, is directly proportional to the speed.

The work done by a fan in moving air is represented by the distance through which the total pressure is exerted in a given time. As ordinarily expressed in foot pounds, the work per second would, therefore, be the product of the velocity of the air in feet per second, the pressure in pounds per square foot, and the effective area in square feet over which the pressure is exerted.

From this it is evident that the work done varies as the cube of the velocity, or as the cube of the revolutions of the fan; that is, eight times the power is required at twice the speed. The reason is evident in the fact that the pressure increases as the square of the velocity, while the velocity itself coincidentally increases; hence, the product of these two factors of the power required is indicated by the cube of the velocity.

The actual work which a fan may accomplish must depend not only on its proportions, but upon the conditions of its operation and the resistances which are to be overcome. Evidently it is improper to compare fans when operating under such conditions that these resistances cannot be definitely determined. The simplest and most natural condition of operation is that in which the fan is operated without other resistance than that of the case; that is, with open inlet and outlet. For proper comparison of different fans the areas through which the air is charged should bear some constant relation to the dimensions of the wheels themselves.

It has been determined experimentally that a peripheral discharge fan, if enclosed in a case, has the ability, if driven at a certain speed, to maintain the pressure corresponding to its tip velocity over an effective area, which is usually dominated the "square inches of blast." This area is the limit of its capacity to maintain the given pressure. If it be increased, the pressure will be reduced, but if decreased, the pressure will remain the same. As fan housings are usually constructed, this area is considerably less than that of either the regular inlet or outlet. It, therefore, becomes necessary, in comparing fans upon this basis, to provide either the inlet or the outlet with a special temporary orifice of the requisite area and the proper shape, and make proper correction for the contracted vein. The fan is thus, in a sense, placed in a condition of restriction of discharge, which it approaches in practice only in so far as the resistance of pipes, passages and material through which the air must pass have the effect of reducing the free inlet or outlet of the fan.

The square inches of blast, or, as it may be termed, the capacity area of a cased fan, may be approximately expressed by the empirical formula:

$$\text{Capacity area} = \frac{DW}{x}$$

In which D = diameter of fan wheel, in inches.
W = width of fan wheel at circumference, in inches.
x = a constant, dependent upon the type of fan and casing.

The value of x has been very carefully determined by the B. F. Sturtevant Company for different types of fans; but these values must be applied with great discretion, acquired through experience and a thorough knowledge of all the conditions liable to affect the fan in operation.

A NEW INDUSTRY IN THE WEST: WOODEN WATER PIPES.

By A. B. Irwin.

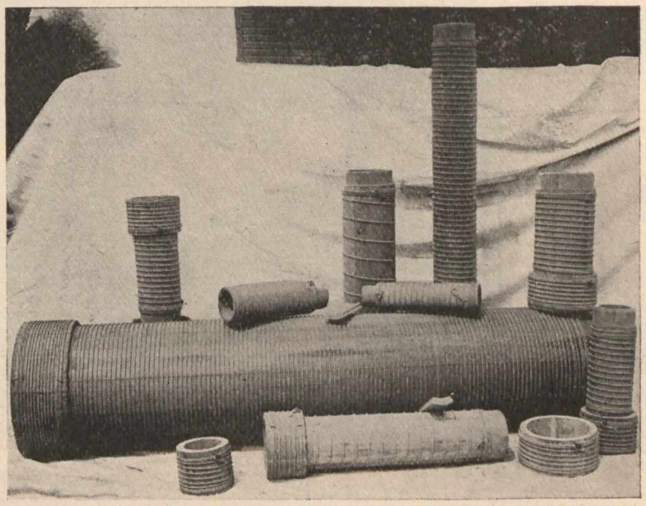
What may be classed as a new industry in the West, and one which has been gradually finding field for development as the towns of Western Canada have grown in the past four years, is the manufacture of water pipe from the famous Douglas fir of British Columbia. This material lends itself peculiarly to the construction of stave pipe, because of its wonderful quality, being so clear and straight grained and free from all defects. It is possible to secure a class of timber in B. C. which is absolutely free from knots, pitch pockets, shakes, or other defects common in almost every other class of timber. This perfect timber is used in making machine banded wood stave water pipe.

The product which is now being turned out by two factories of the Pacific Coast Pipe Co., Ltd., in Vancouver, is finding favor in the entire West, and has even been making its way in Eastern Canada. As a material at once cheap and reliable, and satisfactory for water works construction in towns and cities, the wood stave pipe is recommending itself to those numerous towns in the new West which find themselves with perhaps very moderate means, compelled to install an entire new system of water supply. The conditions in the West are such that very young communities have to undertake public works of this kind which much older towns in the East have not yet thought of.

Naturally when such heavy responsibilities are to be undertaken, with their burden of taxation, economy as well as efficiency is a factor of very great importance. In this way, many towns in the new provinces of Western Canada are being enabled, through using wood stave pipe, to install very complete and high-class water works systems at very low cost. The number of such towns where modern improvements are demanded increases year by year with the wonderful growth that characterizes the West.

Machine-banded wood stave pipe has been constructed in the United States for many years. The first factory was in Eastern New York State, and many towns have systems installed with this product many years ago. In the West the wood stave pipe of machine-banded construction has for many years been made in the State of Washington, where the class of timber is practically the same as that in British Columbia. It is this splendid material which makes it possible to turn out such high-class pipe at a price so much lower than any other pipe made. It is in fact a specialty, and no other timbered region in Canada can ever turn out the class of product which is being made in Vancouver from the Douglas fir.

The machine-banded pipe is made in all sizes from 2 to 24", internal diameter, and is also constructed for all pressure, from mere conduit pipe, suitable for irrigation, up to several hundred feet head. In making the pipe of



Examples of Wooden Pipe.

these different pressure, there is no difference in the quality of the material, the banding being the only change the construction being exactly similar. In all cases the pipe is positively guaranteed to stand the pressure for which it is supplied.

Many eminent engineers, including some of the most prominent consulting engineers in water works construction in Eastern Canada, have expressed themelves as heartily in favor of the wood stave pipe. Its use is so extensive now that there is no question of experiment in it, and the fact that it has been used so many years with extreme satisfaction is proof that the claims of the manufacturers are well substantiated.

The Pacific Coast Pipe Co., Ltd., has a well-equipped and very conveniently arranged factory in Vancouver, its headquarters, and many Canadian Engineers and members of the Canadian Manufacturers' Association inspected the works the past summer on the occasion of their visits to the Pacific Coast. The process of manufacture is simple, yet every part of it is a specialty, and skilled men are employed, while not a section of pipe is turned out which has not had the most watchful supervision in the various steps of manufacture. This care and excellent workmanship is the pride of the Pacific Coast Pipe Co., and they unhesitatingly refer all inquirers to the many cities and towns which have used their product in the three seasons it has been made, since the factory was established.

WITH THE CIVIL ENGINEERS IN THE WEST

By the Editor.

Article II.

Sept. 8th, 1906.———If it be true that "the study of mankind is man," then the writer had a rare opportunity of studying at close quarters 425 of the strong men and faithful women who are rapidly transforming the great North-West from a wilderness into a fruitful land. Missing the Civil Engineers' special at Toronto, by about three minutes, I had only one chance to catch up, namely, to board a $12 harvesters' excursion train—about to start for Winnipeg—and rough it with the settlers 1289 miles. I prefer to forget the tough part, and remember only the kindness I experienced at the hands of these pioneers. In the car where I dropped my grip and cloak, were a bright young couple, newly married—Mr. and Mrs. Will McClinton— going to to start business in Vermillion, Alberta; a Mrs. Archie Carmichael, a cultured young woman, going out to her husband—a schoolmaster in Herbert Sask.; and an enterprising young business man, Mr. Isaac Hahn, going out to stake his claim: all from Collingwood, Ontario. Unlike the English snob who declined to help a drowning man because he had not been introduced, this group, perceiving that I had nothing to eat, insisted on my joining them at their abundant spread at meal times, and what was more, invited a lonely woman and her little girl, who, like myself, had no food except what we could buy at miserable station restaurant counters. No wonder the lands toward the setting sun are blossoming like the rose, when they are being settled by God's ladies and gentlemen like these.

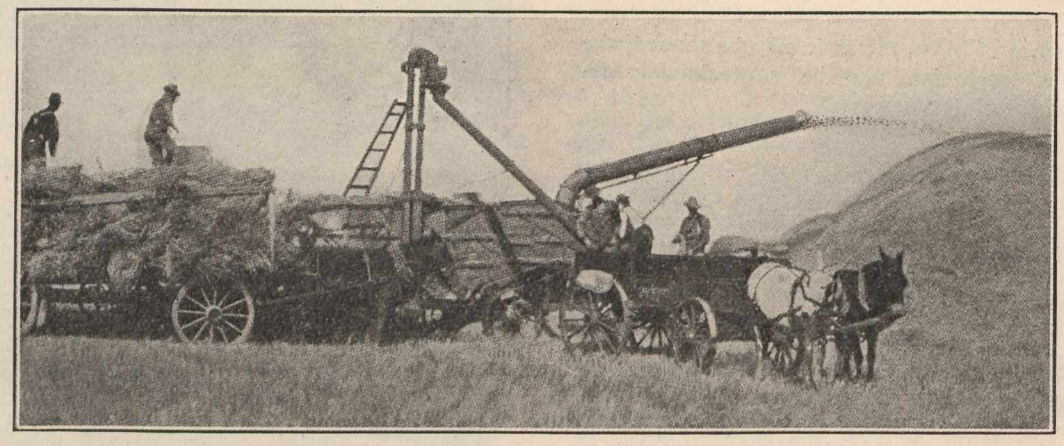
> "Kind hearts are more than coronets,
> And simple faith than Norman blood."
> (Tennyson)

On the full dress shake down the first night, I found my companion to be a sturdy yeoman from Orillia, Ontario, W. H. Barr, going out to East Saskatoon, with a locomotive engineer's certificate in his pocket, to run a threshing machine owned by J. Ludkey, of Barrie, Ont. Mr. Ludkey owns two machines, which he takes out from Barrie, and loans to the Western farmers. Barr gets $6 per day for two months. It is a right good scheme, for it enables the skilful, but comparatively poor farmers to pool their interests, and get in the harvest much earlier and at less cost than by scarce hand labor. The farmers are well served; Ludkey makes a good thing out of it, and Barr pockets $288 as his share. In crossing 860 miles of broad prairie between Winnipeg and the foot hills, which guard the entrance to the snow-capped Rockies, we beheld many scenes like that pictured in Fig. 1; for it was harvest time, and the golden grain was being gathered in everywhere.

Shortly after midnight our train was held up for some hours, not by robbers, however, but due to the officials having to scour the countryside for a doctor. As a result of the doctor's visit, the population of the train was increased from 425 to 426.

Sept. 9th.—How the Civil Engineers spent the Lord's Day on the special, four hours ahead, I know not, but on this harvester's train, the schoolmaster's wife had her Oxford Bible open, and group singing of the "Glory Song," etc., attracted eager listeners. In another part an Edison phonograph played sacred tunes and popular airs. True, some indulged in cards, while others preferred coarse stories, the whiskey bottle and boisterous fooling; but on the whole, a sober, moral, decent folk were these westward bound sons of toil.

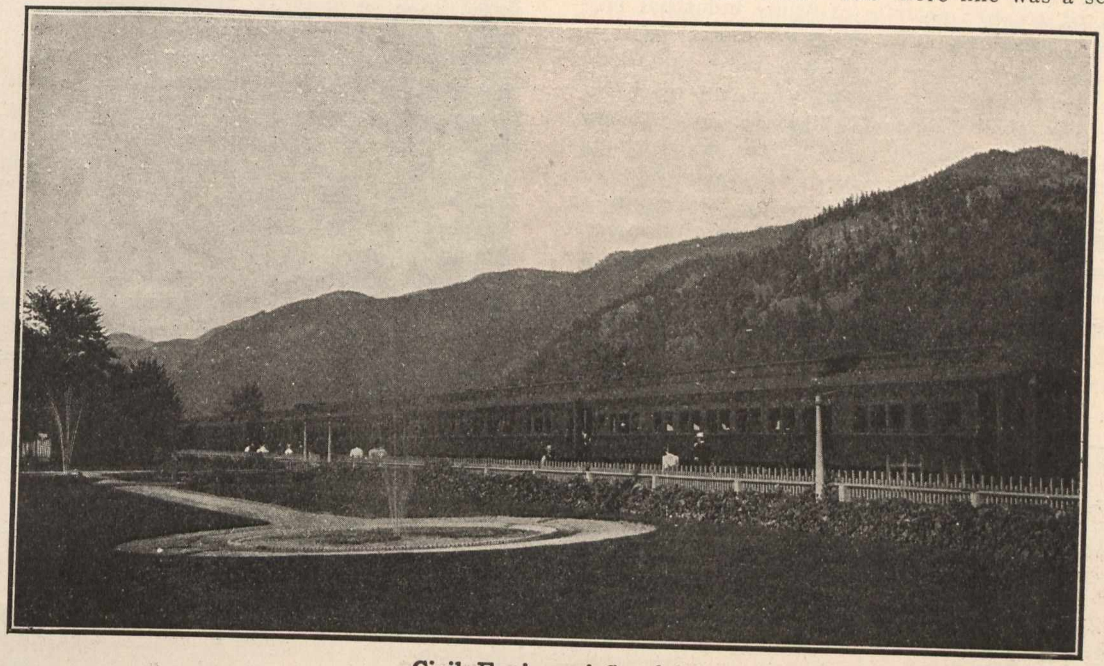
At 3.30 p.m., after passing through many miles of monotonous, scrubby, barren, rocky country we had our first sight of the blue waters of Lake Superior, glistening in the autumn sunlight. This great inland sea, covering 31,200 square miles, is especially interesting to Engineers, since on its surface fleets of ships ply to and fro, carrying over 30,000,000 tons of iron ore—one third of the entire globe's supply. If we could ascend in an air ship to a high altitude over Lake Superior, and look down on the great mountain ranges of iron ore near the north-west shores; trace the minerals being rushed down to the immense wharfs at Duluth and Ashland; see the colossal ore ships loaded rapidly by mammoth machinery; follow the fleets across the mighty waters, down through the chain of lakes, to Erie ports; witness the ore transferred by rail to Pittsburg and other great centres of iron and steel industry, and there smelted into pig iron, and converted into steel shapes and forms, ready for use in the myriad machines, appliances and structures designed by the Engineers—we should have before our eyes the most imposing commercial panorama to be seen in the civilized world! The lake is 627 feet above sea level, and although the track is considerably elevated, so clarified were the crystal waters that we could clearly perceive the stones in the depths below. For many miles the train hugged the shore, climbing heavy grades, winding in and out picturesque bays, crossing viaducts, circling around jutting capes, and dashing through tunnels and deep cuttings of solid rock; showing the masterful spirit of the engineer, not to be thwarted by any obstacles however formidable, in his determination to cut his way through to "the land of the West." At this stage of the journey, we observed a change in the aspect of Nature. The trees, shrubs and vegetation generally began to exhibit more color, doubtless due to earlier frosts in these higher latitudes. The broad patches of grass and weeds which relieved the ugly, scrubby, rocky, undulating woodlands, looked like a series of lovely oriental carpets: the dashes of bright red amid the dominant yellows and greens, being due to the autumn leaves of the huckleberry, which there abounds. The forest trees which stretched over the uplands on our right, were already taking on their autumn tints of russet and gold, all in a setting of olive green, relieved here and there by clusters of scarlet berries on the boughs of the mountain ash. One thing we missed was life. For nearly two hours we travelled along the wild, rugged shore of the



Modern Threshing Operations.

lake without seeing even a bird. In that desolate region which fringes the great lake, (beginning 150 miles west of Port Arthur, and extending a two hours' ride eastward) the land is broken, rocky and apparently unfertile, while the lumber does not seem of much account, and unless profitable minerals are found, its chief utility will be the pleasure given to romantic tourists by its surpassingly beautiful marine landscape scenery. Of course the tapping of the country many miles northward by the G. T. P. may disclose new surprises in the way of agricultural lands and mineral deposits; but down by the lake shore nothing of the sort is in sight.

Speaking of the absence of life, we at last caught a glimpse of a flock of black crows in session, and almost immediately came in sight of a small Indian encampment down near the edge of the lake. An Indian squaw, standing near one of the wigwams, gave the salute: the right arm elevated, with the forefinger pointing skyward. Soon after we dashed around a rocky promontory, and charming Jack Fish Bay came into view. This picturesque spot—already a port of some importance, with its wharf and pier, and modern coal loading machinery—has recently come into prominence as part of the unique engineering project of Col. Charles T. Harvey, C. E. This distinguished Engineer proposes to bring salt water fish from Hudson Bay, 200 miles by means of a special line of steamers, down the deep Albany River, then 190 miles by an electric railway, from near Martin's Falls, to Jack Fish Bay, and from thence across Lake Superior to Chicago, Cleveland and other great North American cities, to feed a population of 30,000,000. We hope to have the pleasure within the next four years of travelling from Jack Fish Bay over the rail and water system proposed, and then cruise over the briny waters of the great Canadian sea, to investigate the wonderful resources of fish, porpoise, seal, walrus and whale, which abound in this magnificent, untapped asset which Canada has in the Northland.



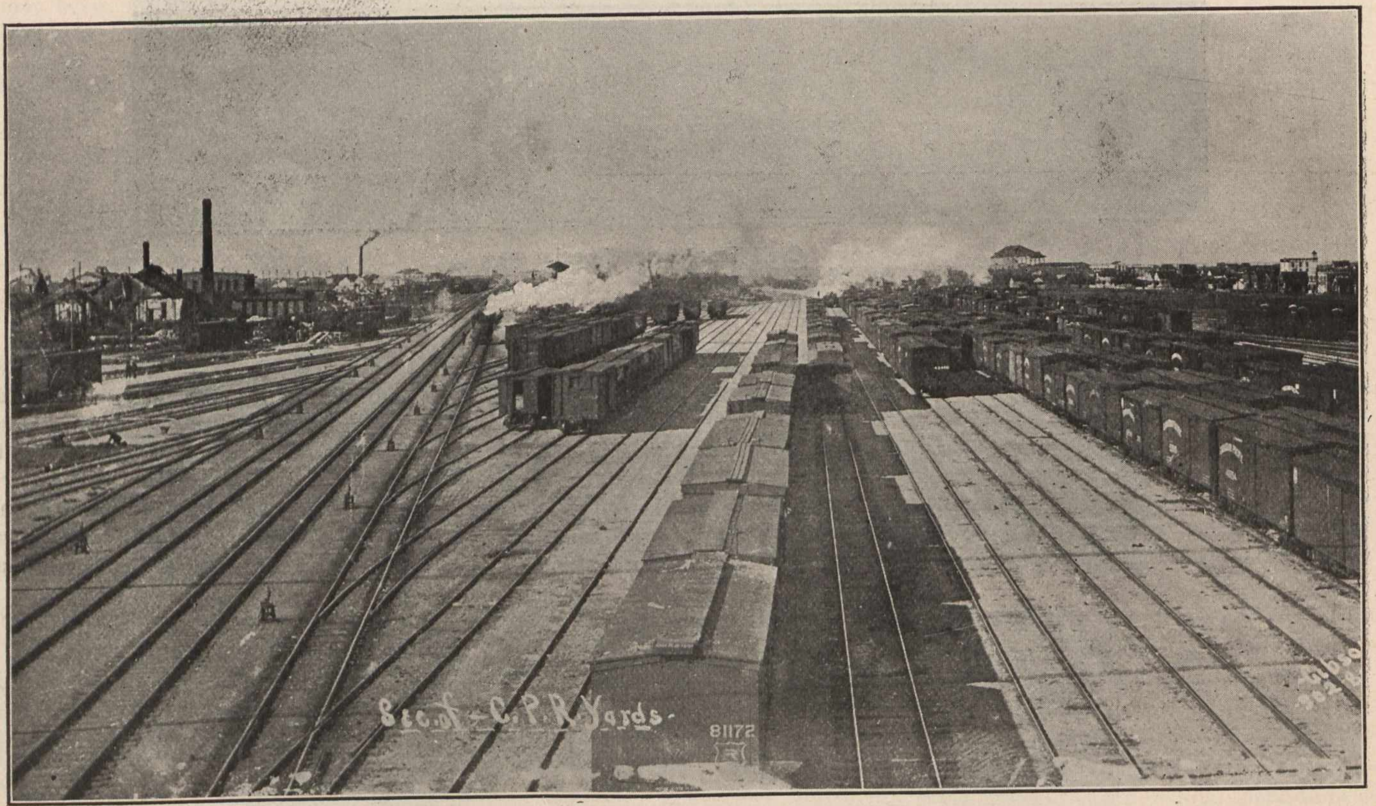
Civil Engineers' Special.

Leaving Shrieber—a divisional point of some importance, 129 miles from Port Arthur—at 6.45, a remarkable vision met our view. The shore line was a series of irregular bays. In the offing, over the darkening blue waters, lay a number of wooded islands like a line of battleships at anchor, casting their lengthening shadows. Between two of these islands the setting sun was glowing with a golden light of indescribable glory. The reflection across the lake towards us, was a striking phenomenon, commencing at the water line with a half disc, it was connected by a narrow neck to an elongated projection, in shape like a pine cone, and as clearly defined in outline as if it had been drawn by an artist's pencil. The color of the reflection was orange yellow, the waters on either side near the sky line being deep orange. Between the cone point and the shore was a line of glittering, dancing stars, like the Milky Way, over which small dark boats passed and repassed. As the sun went down, the azure sky over the islands, changed into a wondrous purple, while the reflection above on some hovering cumulus clouds, silvery white faces and dark purple shadows, was entrancingly beautiful.

Where Iron Ore was First Discovered in the Lake Superior Country:. 1844.

Scenes like these in the chambers of an engineer's mind, are priceless treasures, which neither moth nor rust can corrupt, nor thieves break through and steal. This sunset was only the prelude to many wonderful visions of the sublime nd beautiful in Nature, which alternated day by day with notable examples of the engineering triumphs of man. Soon after the scene described, the shades of evening fell, and important industrial cities, like Port Arthur and Fort William, were passed in the night. Mr. W. A. Bucke, E. E., stated at the Engineers' Club, Toronto, (Oct. 4) that in his opinion, the twin cities on Lake Superior had the greatest promise of future industrial prosperity of any places they (Civil Engineers) had seen on their twenty-one days' trip. We visited these remarkable cities on our homeward journey, and when we reach that stage of our story, shall have some things to say and show, that will be a revelation to not a few, of the mighty things that are doing on the northern shore of Lake Superior. (Inasmuch as the industrial and engineering work going on at Fort William and Port Arthur is of superlative interest from the engineers' standpoint, it is just possible that we may deal specially with this subject in December.) Sleep, on the journey through this section, was next to impossible, owing to the shriek of engine whistles, clanging of bells, shouting of voices, shunting and bumping of heavily laden

At 2 p.m., Winnipeg, the metropolis of the West, came in sight. We were greeted with a salute of Heaven's artillery and cooling showers of rain, as we crossed the river with Ogilvie grain elevators and Massey-Harris Co.'s large agricultural implement depot on our left; and the picturesque, red-roofed, yellow-walled gas works buildings with brown gasholders on our right, and steamed into the noble, commodious new C.P.R. station: the finest in the Dominion. The immense general waiting hall, with its seried rows of massive marble columns, balustraded galleries, and ample seating accommodation, is one of the most imposing station interiors to be seen on the continent; and shows the boundless confidence the C.P.R. have in the future of this phenomenal city. Three years ago, an English traveller—W. Beecher Smith, of Manchester, England—had declared to us in Pittsburgh, that Winnipeg was the best laid out city he had seen in British North America. We were sceptical. But as I walked out of the Corinthian columned portico of the station, into the sticky, muddy streets that autumn afternoon, past the magnificent Royal Alexandra Hotel, into Main Street: equalled only in width by Pennsylvania Avenue in the capital of United States—and already ornamented by substantial municipal buildings,



Canadian Pacific Railway Freight Yards at Winnipeg.

freight trucks: part of the 30 freight trains being dispatched out of Winnipeg every day, carrying the fruits of the bountiful harvest eastward. In five years the freight business has more than doubled: 1901, $18,983,185; 1906, $39,512,973; and although the rolling stock has been enormously increased, the roads are manifestly congested, and delays frequent. There will be little relief until the double track from Fort William to Winnipeg is completed, which is now laid to within a few miles of Kenora.

At early noon, 35 miles east of Kenora, we glanced out of the carriage windows, and saw a locomotive and freight cars piled up in a scrap heap on the side of the tracks, due to a smash up. Our wonder was that these terrible mishaps were not more frequent. Labor it was almost impossible to get, and the regular employees in the freight service were greatly overworked, and worn out for want of proper rest and sleep. We gleaned from an intelligent young linesman, finely built, but with marks of strain on his face, who boarded our train at this point, that the Company compensated them well for the overstrain, since they were paid $2 extra per 100 miles. Sometimes they were able to do 1,000 additional miles in a month, hence, made $40 extra.

splendid stone banks, business offices, and stores; then traversed Portage Avenue, on which is Eaton's great emporium; "Free Press" Building, and other important business blocks; then down other great thoroughfares—all of ample width; and finally through the fine residence section, back to where we started on our observation tour, I had to admit, that my English friend's opinion was well founded. The first impression is startling: there seems something almost uncanny about the wonderful rise of this Western city. It is like a chapter out of "The Arabian Nights." However, no mirage of the desert is it, but a substantial, modern city of 100,000 inhabitants, destined to rival in vastness and importance, Chicago and other mighty cities of the North American Republic. If some day—when the city has become boundlessly wealthy, and the commoner business blocks on Main Street have been displaced by institutions for the cultivation of science, literature and art; together with resorts for the recreation of the people: all architecturally designed for artistic effect and scenic beauty, on the grand scale—this great central thoroughfare is flanked on either side by a lofty colonnade or archwork of stone, covering the promenade walks from one end to the other (as in the ancient city of Antioch), Winnipeg will have one of the noblest city avenues in the world.

The Civil Engineers, on reaching the city at 9 a.m., were met at the station by Mayor Sharpe and Aldermen Latimer, Sandison and Pulford, representing the City Council; also by the City Engineer (Col. Ruttan) and his staff; representatives of the C.P.R. engineering department, and others. The morning was spent, inspecting, first, the freight yards and machine shops of the C.P.R.; then the

Rotunda of the Royal Alexandra Hotel.

City Waterworks and Concrete Reservoir. The magnitude and moderninity of these engineering works was a surprise to those who had not been in "the wild and woolly West" before.

On returning from the suburbs, the Engineers were entertained to luncheon at Deer Lodge, as guests of the city. Mayor Sharpe acted as toast master. Octave Chanute, C.E., of Chicago (Past President of Am. Soc. C.E.), responded to the toast of the President of the United States, pointing out that in the engineering world, the boundary line between the two countries is little more than a myth. Professor McLeod responded to the toast of Canada, assisted by Messrs. Papineau and William Kennedy, and Col. Ruttan spoke on the work and organization of the Society of Civil Engineers.

After a couple of hours' riding about, seeing the sights of the city, the party accepted the generous hospitality of Col. and Mrs. Ruttan at their home on Armstrong's Point, where refreshments were served and a pleasant hour spent. At 9 p.m. a conference between the Local Engineers and officials of the C.S.C.E. was held in the City Hall. Col. H. N. Ruttan, City Engineer, presided. After an interesting discussion, in which Messrs. J. A. Hesketh, J. E. Schwietzer, J. W. Harris, O. C. H. Dancer, etc., took part—representing the sentiment of the Westerners; Prof. C. H. McLeod (Secretary of the Society) gave a brief, succinct exposition of the aims and objects of the C.S.C.E., replying effectively to objections and clearing up misconceptions; declaring that the Society with headquarters at Montreal "had no desire to be a money-making affair, but simply an organization to increase the influence of the profession." He was followed by Prof. J. B. Porter, and Messrs. Sproule and Wm. Kennedy. This important gathering terminated with the unanimous adoption of the following resolution, moved by J. W. Harris, seconded by O. C. H. Dancer:—

"That in the opinion of this meeting, it is desirable that a branch of the Canadian Society of Civil Engineers, should be established in the Province of Manitoba, with headquarters at Winnipeg."

Among the engineering projects on foot at the present time, one is the installation of a municipal 100,000 H. P. hydro-electric power plant at Point du Bois, with Mr. Cecil B. Smith as Engineer. Another is, much needed new waterworks: the city water is vile. Both these schemes are being pushed forward with great energy; especially the latter, towards which the C.P.R. have generously contributed (September 25th) $200,000. Take this great Company, with its new station, magnificent hotel, and immense workshops out of the city, and it would be like Shakespeare's "Hamlet," with the Prince of Denmark left out. Next to the C.P.R., the most dominant force is the "Manitoba Free Press," which is to the West what "The Globe" is to the East. This powerful journal is now entrenched in fine, new offices on Portage Avenue. Its office outfit, and modern printing plant, is one of the sights of the city. We had it on high authority that it costs $40,000 a month to run their business! The Editor-in-Chief, John W. Dafoe, is one of the strongest intelectual personalities out West, while W. P. Macklin, the business manager, is a man of keen resource, and great executive ability. The writer here makes his acknowledgment of the courtesy and kindness which he received at the hands of these gentlemen of the West.

Lack of space hinders detailed reference to the various municipal features, the industrial resources and boundless possibilities of the city, but to such of our readers as are interested, our advice is, get a copy of "The Monetary Times" for October 12th, 1906, for there will be found the ablest and most complete digest of facts and figures about Winnipeg, for business men, ever published.

Winnipeg City Hall; Where the Civil Engineers' Conference Was Held.

Sept. 10th.—At 22 minutes after midnight, the Civil Engineers' party bade adieu to the metropolis of the West, where they had been so generously and hospitably entertained, and the special steamed out of the station, bound for the prairies, Rockies, Selkirks, Fraser Canyons, and Pacific Coast.

(To be Continued.)

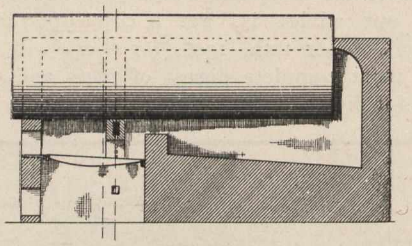
INTERNATIONAL PATENT RECORD

Dominion Houses of Parliament.

CANADIAN PATENTS.

Specially compiled by Messrs. Fetherstonhaugh, Dennison and Blackmore Patent Attorneys Star Bldg., 18 King St. W., Toronto; Montreal and Ottawa.

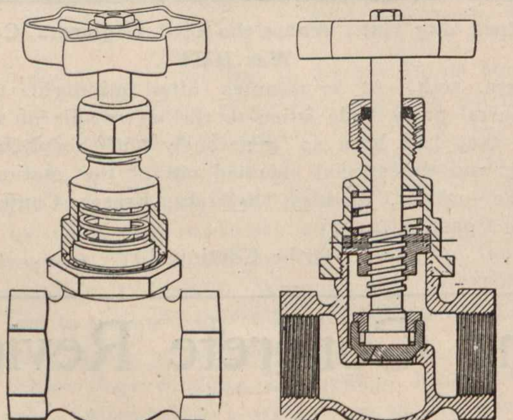
Furnaces.—James Lees.—101,479.—A simple and durable construction of furnace is shown whereby a complete combustion of fuel is provided for, thereby increasing the efficiency and preventing the smoke nuisance. It consists essentially of feeding the oxygen-laden air from the ash-pit through passages in side ledges to an arched baffle wall, which is hollow, and provided with radial openings through



101,479.

its lower side, through which the oxygen necessary to complete the combustion, is emitted into the firebox. The essential feature being the placing of the hollow baffled wall comparatively a short distance in front of the bridge wall, consequently in the combustion of the fuel all the gases must pass the constant discharge of oxygen through the crescent-shaped row of radial ports in the arch where all combustible matter is completely consumed, thus permitting only the heating gases to pass along and throughout the boiler.

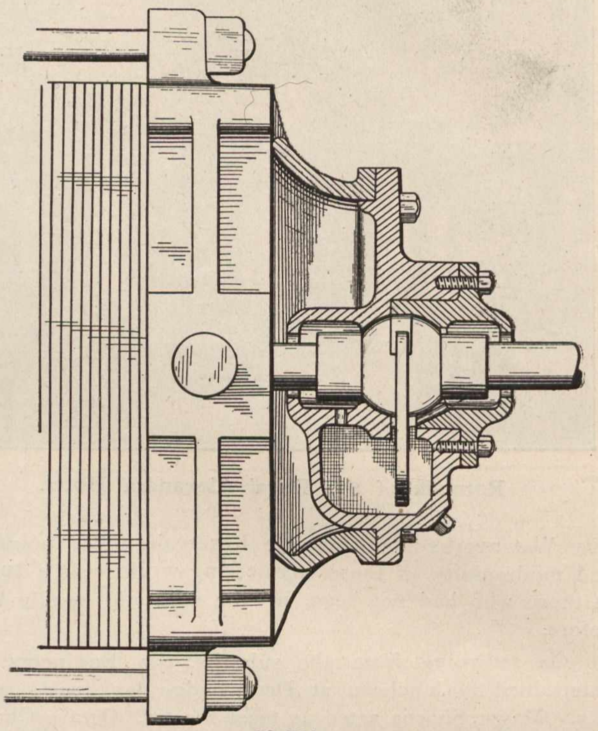
Self-grinding Valve. — Henry Rustad. — 100,964. — The illustration represents two views of self-grinding valve. The invention consists of a valve body and a bonnet closing in said body having a cylindrical recess therein, a valve and valve spindle suitably supported in said bonnet and valve body having the usual threaded portion engaging a slidable nut held within said bonnet and a compression spring within the aforesaid recess inserted between the top of the



100,964.

bonnet and the said slidable nut. The valve and valve spindle are rotated in the usual manner until the valve closes down upon its seat, the spring holding the slidable nut in its downward position. When the valve rests upon its seat the spindle may be turned further, and the slidable nut will rise upwardly against the pressure of the spring, thus allowing the valve to turn upon its seat, and on opening and closing grind both the valve and seat, thus making a perfect-fitting valve at all times.

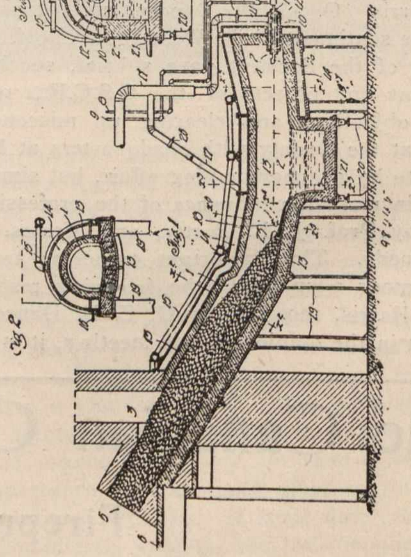
Self-aligning Bearings.—Isidor Deutsch.—80,231.—The illustration represents a sectional view of a self-aligning bearing, particularly applicable to electric motors. The invention consists essentially of inner and outer members, vertically split, the former securely bolted to the frame of the motor and the outer member inserted in a recess in the inner member, both having cup-shaped sockets in which a part spherical bushing is contained. The lower portion of



80,231.

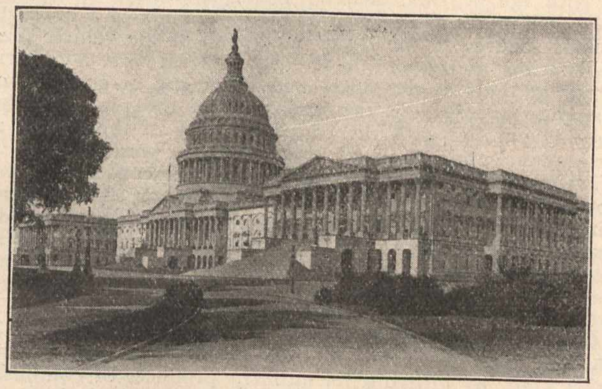
the inner members forms an oil chamber, into which depends an oil ring through a suitable cross slot in the bushing. The advantage of the bearing is that both members may be removed without disturbing their relation one to the other, and consequently the core of a motor may be taken out and replaced and the bearing members secured to the frame again in a very short time. It is also a very simple matter to replace the bushing by removing the outer member.

Furnace for Smelting Ores.—Elfego Riveroll.—98,445.—This invention consists of an ore-smelting furnace comprising an inclined ore chute having a charging opening at its upper end and an outlet chute from the stack below the upper end. The combustion chamber is arranged at the



98,445.

lower end of the chute, and closed to permit pressure to be developed therein. Combustible material is fed under pressure into the chamber, and air under pressure is also fed into said chamber. The ore is fed to the combustion chamber by gravity, and suitable mechanical means are arranged in the ore chute for arresting the said ore when desired.

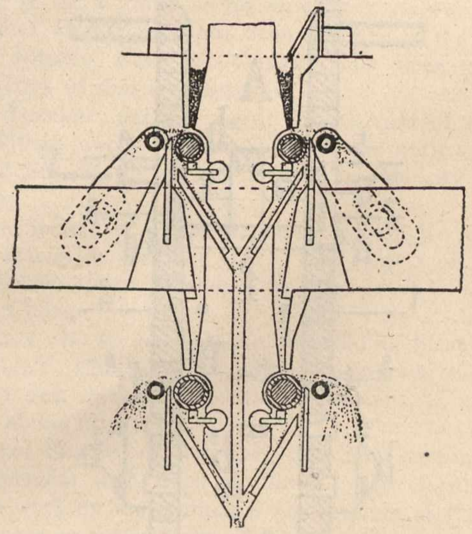


Capitol, Washington, U. S. A.

UNITED STATES PATENTS.

Specially selected and abridged by Messrs. Siggers and Siggers, Patent Attorneys, 918 F. Street, N. W., Washington, D.C., U.S.A.

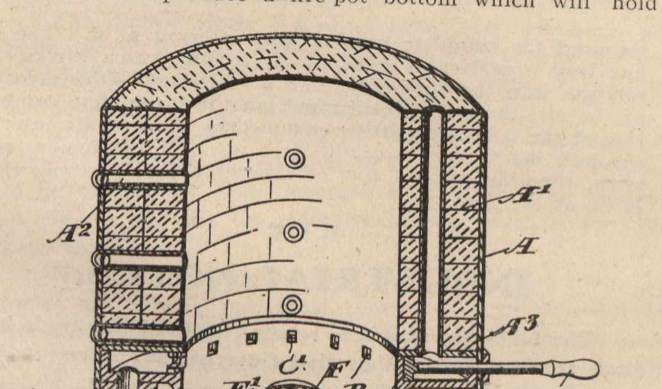
Electrostatic Apparatus.—Millard Woodsome, Boston, Mass.—831,916.—An electrostatic separator having a pair



831,916.

of opposed electrodes, to one of which material is fed. The arrangement of fenders, one between, the other below, the electrodes, is to facilitate the separation.

Gas-generator.—William Henry Cone, of Berlin, Ont.—830,883; Sept. 11, 1906.—This invention relates to improvements in gas producing generators; and the object of the invention is to produce a fire-pot bottom which will hold

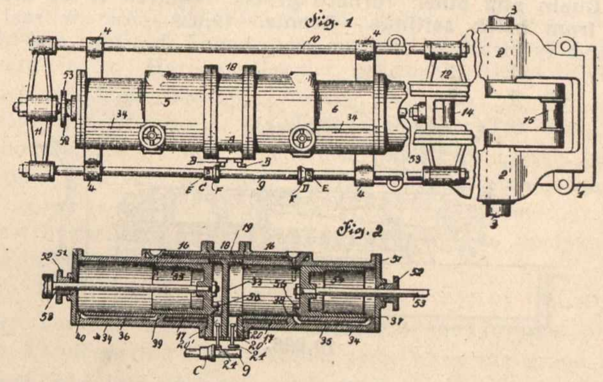


830,883.

the fuel up in the centre, and so produce an equilibrium of heat in the side and centre. It consists of a fire-pot and casing surrounding the bottom of a gas-generator, an annular chamber surrounding the casing and communicating therewith through holes in the casing, and with a source of steam and air-supply, of a bottom for the fire-pot provided with a raised centre and passage-way therethrough and communicating with the annular chamber, a valve covering the top of the passageway and conduit extending through the raised centre and means for controlling the valve.

Gas Engine.—Reuben Willetts, of Butler, Pa.—830,270.—This invention relates to certain new and useful improvements in gas engines, and relates more particularly to a compound or double-acting gas engine. This invention aims to provide a double-acting gas engine wherein a novel form of cylinders is employed, the gas and air inlets and exhausts being so constructed that the pistons mounted within the cylinders will be alternately actuated.

The pistons of this improved engine are connected together by cross-heads and connecting-rods, in order that a positive co-operation of the pistons of the improved engine can be obtained, and by this construction the efficiency of

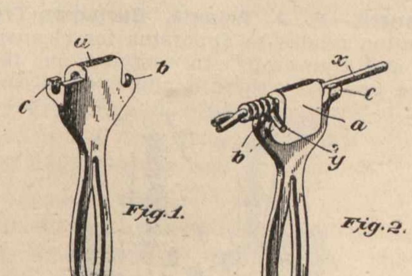


830,270.

gas engines is greatly increased, and at the same time a strong, durable, and inexpensive engine is produced. In connection with this improved engine electric-spark igniters are employed, and there has been put into practice novel means for automatically firing each cylinder of the improved engine at predetermined times.

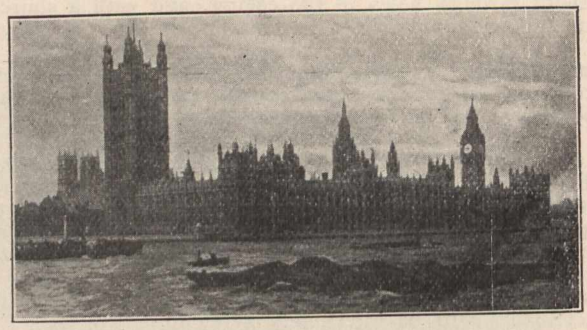
The invention consists in the combination with a suitable bed-plate, of cylinders, a head formed with a partition and composed of a separate section of material from the cylinders and mounted between said cylinders, said cylinders having gas-inlet ports formed therein, said cylinders having air-inlet ports formed therein, said cylnders having exhaust-ports formed therein, spring-pressed air-valves controlling said air-inlet ports, pistons mounted in said cylinders, rods connecting said pistons, means carried by said head to fire said cylinders, and means carried by one of said connecting-rods to actuate the first-named means.

Wire Splicer.—Datus C. Smith, New York, N.Y.—815,754; March 20, 1906.—The object of this invention is to provide an improved means for splicing wires. To accomplish this result the inventor shews the different models embodying the same principle, one of which is shown herewith. Referring to Figs, 1 and 2, a shank or handle is provided with a flat part formed into a hook **a** and having notches or shoulders **b** formed on both sides of the hook. A notch **c** is provided at the other end of device. In opera-



815,754.

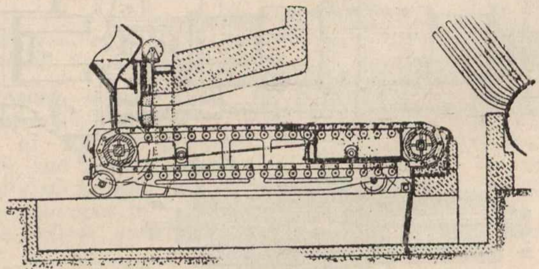
tion one wire **x** is placed in position beneath the hook **a** and over the hook **c.** The wire **y** to which it is to be spliced is then caught by one of the notches **b.** The two free ends in the direction of **b** are then grasped by any suitable tool and the splicer is revolved, which causes the wire **y** to coil around the wire **x.** To complete the splice the tool is disengaged and applied to the end of the wire **x** and the wire **y** in a similar manner.



British Houses of Parliament.

GREAT BRITAIN.

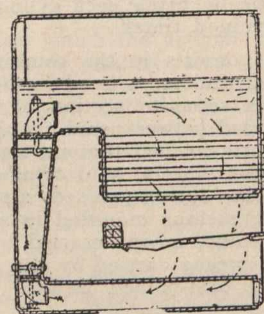
Chain and other furnace grates required to be drawn out from brick settings.—Bennis.—19,028.—An air seal is formed by means of sand or ashes round the sides and after



19,028.

part of the furnace. Baffle plates and hit-and-miss devices are arranged whereby the supply of air can be regulated, and the ashes can fall out where not required.

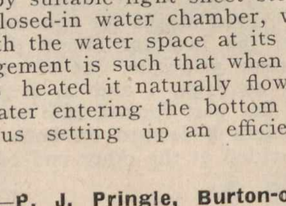
Means for Promoting Circulation in Steam Boilers.—Circulators Ltd. and Ross.—2,248.—The water space within the wet back is utilized as a means for promoting circulation, the space being enclosed at the sides and at the top



2,248.

and bottom ends by suitable light sheet steel or other walls so as to form a closed-in water chamber, which is only in communication with the water space at its upper and lower parts. The arrangement is such that when the water in the wet back becomes heated it naturally flows in an upward direction, fresh water entering the bottom of the space to take its place, thus setting up an efficient and positive circulation.

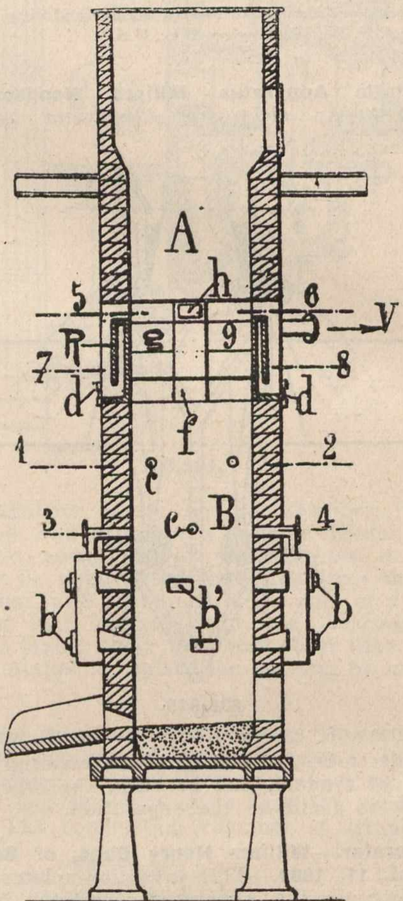
Rail-cleaners.—P. J. Pringle, Burton-on-Trent.—13,130.—This invention relates to apparatus for cleansing the rails of railways and tramways. In carrying out the invention, and speaking generally, there is employed in each apparatus



13,130.

two scrapers **a** and **b**, the scraper **a** operating on the tread of the rail **c**, and the other in the groove thereof, an oblong plate **d** serving as a guide for the scrapers **a** and **b**, two supports for the ends of the plate **d**, and two springs **i** and **j** applied to the ends of the latter to maintain them in contact with the bearing pieces. For convenience of construction the supports are formed at opposite ends of a bracket **k**, which is secured to the frame member **l** of the vehicle truck. The bearing pieces of these supports are of a spherical contour at their upper sides, and enter and co-act with corresponding recesses in the underside of the plate **d**, whose length is parallel with the edges or sides of the rail **c**, and whose plane under normal conditions is parallel with the surface thereof. Thus the bearing-pieces constitute lateral pivots whereon the plate D can move, tilt, or oscillate longitudinally of the rail **c** when an obstruction is encountered or a crossing or point is being negotiated, and transversely thereof when a curve is being rounded, all under the influence of the springs **i** and **j**.

Cupola Furnaces.—A. Baillot, of Haybes, France.—10,312, 1905.—By this invention fuel is economized, in a furnace of this kind, by utilizing its unburnt products of combustion as well as those of other installations, particularly carbon monoxide. For this purpose these products as they leave the heat zone **B** are withdrawn through openings **h** into the heating passages **g**, where they are mixed with cold air



10,312.

required for complete combustion, entering at **d**. The exhausting operation is effected by a fan, which forces the mixture into the fusion tuyeres **b**. Owing to the pressure of the air, the gases resulting from the incomplete combustion of the coke are partly consumed by the mixture injected through the tuyeres **c** of the first row. If the fusion zone rises, then the second row of tuyeres **c** performs the same office as the first row.

INDUSTRIAL NOTES.

The following enquiries relating to Canadian trade have been received at the Canadian Government Office, 17 Victoria Street, London, S.W.:—

A North of England firm, interested in nearly all kinds of ores and minerals, wishes to hear from Canadian firms who are in a position to dispose of mining properties or who desire assistance in developing the same.

A North of England firm manufacturing electrical wires, cables, etc., and using large quantities of soft pig lead, is desirous of corresponding with Canadian producers who are in a position to supply.

A Scotch firm of manufacturers of fire-bricks, fire-clay, etc., is seeking to extend business connections with Canada.

A firm of agricultural and general engineers in the eastern counties makes enquiry respecting the opening in

Canada for their light hauling engines, with a capacity of hauling eight tons on ordinary level roads.

Enquiry is made for names of manufacturers of electrical machinery, etc., by parties in the Province of Quebec who are desirous of working up export trade in mica produced in their district.

A French firm having a connection for the sale of molybdenite, vanadium, antimony, and other ores is desirous of corresponding with Canadian producers.

From the City Trade Branch, 73 Basinghall Street London, E.C. :—

A firm manufacturing engineers' hand tools, patent copper joining rings, and other engineering goods, are prepared to appoint a suitable Canadian resident agent.

The manufacturers of a patent boiler fluid and similar specialities are open to appoint a suitable Canadian resident agent.

A Glasgow firm would like to get into touch with Canadian manufacturers of Portland cement in a position to undertake export trade.

Toronto.

G. H. Burgar, Welland, and Mr. Waddington, Toronto, are asking for a franchise for an electric railway in Welland.

Walter McRae, who has been foreman of the motor shop of the Toronto Railway Company, has been promoted to the position of master mechanic.

R. Turnbull, general agent for Canada of the Héroult ore smelting process, whose headquarters until recently were at Sault Ste. Marie, is now located in this city at Spadina Gardens.

The Society of Chemical Industry held its first meeting of the season on October 25th. The subject of the evening was "Excise—Free Alcohol," by Professor Cohoe, of McMaster College.

The C. N. R. are desirous of building blast furnaces on Ashbridge's Marsh. The company intends to smelt ore from its own mineral deposits. The plant, if erected, will occupy about fifty acres.

Mayor Sharpe, of Winnipeg, has now consented to sign the agreement with Cecil B. Smith. Mr. Smith estimates that the work on the municipal power plant at Point du Bois will involve an expenditure of $3,500,000.

Messrs. Speight & Van Nostrand, Ontario land surveyors, have surveyed 180 miles of base and meridian line in the district of Algoma. Good farming land, clay, and clay loam was found in the area, which is well timbered.

The Canada Foundry has been awarded a large portion of a 20,000 ton contract for structural steel by the C.P.R. for bridges in Ontario. The Foundry Company made a much better bid than did a number of large American companies.

The Polson Iron Works, Limited, are planning new buildings, at a cost of about $100,000, and already the contract has been let for the construction of a new machine shop, 80 x 300 ft., to cost about $50,000.

The Ontario sales office of the Jenckes Machine Co., Limited, has been moved from 12 Lawlor Building, Toronto, to St. Catharines, Ont., where it will in future be operated in conjunction with the extensive branch works of the company there.

The Electrical Maintenance and Repair Company, Toronto, are moving into more commodious premises at 162 Adelaide Street West, where they will occupy the two upper flats. The change will afford them much greater facilities for the execution of their rapidly growing business.

M. C. Huyette, Canadian representative of the Murphy Iron Works, of Detroit, has moved from his late quarters in the Board of Trade Building to No. 1203 Traders Bank Building. Mr. Huyette reports great prosperity in business, the demand for the Murphy furnace being unusually good.

The Canadian Northern Railway have applied to the city for the purchase of a 10'-0" strip along the Esplanade, from Sherbourne Street to the Union Station, in order that they may make a right-of-way into the station. They have arranged for a private right-of-way from the Don to Sherbourne Street, and depend upon the city's concessions to let them in.

The Canadian Machine Telephone Co. have secured a 21-year franchise from the town of Lindsay, and will install the system in about a year.

After a visit to the site of the proposed Bloor Street viaduct, viz., Bloor and Sherbourne Streets, Mayor Coatsworth is more than ever in favor of the proposed eastern extension of Bloor Street. If the project is carried out it will open up 2,000 acres of good land suitable for cheap homes, and will form a highway from East Toronto to Toronto Junction.

At a recent meeting held in this city it was decided to organize a Railway Engineers' Club, similar to existing clubs in the United States. The club will embrace all classes of railway men in the district, and its objects will be educational and social. Papers on topics of interest to the members professionally will be read by experts. Permanent rooms will be secured.

At a recent meeting of the board of directors of the Lehigh Portland Cement Co., Limited, the following officers were elected: Harry G. Trexler, president; Alfred W. Thorn, vice-president; George G. Sykes, secretary; E. M. Young, treasurer; Charles A. Matcham, manager. The company is about to erect a mill of not less than 2,500 barrels per day capacity, or not less than 750,000 barrels annual capacity. The works will be located on Point Ann, about four miles east of Belleville. The Toronto office of the company will be in charge of A. W. Thorn.

The Exhibition grounds was the scene of the greatest fire Toronto has witnessed since the conflagration of 1904 on Thanksgiving Day, October 18th, when the grand stand, Transportation Building, and cattle sheds were totally destroyed. The loss is estimated at about $130,000, with insurance as follows: Transportation Building, $40,000; Annex, $13,400; grand stand, etc., $54,000; cattle sheds, $5,000. The soldiers at Stanley Barracks were the first to discover the fire, and they did good work in helping the firemen to extinguish it, and in keeping order among the immense crowds that turned out to witness the awful spectacle.

Mr. John Robson, A.M.I.M.E., who recently arrived in Toronto from England, has taken over the Miller Reversible Gasoline Engine Co., of Toronto. Associated with Mr. Robson are J. Miles Wilkinson, M.A., vice-president of the Amalgamated Oil Co. of Canada, Limited, of Petrolia and London, and Mr. M. J. Miller, of Toronto. The name of the new company is The British Canadian Engineering Company; capital $250,000.00; temporary offices 164 Bay St. Messr. McWhinney, Lennox, Wood & Brown, Barristers, Home Life Bldg., and J. L. Sutcliffe, chartered accountant, of Adelaide St., are acting on behalf of the company. They will manufacture Gas Engines, and Gas Producer Plants, and Miller's Patent Reversible Marine Gasoline Engines. In addition this company will act as sole Canadian agents for Pollock, Whyte and Waddel, of Glasgow, Scotland; Blackstone & Co., Limited, Stamford, England, and the Springfield Gas Engine Co., of Springfield, Ohio, U. S. A. We understand that large contracts for Producer Gas Plants and Engines have already been placed with the new company.

Montreal.

The Jeffrey Manufacturing Company, Columbus, Ohio, have established a new Canadian branch office in Montreal, Canada, at Lagauchetiere and Cote Streets.

The Canadian Express Company have been granted a permit to construct a ten-storey office building at the corner of Youville Square and St. Paul Street. The new structure is to cost $250,000. The Canadian Pacific Railway Company have also been given permission to erect a new paint shop adjoining the Angus shops. The cost will be about $70,000

General.

The Lake Superior Corporation's net income for the year ending June 30th was a million dollars, double that of the previous year.

The Lakefield Portland Cement Company have broken ground in the Parish of Longue Pointe, Montreal, on which they will erect cement works.

The Canadian Westinghouse Co. have placed an order for three jib cranes with the Smart-Turner Machine Co.

Twenty-five acres of land in Revelstoke, B.C., have been washed away lately by the Columbia River, and the whole town of five thousand is threatened.

The Iberville Lumber Co., whose headquarters are in New York City, are establishing a large sawmill at Sault-au-Mouton, Que., a point on the north shore of the St. Lawrence, some distance below the Saguenay. The contract has been placed with the Jenckes Machine Co., Limited, of Sherbrooke, covering the turbine plant to furnish power for the mill.

The Manson Manufacturing Company, a new incorporation, have taken over the plant of the Thorold Foundry and Machine Company, Thorold, Ont., where they will manufacture rotary steam engines and machine tools.

The Welland Construction Company, who purchased 102 lots in Welland, have contracted to erect fifteen houses by January 1st and fifteen by March 1st for the Ontario Iron and Steel Company. The houses are to cost from $1,500 to $2,500 each.

The Ideal Concrete Machinery Company, South Bend, Indiana, has recently received a large order for concrete machinery and supplies, amounting to about $250,000. The company is doing an extensive business in foreign countries, and has orders on hand amounting to about $150,000.

The Chapin Mine, Iron Mountain, Mich., which is the deepest iron mine in the world, is to be supplied with a single drum hoisting engine of the first motion type; the capacity of the engine will be 26,400 lbs. at a speed of 1,900 ft. per minute, built by the Allis-Chalmers Company, of Milwaukee.

As a result of experiments being carried on by the Government at the old Lewis & Clark fair grounds, Bessemer steel has been reduced from the ordinary black sands found at the mouth of the Columbia River. Whether this reduction can be carried on at a profitable basis has not yet been determined.

The Bell Asbestos Mines, of Thetford Mines, Que., and the Asbestos Mining and Manufacturing Co., of Chrysotile, Que., have recently increased their hoisting plants, the former by the addition of three and the latter by the addition of two 9 x 12 special cableway hoisting engines, as built by the Jenckes Machine Co., Limited, of Sherbrooke, Que.

Work has been commenced on the new plant of the Canadian Iron and Foundry Company at Fort William. By June, 1907, the company expect to be employing over 200 men. The foundry will make a specialty of railway car wheels and castings, and cast iron water and gas pipes. The capacity will be 150 tons per day.

Wayland Williams, who for the last two years has represented the Campbell Gas Engine Co., has now taken hold of the gas engine department of Messrs. W. H. Laurie & Co., Board of Trade Building, Montreal, the Canadian agents for the well-known Crossley gas engines, suction gas-producers, and the Loomis-Pettibone producers.

The Canada Forge Company have begun construction of their buildings at Welland, Ont., the contractors being the Welland Construction Company. There will be two buildings about 50 x 100 feet each, to be completed in November, and manufacturing operations will begin early in January. The capital of the company is $100,000.

The Morgan Construction Company recently received the largest order for gas-producers that has ever been placed namely, that from the Illinois Steel Company, Gary, Indiana, for 140 large producers to operate the 28 open-hearth furnaces. This is the fifth order that has been awarded to the Morgan Company by the Illinois Steel Company.

The Montreal Smelting and Refining Co., which is building an extensive custom smelter at Trout Lake, near North Bay, Ont, for treatment of Cobalt ores, has closed a contract with the Jenckes Machine Co., Limited, Toronto, for the complete steam plant which will be required. This will consist of four 150 Horse Power high-pressure tubular boilers, two 250 Horse Power heavy duty Corliss engines, with feed water heater and boiler feed pump. The boilers are being built at the St. Catharines works and the balance at Sherbrooke.

The Smart-Turner Machine Co., Limited, Hamilton, have received an order from the Locomotive and Machine Co., Montreal, for a power-driven vacuum pump.

A terrible accident occurred at the Point Anne works of the Belleville Portland Cement Company recently. A party of men were working in the quarry, and there was a premature blast, by which two men lost their lives.

P. M. Cleave of the Royal Mint of Canada, has been inspecting the coinage method adopted in the United States at the Philadelphia Mint, and it is hoped that Canada will divert the Klondike gold, which has heretofore been sent to San Francisco for coinage.

The value of mineral productions exported from Japan in 1905 amounted to $31,860,000, an increase of $2,000,000 compared with the year before. Japan is now raised from the sixth to the fourth in rank among the copper producing countries of the world, and supplies five per cent of the world's demand.

Fears of Japanese commercial supremacy in the Far East have received a great impetus in the recent discovery of the fact that Japanese coal is expelling English coal from China, the East Indies and India and competing with Australian coal throughout the Pacific.

The Jenckes Machine Co., Limited, recently shipped from their St Catharines Works two 60 Horse Power tubular boilers to the Slough Creek Gold Mining Co., of Stanley, B.C. Stanley is 250 miles back in the mountains from Ashcroft, B.C., on the Canadian Pacific, from which point the boilers will have to be transported by team. The order was secured in London, Eng.

The Electric Controller and Supply Co., Cleveland, Ohio, have opened an office in the Merchants' Loan and Trust Building, 135 Adams Street, Chicago, Ill., with W. M. Connelly, in charge. Mr Connelly was connected with the Electrical Department of the Homestead Works of the Carnegie Steel Co. for five years, and resigned his position there to become electrical engineer of the Ensley plant of the Tennessee Coal, Iron and Railroad Co. at Birmingham, Ala., which position he held for three years and resigned to enter central station work at Birmingham, Ala., and at Houston, Tex., where he organized and had charge of the sales department. Mr. Connelly enters upon his new duties fully equipped.

To consume the refuse from their extensive mills Messrs. Williamson & Crombie, of Kingsbury, Que., will put up a burner. This will be 18'-0" diameter by 60'-0" high, with semi-circular wire cloth bonnet, and the steel shell will be erected complete by the Jenckes Machine Co., Limited, of Sherbrooke, Que., which firm will also furnish all the cast-iron fixtures required.

LIGHT, HEAT, POWER, ETC.

Natural gas has been discovered in Alberta, although the company operating has only bored down 760 feet.

Owing to the low water in the Ottawa River the E. B. Eddy Company is finding great difficulty in operating its plant.

The Leamington Oil Company opened a large gas well recently, about one and a half miles east of Leamington, which assures an abundant supply for several years.

The Ontario Power Company have decided to proceed with the completion of the first section of their development plant. Three more generators, with turbines to run them, have been ordered, and will be installed as soon as received. They will be capable of producing 12,500 H. P. each being duplicates of generator No. 4, now installed in the power house, which is the largest machine of its kind in the world. There are now four generators in the company's power house, and when the three new ones are installed the available space will be all occupied, and the seven units will take all the water supplied by the present conduit to run them. When the company desires to further increase the capacity of its plant it will have to build another section of the power house and another conduit or a tunnel to supply water to run it.

Charles D. Warren, president of the Lake Superior Corporation, says a contract for improving the power plant in the Michigan Soo will be let shortly. The cost of the improvements will be nearly $1,000,000, and it will take five months to complete the work.

The Ontario Government has leased Fountain Falls, on the Montreal River, Ont., to Beach Bros., of Haileybury, who intend to use the power developed there for running an electric railway connecting New Liskeard, Haileybury and Cobalt. The capitalists who are behind the project also intend to use the power for the operation of the silver mines.

The report of the engineer in charge of the Georgian Bay Canal survey will show the feasibility of a hydro-electric development of 1,250,000 H. P. along the route. It is now claimed than an expenditure of $100,000,000 would be justified by the increased facilities afforded transportation of the products of the West to the seaboard by this great waterway, and if so great an electric development can be realized, there would be a greater incentive to construct the works as a national undertaking.

MARINE NEWS.

The Canadian Government has refused to renew the franchise of the Detroit, Belle Isle and Windsor Ferry Co

The new ice-breaker for the Marine and Fisheries Department of the Canadian Government, the "Lady Grey," arrived in Quebec on October 21st.

The first American-built turbine steamer, "The Governor Cobb," was put into commission on October 22nd. She is 305 ft. over all, beam 54½ ft., and draws 14 ft. of water. She will ply between Boston and St. John, N.B.

The Dominion Government has built at its shipyard at Sorel, Que., a steamboat, the "Rouville," for use in Hudson Bay by the Royal Northwestern Mounted Police. The "Rouville" is 130 ft. over all, 96 ft. long, 26 ft. beam and 13 ft. deep.

The battleship "Dreadnought" has completed her full power trials under war conditions. It is stated that she steamed eight hours at an average speed of 21.5 knots. Her maximum speed was 22.4 knots. She is the fastest battleship ever built, and her performance is regarded as a great triumph for turbine engines.

A lighthouse and fog alarm station is being established by the Government of Canada on the southern end of Trial Island, Juan de Fuca Strait. The lighthouse is being built on the summit of the 80 foot knoll near the south-west end of the island. The fog alarm consists of a diaphone, operated by means of compressed air, the power being supplied by an oil engine. It was put in operation on the 1st September, 1906.

RAILWAY NOTES.

It is stated the C.P.R. purpose building from Woodstock to Brantford next spring.

The Strathcona Radial Tramway Company have asked the town council of Strathcona, Alta., for an exclusive franchise for an electric railway to run between Strathcona and Edmonton.

Rumor has it that the T., H. and B. Railway is desirous of acquiring control of the Grand Valley road. Officers of the company recently visited Paris and made enquiries re sidings, etc.

Great Northern engineers are working out a plan to harness Chelan Falls and generate electricity to operate all trains on the Hill road between Wenatchee and Seattle; between Wenatchee and Chelan Falls, on a road yet to be built, and on the coast line between Seattle and Vancouver.

The first electric or trolley locomotives to be used on the Canadian Pacific or in Canada are to be installed in the Fort William yards of the C.P.R. It is stated that the Company will, as soon as the Kakabeka Falls power plant is completed, use electricity for motive power in the local switching yards.

It is proposed to extend the Quebec and Lake St. John Railway to James Bay, which will also pass through the Chibugamoo mineral properties and assist in developing the resources of the same.

It is stated that the Southern Pacific Railway Co. have placed an order for 1,500,000 sleepers in Japan, the price being 56 cents each, delivered at a Mexican port. The impression has been prevalent that British Columbia controlled the market for ties on the American continent, but evidently this is not the case.

The C.P.R. has placed an order for the construction of one hundred new locomotives of the largest type. They now have on order a hundred and fifty new locomotives, representing an expenditure of approximately $3,000,000. The company has also placed orders for 200 passenger coaches and 4,000 freight cars.

Owing to satisfactory tests having been made in actual service, the Grand Trunk Railway have placed an order with the Locomotive and Machine Company, of Montreal, for fifty-five new Richmond compound consolidation engines, to be delivered as soon as they are turned out, and all to be in service on different divisions of the system before January 1st next.

MINING MATTERS.

The Handsome mine, Cobalt, has been sold for $750,000.

The British Columbia Copper Co. is now operating the three large blast furnaces which have just been erected at Phœnix, B.C.

The Krao mine, at Ainsworth, the oldest location in the Kootenay of silver-lead property, was sold recently to Butte parties for $100,000.

Gold, mica and coal have been discovered at Yellowhead Pass, B.C. Some of the richest samples of gold quartz ever seen in British Columbia were taken out.

Large quantities of copper are being discovered in the Yukon district, and from all indications Southern Yukon is destined to become the most valuable copper field in the world.

An immense nugget was taken out of the La Rose mine at Cobalt recently. It is 5 ft. long, 2½ ft. wide and 14" thick, and is composed of the highest grade ore, seamed with native silver. The weight is about 3,500 lbs.

The recent gold strike in Blum's Laurentian mine, near Wabigoon, Ont., surpasses in richness all previous discoveries. A single blast broke down over $15,000 worth of gold. Three-fourths of the weight of the ore is native gold, valued at $300,000 per ton.

Active work has begun at the iron properties at Logan's Glen, four miles from Whycocomagh, C.B., and three-quarters of a mile from tide water, where men are engaged in sinking a shaft to prove the quantity of the ore, the quality having been satisfactorily shown already.

Gold has been discovered at Innisfail, Alberta. A steam shovel at work in the dry bed of an ancient river has unearthed the mineral, whether in paying quantities or not remains to be seen. Samples so far discovered are said to be remarkably rich. Claims have already been staked, and the townspeople are considerably wrought up over the discovery.

The following list gives the ore shipments in British Columbia for the first nine months of this year:—

	Tons.
Boundary	891,303
Rossland	241,071
Slocum and Kootenay	97,862
British Columbia Copper Co.	641,168
Dominion Copper Co.	162,384
Trail smelter	260,894
Hall mines smelter	29,600
Marysville smelter	19,520
Total	2,343,802

Up to date few shafts in the Cobalt are down over 50 or 60 feet. Prof. Hidden, the American geologist, says there is no doubt of the permanency of the camp; that is, that the ore will be found at great depths. Ore is being mined in Germany at depths of 1,500 and 2,000 feet under similar conditions.

PERSONAL

S. Walter Mower, of London, Ont., was recently appointed secretary and treasurer of the American Engineering Association.

Chas. H. Mitchell, C.E., Niagara Falls, Ont., has been re-elected to the Senate of the University of Toronto. Mr. Mitchell is now reporting on a hydro-electric development in Calgary, Alta.

Robert Surtees, one of the best-known engineers in Canada, died at his home in Ottawa on September 29th. Mr. Surtees was for many years City Engineer of Ottawa, his most recent work being the planning of the Ottawa Drive System, which is admired by all visitors to the capital.

MUNICIPAL WORKS, ETC.

The Smart-Turner Machine Co., Limited, Hamilton, are building a compound duplex pumping engine for the town of Carberry, Man.

The town of Dartmouth has awarded the contract to the Canadian Fairbanks Co. for the complete lighting plant for the town, consisting of a 150 Horse Power Fairbanks-Morse suction gas-producer plant and a 10 k.w. alternator. The Fairbanks Company will make the complete installation, consisting of the producer engine, alternator, switchboard, etc.

The corporation of Port Arthur, Ont., have placed contracts for an important extension to the municipal hydro-electric plant. The water wheel portion of the equipment will consist of a pair of 30" special Crocker turbines, arranged in horizontal steel case, discharging centrally, and developing 1,300 Horse Power at 450 R.P.M. under 85'-0" working head, the runners being of bronze. For government there will be a type "C" Woodward water wheel governor. The contract for the turbines was placed with the Jenckes Machine Co., Limited, Toronto, which company also built the two turbine plants already embraced in the Port Arthur municipal plant. The turbine unit will be direct connected to an Allis-Chalmers-Bullock generator.

TELEGRAPH AND TELEPHONE

The Quebec city council have granted a franchise to the La Compagnie de Telephone de Bellechasse, of Levis, giving them the right to operate in the city.

The wireless safety appliance of a German marine engineer is set to work during fogs and heavy weather, and acts automatically when two vessels approach within a certain distance. The action closes the steam-pipe to the screw of each vessel. This checks the machinery, gives time for reversing the engines, and prevents collision.

The Ingersoll Telephone Company, Ingersoll, Ont., has been organized, with the following officers: President, H. F. Boyse; vice-president, O. E. Robinson; secretary, E. H. Hugill; manager, T. A. Mayberry. Over 300 subscribers have already been secured, and the work of installing the system will be commenced at once.

The Stark Telephone Power and Light Company has decided to enter and compete with the Bell Telephone Company. The company has been granted a franchise by the Welland town council, and will make its headquarters in that town. It will operate without a central office, and will have no hello girls, the system being an automatic one. The company will also be in a position to furnish power, as it has practically closed the deal for a block of power with one of the electrical companies of the district.

Sensational developments are reported from the International Wireless Telegraph Conference, held in Berlin recently. The opposition of Great Britain to an interchange of communication by all systems was not supported. Japan and France have deserted her, Italy being the only country that showed any indication of supporting the British opposition.

The town of Lindsay, Ont., is to have competition in the telephone business, the town council having passed a by-law granting a 21-year franchise to the Canadian Machine Telephone Company, of Toronto. The new system is to be installed in a year.

NEW INCORPORATIONS.

Manitoba.—Russell Gas Company, Russel, $5,000. T. A. Wright, A. McDonagh, D. M. Kinnaird, A. G. P. Smellie, W. J. Doig, A. L. Buie, R. R. Roger, W. Ledingham, Russell.

Ideal Fence Company, Winnipeg, $100,000. W. L. McGregor, G. M. McGregor, Walkerville, Ont.; W. H. Burnham, Adrian; F. W. Prentice, Detroit, Mich.; F. C. Stevenson, Winnipeg.

Detachable Boiler Flue Manufacturing Company of Canada, Winnipeg, $150,000. F. C. Bell, J. Y. Griffin, W. E. Skinner, G. A. Metcalfe, E. J. Gifford, Winnipeg; J. M. Crozier, Minneapolis; F. W. Newton, St. Paul, Minn.

Dominion.—La Fonderie de Cloches, Crouzet, Hildebrand, Montreal, $100,000. J. D. Rolland, A. Turcotte, P. V. Rongier, R. G. DeLorimier, L. Boyer, Montreal.

Milton Hersey Company, Montreal, $40,000. M. L. Hersey, Montreal; T. S. Gladding, New York, N.Y.; C. R. Hazen, Cleveland, Ohio; C. H. Lester, P. C. Ryan, A. F. Bazin, J. B. Saxe, Montreal.

The Stuart Turbine Company, Montreal, $20,000. H. A. Allan, G. Hannah, T. M. Todd, P. Davidson, A. J. Collins, Montreal.

Megadyne, Limited, Montreal, $250,000. C. A. Barnard, C. Dessaulles, R. Roy, C. A. Sara, W. F. Sharswood, Montreal.

Canadian Primelectro Company, Montreal, $1,000,000. A. Quackenbush, Ottawa; G. G. Roe, W. Robertson, Montreal; S. L. Tingley, Providence, R. I.; B. L. Nowell, Montreal.

Mexican Production and Development Company, Montreal, $100,000. A. T. Lawrence, D. Smith, W. Wetzel, Montreal; W. F. Thomas, St. Thomas; G. M. Hamann, Mexico.

Ontario.—Rochester Mining Company, Toronto, $40,000. J. E. Dupuis, Massey, Algoma; J. LeFrois, Rochester, N.Y.; Z. Gallagher, E. M. Wilson, H. M. English, Toronto.

The Manson Manufacturing Company, Thorold, $100,000. C. H. Manson, W. Manson, St. Catharines; S. E. Craig, Snelgrove; R. L. Murray, Paris; A. Gunn, Durham.

Welland Electrical Company, Welland, Ont., $175,000. W. E. Phin, M. McAuliff, W. M. German, R. Cooper, J. H. Crow, Welland; C. Henderson, Wainfleet, Ont.

The International Cobalt and Silver Mining Company, Sault Ste. Marie, $500,000. G. Kemp, D. H. Jacobi, C. Frank, S. Frank, F. Niebuhr, Sault Ste. Marie, Mich.

Pittsburg Coal Company, Port Arthur, $100,000. J. S. Lovell, R. Gowans, E. W. McNeill, W. F. Ralph, W. Gow, Toronto.

Canada Steam Pump and Machine Company, Toronto, $40,000. A. H. Eby, T. O. Bard, A. A. Eby, J. Bard, M. F. Eby, Toronto.

The Canada Forge Company, Welland, $100,000. T. J. Dillon, J. T. Dillon, C. Burgess, E. O. Emerson, E. O. Emerson, Jr., J. L. Emerson, Titusville, Pa.

Lehigh Portland Cement Company, Thurlow, $1,000,000. H. C. Trexler, E. M. Young, C. A. Matcham, G. G. Sykes, Allentown, Pa.; A. W. Thorn, Buffalo, N. Y.

Canadian Gas Power and Launches, Toronto, $500,000. J. Laishley, S. F. McKinnon, L. C. Laishley, R. Hunter, H. M. Wetherald, Toronto; W. S. Marshall, M. Campbell, Chatham.

The Detroit and Algoma Silver Mining Company, Windsor, $100,000. A. W. Wright, W. H. Morris, L. J. Wohnlich, Detroit, Mich.; M. Cowan, J. W. Adams, Windsor.

Ideal Cylinder Snow Plow Company, Toronto, $100,000. E. D. Weber, A. H. Hough, Wiarton; G. Currie, M. M. Heiles, Atwood; A. G. MacKay, Owen Sound.

Ideal Concrete Machinery Company, London, $75,000. F. A. Borst, G. B. Pulfer, M. Wetzstein, South Bend, Indiana; J. M. McEvoy, F. M. Leach, London.

Temiskaming Hematite Iron Company, Toronto, $42,000. C. G. Knott, G. H. Smith, O. M. Hodson, G. Stevenson, Toronto; W. H. Hodson, Lockport, N. Y.; J. E. Clark, Orillia.