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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.

CHARLES HAMILTON MITCHELL, C.E.

Member Canadian Society of Civil Engineers; Member American Society of Civil Engineers; Associate Member Institution of Civil Engineers (London); Associate American Institute of Electrical Engineers.

Industrially, the Dominion of Canada in 1906, has crossed the threshold of her Hydro-Electric age. The three magnificent Hydro-Electric installations on the Canadian side of Niagara Falls, are the admiration of the world.

Almost simultaneous with the demonstration at Sault Ste. Marie, of the successful smelting of the refractory magnetic iron ores of the country in the Electric Furnace, came the equally important announcement, that in close proximity to our ore fields, Nature has provided water-falls and rapids from which "white coal," for generating the electrical energy necessary for operating the furnaces—may be obtained in abundance, and at a figure unapproachable by the best modern Blast Furnace practice. "The harvest is ripe, but the laborers are few." Among the very limited number of thoroughly trained disciples of Leonardo da Vinci,* in Canada, capable—on their own initiative—of designing modern hydro-electric plants of magnitude, may be counted the Hydraulic Engineer whose portrait appears above.

Charles H. Mitchell was born at Petrolea, Ontario, February 18th, 1872; and is the eldest son of Rev. George A. Mitchell, B.A., Methodist minister. He matriculated to Toronto University in 1888, graduating from the School of Practical Science in 1892. Granted post-graduate degree of B.A.Sc., (Bachelor of Applied Science), 1894; and C.E. (Civil Engineer), 1898. His career began as Assistant City Engineer, Niagara Falls, N.Y., 1892-3; engaged on special work in water-works and water-power construction and trunk sewer tunnels in rock. From 1894 to 1901 he was in private practice at Niagara Falls, Canada, and during this period designed and superintended construction of the following works:—**Municipal**—Sewer System, brick pavements, and water works for Niagara Falls, Ontario; also bridges for County of Welland; **Power Work**—The hydraulic plants at Bracebridge, Fenelon Falls, Orillia, Merritton, Wahnipitae, and St. Catharines, together with minor works, and improvements to existing plants. Also made reports, plans and estimates of projected hydraulic power plants in Ontario, Quebec, Maritime Provinces and New York State. From 1901 to 1905 was Chief of Mechanical Department of the Ontario Power Company of Niagara Falls, Canada; in charge of detail, design, and construction of Civil, Hydraulic, and Mechanical portions of this famous hydro-electric installation; probably the finest in existence. In December, 1905, sailed for Europe, and during an eight months' tour, inspected critically upwards of forty Hydro-Electric plants in France, Italy, Austria, and Switzerland, also numerous steam electric power installations in Germany and Britain. Has held Captain's Commission in Canadian Militia since 1899—first in Infantry and later in Corps of Guides. And is a member of Toronto University Senate (since 1901) representing graduates in Applied Science and Engineering.

This record from an educational standpoint, seems to us almost ideal: a foundation of theoretical university training, followed by wide practical experience, and all this broadened by travel—inspecting the hydro-electric work of the master minds of Europe. History shows that in Social Evolution there never comes a crisis, but a man fitted to cope with it appears. Canada is now ready for a forward movement in hydro-electric development; the man for the times is here: he whom we have placed in our portrait gallery this month, among the men who have "done things."

We understand that Mr. Mitchell is opening offices in Toronto and Niagara Falls, as Consulting Engineer; making a specialty of hydro-electric power work, and its allied branches. That he will succeed is in the order of things; for he is still young, is full of ideas, possesses unusual executive ability, and above all, has a clean record.

*The Father of hydraulic engineering.

EUROPEAN HYDRO-ELECTRIC DEVELOPMENT

LATEST ITALIAN PLANTS IN VICINITY OF MILAN.

By CHARLES H. MITCHELL, C. E.

V.

The city of Milan—the electrical city of Central Europe—is daily making fresh demands for electric power. This increasing demand has of late years been far ahead of the actual supply, with the result that the electric companies in the field are using every means to increase their output, are constantly seeking methods of extension and are, as well, exploiting new hydro-developments.

The general situation in Milan with regard to the supply and demand for electric current has already been described in a previous article. While the lighting and traction demands are increasing at a rapid rate, the greatest activity exists in the market for mixed motor load for manufacturing purposes. As previously outlined, not only have the parent electric companies built new generating works adjacent to the pioneer stations at Paderno and Vizzola, but new groups of stations have been constructed by an independent company whose interests are, however, closely allied with those of Paderno.

The new company, the "Societa Conti per Imprese Eletriche" so called from the name of its energetic founder, Signor Ettore Conti placed in operation in January, 1906, one of its most modern plants, situated at Vigevano, 20 miles west of Milan. The original Paderno company, the "Societa Italiana Edison di Elettricita" has also placed in operation (April last) a second station, located at Trezzo, about 15 miles east of Milan. These two stations, the

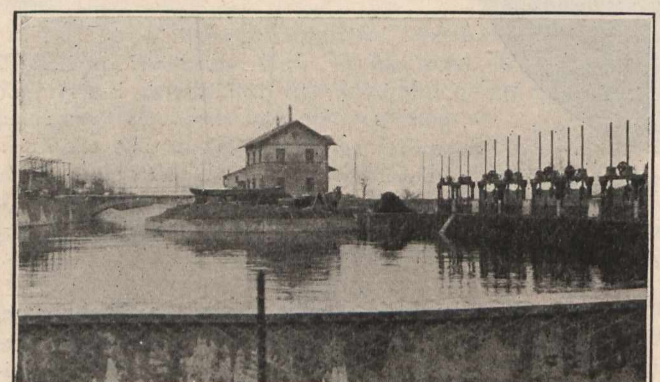


Fig. 2.—Vigevano, Exterior of Generating Station.

newest additions to the Milan group, are described below, because they illustrate the latest types adopted by Italian engineers: hence, should be of general interest.

Vigevano on the Tessin.

The vicinity of Vigevano is not exactly one in which a hydraulic installation would be expected, as it is well down in the plain of Lombardy. The Tessin River, however, sweeping down from the Alps, winds through the country between great gravel banks, and has a very considerable fall. It has, for several centuries, paid toll to the millers along its course, and it is an interesting study in hydraulic evolution to examine the many ingenious water-motors of 20 and 30 H.P. built by the descendants of Leonardo da Vinci. It was in this region, and further north of Milan, that this great engineer and painter labored four centuries ago. "Labor" is a suitable word as applied to the old "Master," because even as an artist alone, he evidently had a tremendous capacity for hard work. Recently new light has been thrown on his work by the discovery in Milan, of many documents, sketches and papers, which show him to have been the rival of Michael Angelo in constructive activity and ability. It can now be said, that Leonardo da Vinci was the father of hydraulic engineering, just as Volta was the father of electricity.

A pleasing incident in this connection occurred at Glasgow on July 2nd last, on the occasion of the visit of the foreign electrical engineers, as the guests of the Institution of Electrical Engineers. The Italian section, consisting of forty members, headed by Signor Semenza, of Milan, presented Lord Kelvin with two ponderous volumes of photographs of sketches and notes made by Leonardo da Vinci. There were upwards of 1,500 photos, each about quarto size, made from the leaves of Leonardo's note books, etc., found two years ago in an attic in Milan; fortunately in a good state of preservation, after 400 years. An examination of these sketches reveals some remarkable things concerning the engineering of those days; particularly in con-

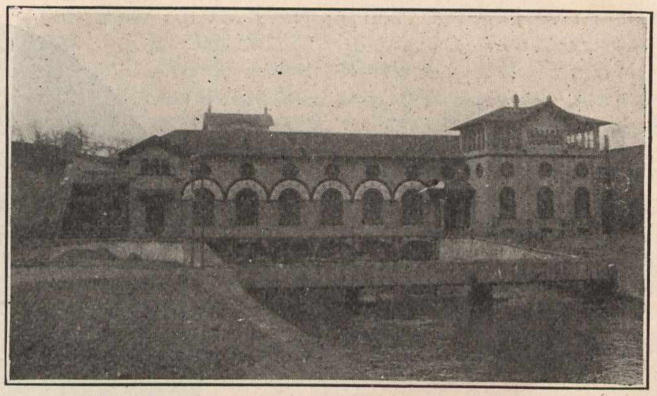


Fig 2.—Vigevano, Exterior of Generating Station.

nection with the canals for navigation and irrigation in Lombardy, upon which Leonardo was engaged for many years. His work in many instances stands to this day, and is still in operation. His applications of water-power by rude impulse and even reaction wheels are most ingenious, and it will be of special interest to Canadians to learn that he is now credited with being the first designer and constructor of locks on navigation canals.

To return to the Vigevano plant, it may be said to be designed in a manner generally similar to that at Vizzola, already described. The water is taken from the river about 3 miles above the station, and is brought down in a canal cut in the side hill of the river bank, which in itself is a large engineering proposition. The formation width of the canal bed is 15'-0", slopes 1:1, with gravel concrete lining and a depth of water of 12'-0": in embankment the outside bank is 15'-0" top width and the outside slope 1½:1, planted with small shrubs 18" apart. The velocity will be about 6'-0" per second. At intervals, overflow weirs and sluices are placed for regulation. On one of the latter an interesting work worthy of note was seen, consisting of an aqueduct 24'-0" span across another canal, with an interior section of 36" width, and 28" depth: this was of granite

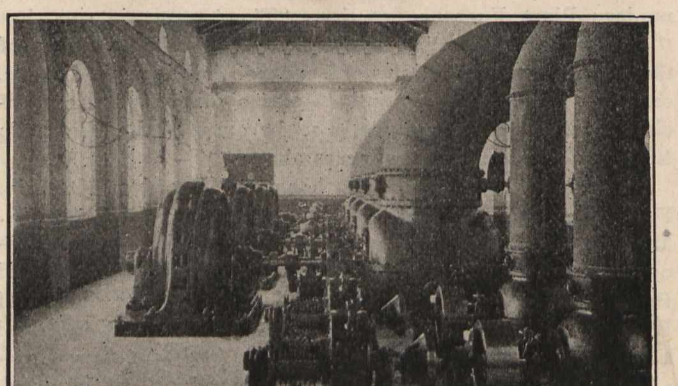


Fig. 3.—Vigevano, Interior of Station.

and each side consisted of one slab of granite 12" wide, 36" deep and 28'-0" long, set on edge; the bottom of the waterway being formed of 4" slabs.

The canal terminates in a forebay, having 12'-0" depth of water with an overflow weir on the side opposite the entrance, shown in foreground of Fig. No. 1. The screens are parallel to the canal, 110'-0" long on the face and in 8'-0" minimum depth of water, with 1" spaces. Water, after passing through the screens, is controlled by 2 sluices in each bay, and flows into a pit 18'-0" deep, from which the penstock carries it to the station. Surplus water passes automatically over the weir and down a spillway consisting of a flight of six gigantic steps, leading to the tail races, see on left of Fig. 2, which shows exterior of station.

The penstocks, 6'-6" diameter, pass down to the power house on a slope of about 30 degrees, leading

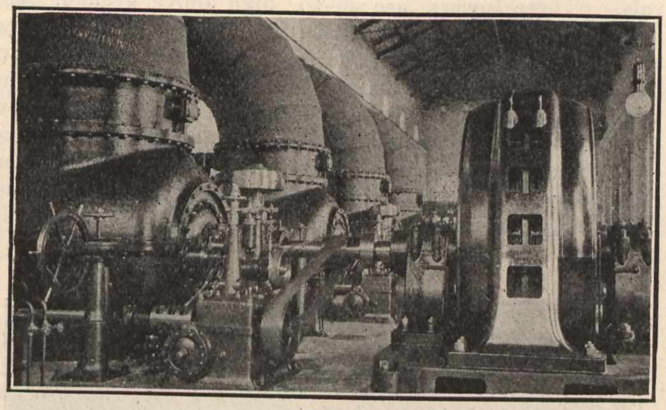


Fig. 4.—Vigevano, Hydraulic Unit with Governor.

through the rear wall above the turbines, and turn down vertically to the tops of the wheel cases. Special provision is made against expansion thrust by placing large abutments outside the wall in which to anchor the pipes. After passing through the turbines, the water is carried through tail pits consisting of arched races in the foundations; it is to be noted that here, as everywhere in European plants, provision is made for closing off each pit from the main tail race for repairs, so that each may be isolated.

As a generating station, the arrangement at this plant is ideal, and, upon entering, the visitor is impressed with the convenient and roomy arrangement. (See Fig. 3.) The turbine and generator units, five in number, are arranged abreast in a long hall, the two exciter units being at one end. At the same end is the switchboard, mounted on, and under, a floor, which is 6'-0" above the main floor; the whole hall is about 340'-00" x 40'-0". Alongside the gallery is an enlarged wing, shown on the right of Fig. 2, containing all switching and transforming apparatus, the arrangement of which in convenient sequence, roomy spacing and isolation is very clever. In the introduction of these features the European practice in design within the past two years is quite marked.

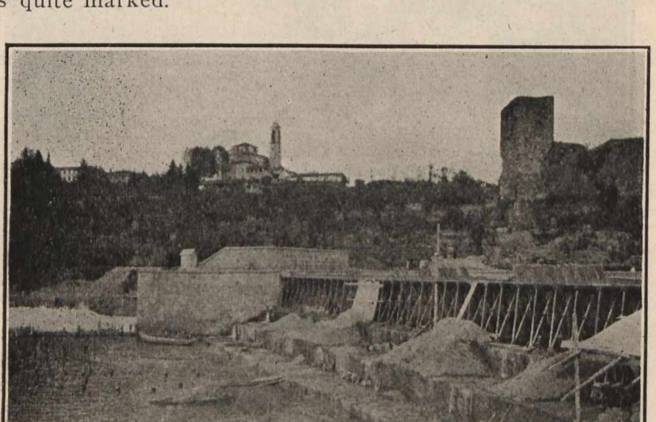


Fig. 5.—Trezzo, Dam with Collapsible Crest.

The turbines are by Riva Monneret & Company, Milan, four units being installed at the time of the writer's visit on February 6th, 1906, and one being still in the shops. The type is horizontal shaft double Francis inward discharge, into a draft chest: the cases are exposed and form the termination of the penstocks. See Fig. 4 for details. Each turbine unit works under a head of 61'-0", developing 1,400 H.P., using 270 cubic ft. of water per second. The governors are of a special oil type, recently perfected by the turbine makers, sensitive and very powerful for their size; the writer looked at the governors, especially to discover periodic hunting while the station was running in parallel with a steam plant at Milan, but could see no injurious irregularities. The generators by Gadda & Company, Milan, are directly connected, 3-phase, wound to 2,750 volts at 42 cycles.

Switch gear is fitted with table type instruments and distant control apparatus, so that the operators can at once see both instruments and machines. Current is stepped up to 25,000 volts and the transmission lines, comprising two circuits of 7MM. wires are carried in steel towers spaced 350'-0" apart.

The power from this station is used in outlying towns to the north and west of Milan, as well as in the city, and the loads and prices are about the same as those indicated in the previous paper, in the same locality.

Trezzo On the Adda.

The Trezzo plant, used in conjunction with the Paderno station, introduces entirely new features in the Milan hydraulic types. The Adda River at this point (5 miles below Paderno) makes a horseshoe bend around a rocky hill and at the same time has a rapid fall. The power project consisted of damming the river at the crown of the bend, and placing a power house alongside the rock cliff, discharging the water from the tail races through tunnels, under the hill, to the river below. The low head thus obtained only 24'-0", required vertical shaft type of units, with low speeds and a corresponding large volume of water, with many units.

The construction of the dam was a very delicate operation, owing to the rise, and peculiar violence of the river

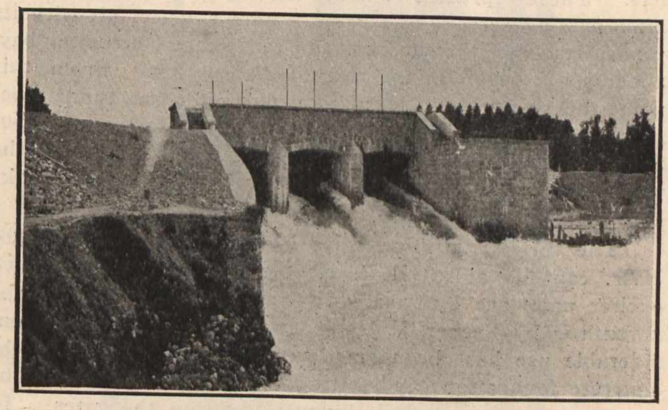


Fig. 6.—Trezzo, Spillway Sluices.

after rains in the mountains, 30 miles distant. The foundations of the whole structure are of concrete, laid on the rock river bed, and, in the main portion, consist of large terraced courses of monolithic concrete, over which the water can discharge in high seasons. The upper part of this work consists of an adjustable crest formed by structural steel bents, provided with removable wooden sheeting and planking capable of raising the water to an elevation about 10'-0" higher than the permanent concrete crest, thus forming a huge flash board system.

This is shown in Fig. 5, from a photo taken on the writer's visit, May 24th—after the plant had been running about six weeks. At the opposite (down stream) end of the dam, a set of three spillway sluices is located (see Fig. 6), having vertical sliding gates operated by hand, permitting water to pass beneath; about 2,000 cubic feet per second was passing through at the time the photo was taken. In the foreground will be noticed a cave-in of the rip-rap retaining wall. While not discernible in the illustration, it is interesting to note that repairs to this were under way by means of a new system, recently introduced in France, of making bags or cylindrical nets of galvanized iron wire fence netting, filling these with stones and small boulders, and rolling or placing them in a suitable position to form a new wall.

Against the high cliff of the river, in the horseshoe, the power house was constructed, having its face parallel to the river flow opposite, yet almost square against the current on the approach to the curve; this arrangement provides ample water with minimum deflection, and at the same time produces a sweeping current to carry past debris, etc. The station shown in Fig 7 is situated about 300 yards up stream from the sluice gates, and is a large and very handsome structure built entirely of stone. The stones are left rock face, but are hewn roughly to courses, and are obtained from the cliff alongside, which is formed of a peculiar cemented gravel, resembling a thoroughly mixed hard gravel concrete. The stones after slight dressing give a very pleasing effect, which many architects would strive hard to obtain in concrete by artificial means.

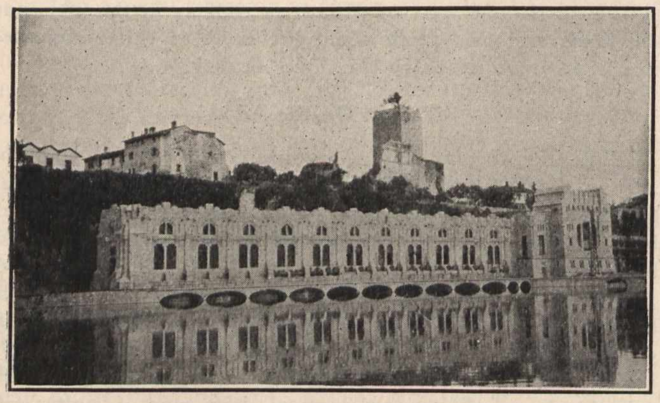


Fig. 7.—Trezzo, Exterior of Generating Station.

It will be seen in the illustration that there are ten main water entrances, each 22'-0" wide, and two exciter inlets. These represent as many units and the water in each, after passing screens and gates, enters a wheel pit with its vertical turbine, thence into the tail pit and common bay, about 300 x 60'-0", in the rear of the station. From this point the water is conveyed by means of two tunnels beneath the cliff to the lower river. For a distance of 150'-0" above the station and in continuation of the face of the water inlets, a series of 10 overflow weirs is arranged to take care of slight inequalities in the river level.

The vertical turbines are Francis type, each of 1,500 H.P. capacity at 105 R.P.M.; the first six and the two exciter units are by Riva Monneret & Company, and the seventh is by Escher, Wyss & Company, of Zurich. Considerable use has been made of re-inforcing steel in the concrete foundations and settings of these machines. The governors are connected by two stems to the gates. In general arrangement (see Fig 9), the power units are similar to those at Lyons already described. The generators are of 3-phase revolving field type, two at 50 cycles, and the remainder at 42 cycles, and are built by Gadda & Company, Milan.

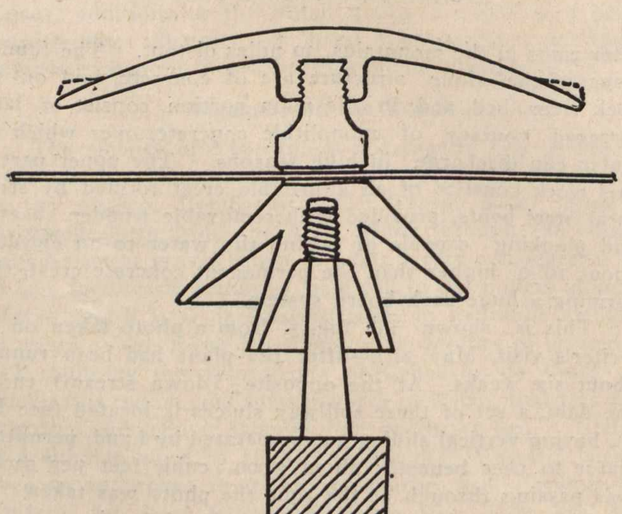


Fig. 8.—Semenza Umbrella Type of Insulator.

In the arrangement of switches, transformers, arresters, instrument boards, control, etc., this station is, if possible, more complete and roomy than that at Vigevano, and the whole large wing at the end of the station is occupied by this apparatus. The distant control apparatus is, in itself, a very perfect arrangement, permitting complete operation from table switchboard to isolated apparatus in different compartments of switch and transformer rooms.

Four transmission circuits, three to Milan and one to Bergamo are now in operation at 13,000 volts, carried on structural steel towers known as the "Elastic" type. The function of these towers is that while rigid at right angles they will oscillate slightly in the direction of the line, creeping of the cables being prevented by guying at intervals. These towers are 40'-00" high above ground, built with two legs (channel section) 7'-0" apart, and each leg set in concrete 5'-0" deep; the top of each leg member carries two circuits. Insulators on these lines are of the Paderno type, but are being partially replaced with a new design recently patented by Signor Semenza, consulting engineer of the company. This is a radical departure, but most simple, with qualities of insulation which are obvious. The design, which can be better illustrated (Fig 8) than

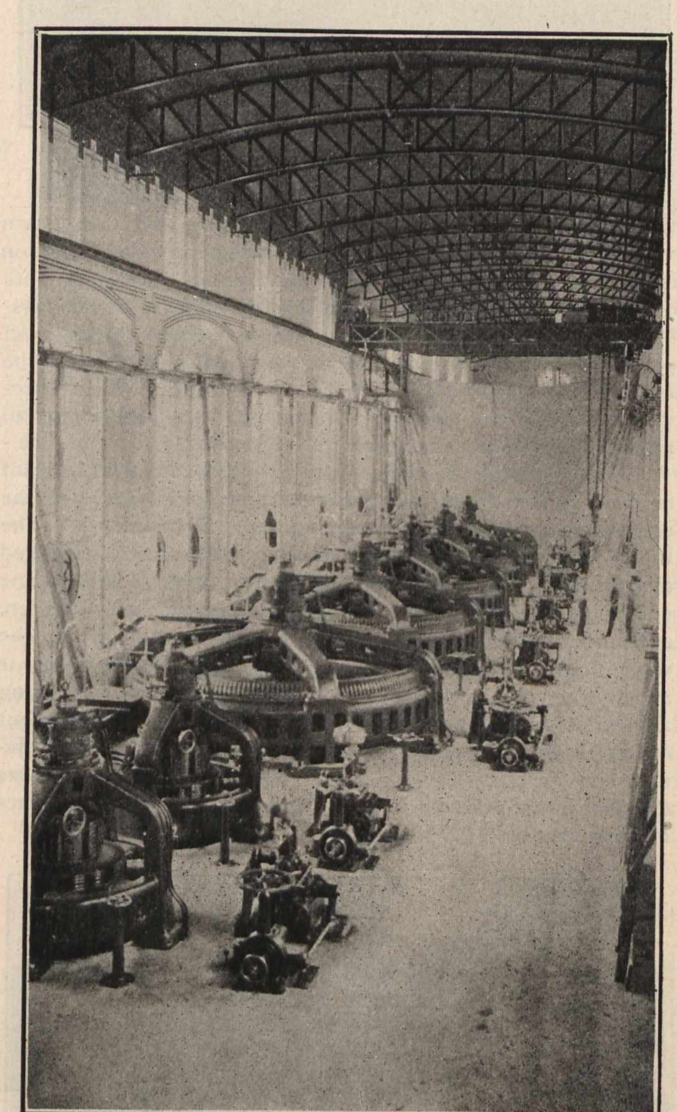


Fig. 9.—Trezzo, Interior of Station.

described, consists of the lower portion of a simple Paderno insulator, provided with a threaded top and side groove in which the wire passes: over the top is screwed an "umbrella" made of terra cotta about 12" in diameter, having a small watershed arranged on each side above the wire. It is interesting to know that in the break-down tests on an insulator designed for 30,000 volts, the ratio between wet and dry conditions is nearly unity, viz.: 122,000 volts for dry and 110,000 volts for wet. A feature of this new type is its small cost, the expensive, large upper part of the usual porcelain insulator being replaced by a simple, easily formed piece of terra cotta or other cheap material. As jokingly pointed out by Sig. Semenza, a new umbrella is, in this case, cheaper than an extra petticoat.

GOLD MEDAL SUCTION GAS ENGINE PLANT

In view of the increasing interest taken in suction gas producer engine plant development in Canada, an account of the recent trials at the British Royal Agricultural Society's Annual Show, held at Derby, England, in which twelve well-known firms competed, will be opportune.

The following is a list of the engines entered with their cylinder diameters and speeds.

Name of Competitor.	Particulars of Engine. Declared Power on Full-Load. Trial. B.H.P.	Cylinder Diameter. in.	Stroke. in.	Revolutions per Minute.
Campbell Gas Engine Co.	21	10	20	190
Ditto	19	9 1-2	19	200
Crossley Brothers	17	8 1-2	21	200
Ditto	15	8 1-2	21	180
Davey, Paxman, & Co.	15 1-2	9 1-2	15	224
Dowson Economic Gas Co.	20	10	18	190
Dudbridge Iron Works	19	..	..	200
Fielding and Platt	18	9 1-2	18	220
E. S. Hindley and Sons	16	Two 7-in. cylinders	7	600
Kynoch, Limited	17 1-2	9	18	240
Mersey Engine Works	18	9	18	200
National Gas Engine Co.	20	10	18	190
Newton Brothers	..	9	18	200
Railway and General Engineering Co.	20	12	18	170

We are indebted to our English contemporary, "Gas and Oil Power," for the following descriptive data of the National Gas Engines Company's installation, which received the Gold Medal award. This record is of particular value, since either the editor or his assistants were constantly in attendance at the tedious trials which lasted a week.

The conditions regulating the competition were:—

(1) The Attendance required by the plant.
(2) The general design, including facility of cleaning and space occupied.
(3) The regularity of working.
(4) Fuel consumption; water consumption.
(5) Price.
(6) The relative proportions of gas producer and engine.
(7) The volume swept by piston relative to B.H.P.

It will be seen that fuel consumption alone was not the determining feature, and, if we may to a certain extent anticipate, we think that when the judges' report is issued, it will be found that the general design and regularity of working are, if anything, given more points than the fuel consumption or any of the rest of the requirements.

Each plant had to consist of a gas generating plant and engine complete, of 15 to 20 B. H. P. as a maximum. Each exhibitor had to declare at what B. H. P. he intended to run his engine at the full load trial, and no variation therefrom beyond 5% more or less was allowed. No other restrictions were placed upon the competitors. There were four trials: full load, half load, and light or no load, these being made with uniformly selected anthracite coal, which was provided by the society. A given quantity of the coal was weighed out to each competitor, and never before was coal considered so valuable or so carefully guarded. The time of lighting up was noticed, and, as soon as sufficient gas had been generated and the engine was running at full power, the time was taken, this time being recorded as the commencement of the run as far as fuel consumption was concerned. On the completion of the coal trial a full load trial on coke, also provided by the society, was made, the programme for the week as follows:

On Monday the plants were got on full load at about 9.30, and run at full load until 6.30 or thereabouts, when the hoppers were sealed and they were shut down for the night without interfering with the fire.

On Tuesday they were started up at 9.20 or thereabouts, and run until 2.20, when the fires were drawn and the contents of the producers weighed. This was done in a wrought iron vessel, so that no water was employed in slacking the fire. After the coal had cooled, the clinker was sorted out and weighed.

On Wednesday the plants were started at about 10.30 and run at half load until about 4.30, when the fire was again drawn and weighed in the same manner.

Thursday was spent in drawing up and running light for the first two hours, then on to full load for one hour, and then to about one-third load for one hour, half load for one hour, and then to full load again for two hours.

On Friday the plants were worked on gas coke, which was supplied by the society, but broken by each competitor to the size he thought fit. The plants were started up at about 9.30, and run to 6.30 under full load, the contents of the producer being weighed at the end of the run as previously described. The coal supplied to each competitor was weighed out in the morning and appeared to be good commercial Welsh anthracite.

The suction gas producer plant illustrated in Fig. 1 and 2, is the outcome of much practical experience in the working of suction plants, and sound theory in what is to be aimed at in their construction. Perhaps the principal and best feature of the plant is the arrangement for superheating the air before it is brought into contact with the water vapour. This, of course, increases very largely its capacity for absorbing moisture, or in other words, raises its

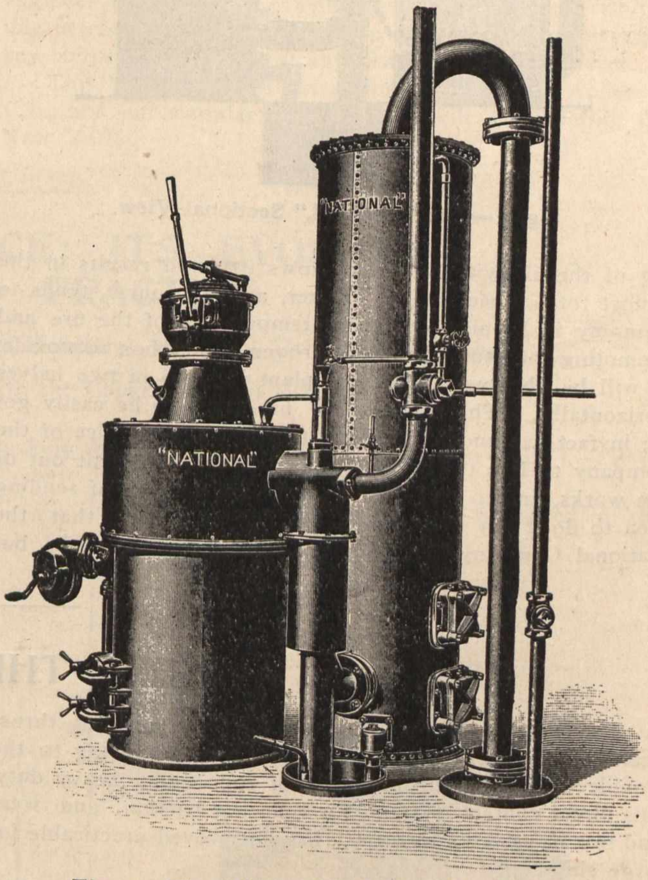


Fig. 1.—The "National," Suction Gas Plant.

dew point. The water supply to the vaporizer is also heated by the hot gases passing to the scrubber, so that by the time it gets to the vaporizer and comes into contact with the air, it is itself already quite hot. The vaporizer consists of a channel or gutter cast round the top of the outside of the internal casing of the generator top. The water entering this gutter flows all round the top of the generator, and overflowing through the notches, passes over the hot cast iron grills or ribs immediately below the gutter, and falls in a thin film down the outside of the inner casing of the vaporizer. The vaporizer is of considerable size, and the air, already hot, passes slowly round it, and comes into intimate contact with the hot cast-iron grills, while the water falling over them becomes highly charged with moisture, and also highly heated. Indeed, so hot does it become that it is impossible to bear the hand on the air pipe leading from the vaporizer to the bottom of the firegrate. The design of the vaporizer is valuable, too, because with hard water, lime is constantly being deposited as the water evaporates. With closed vaporizers this cannot easily be removed, but with the vaporizers in question the outer casing can be easily taken off and the whole surface of the vaporizer exposed to view for cleaning. The section is largely self-explanatory, but we will run briefly through it. The air inlet is shown at the bottom of the casing of the pipe leading from the generator to the scrubber; from this point it passes round both sides of the vaporizer to the pipe leading to the underside of the grate, picking up the moisture as above described on its way. The cold water is admitted to the plant, heated in the annular tube placed in the gas outlet, and run into the vaporizer. The even charg-

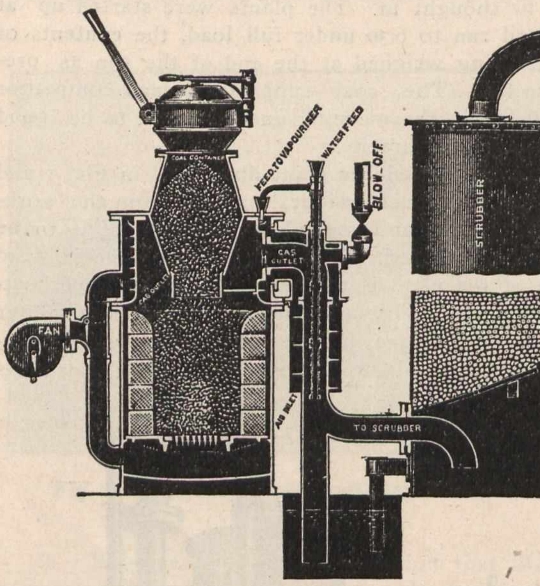


Fig. 2.—The "National," Sectional View.

ing of the air with moisture shows its good results in the almost total absence of clinker, and, of course, tends to economy in keeping down the temperature of the fire and promoting the production of hydrogen and carbon monoxide. It will be observed that the plant is made in two halves horizontally. This enables the fire-brick to be easily got at; in fact, we understand that it is now the practice of the company to line the producers before they are sent out of the works, and to avoid the expense and trouble of sending men to do it on the site. The design shows that the National Company has not been working in the dark, but understood the real needs of the plant before starting to build it. For the rest **circumspice!** The trials being tests of suction gas plants, the engine, like the bridegroom at a wedding, though well to the front, has afterwards to take a back seat for the time being. We will content ourselves, therefore, by stating that the National Company ran one of its 10" x 18" x 190 R. P. M., 20 B. H. P. engines of the type ordinarily sold commercially for that power, and that it ran perfectly satisfactorily from start to finish, and for the credit of all competitors be it stated that, after the load was put on and the engine adjusted, no alteration either to the gas cock or of the air throttle was allowed to be made. That the engine emerged triumphantly from all the changes which were rung upon it speaks well for the regularity of the gas supplied to it, and also for the design and workmanship of the whole outfit.

We purpose in a subsequent issue giving full detailed particulars as to fuel consumption, etc. In the meantime we are enabled to state that the 20 B. H. P. National gas engine was run with 175 pounds compression; starting full in 30 minutes, with coke fuel the size of a walnut. One engine took over 60 minutes, another 55. A notable feature of the trials was the small amount of clinker made; 6 lbs. being the maximum. The rate of combustion was 50 pounds per square foot, average draught 1", maximum vacuum in expansion box about 4". In making comparisons as to rate of combustion between boilers and gas producers, it must not be forgotten that in the former the fuel is burned to CO_2, while in the latter it is CO.

When the engine was taken apart for inspection, after the trials, the piston of the "National" was drawn out of the cylinder in less than two minutes. The work involved in accomplishing this, was removal of bolts at large end of connecting rod, lifting cap off the pin, then drawing out piston.

The total cost of the "National" 20 B. H. P. installation, including electrical ignition and suction plant was $1,132.38.

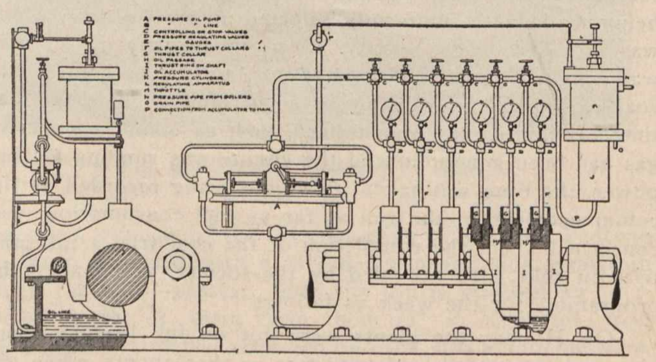
*[One of the competitors, Mr. Hugh Campbell, of The Campbell Gas Engine Co., Limited, makes the following claim. "If none of the coal taken out of the generator and unused by us be credited to us, our consumption is 1.20 lb., per B. H. P., per hour; if all such coal be credited to us, our consumption is 1 lb. per B. H. P., per hour. The consumption of coke used in our engine was 1.25 lb. per B. H. P. per hour, if the coke used in our engine be credited." . . . "Our water consumption under these conditions works out to 1 1-2 gallons per B. H. P. per hour. These are remarkable figures, and we await eagerly the official report of the trials. Editor.]

A NEW THRUST BEARING

The nearest approach heretofore to an ideal thrust bearing, has been the roller bearing; but owing to the trouble caused by the breakage of rolls under heavy duty, this direct contact system for reducing friction, and wear and tear of parts under thrust, has not proved practicable for large ships.

The thrust bearing with forced lubrication, illustrated above, is, it is claimed, superior to anything yet introduced in marine engineering. As will be seen, its adaptibility to any sized shaft in thrust is a very simple matter, since no change is required in the existing thrust collar, except drilling for the pressure oil pipes shown tapped into the oil cup. Assuming that the faces of the collars are true and free from scores, oil under pressure is forced between the face of collars and rings, establishing a constant film of oil between the contact surfaces of the metals, and thus eliminating friction to a greater extent than can be done by any other system.

It is simple in construction and easily applied to any ordinary thrust in very short time, thus causing no delay to the ship. It can be applied in sections if necessary, and makes possible in new work, the use of a less number of rings. There is absolutely no chance of an accident, causing a delay in the operation of the ship or other machinery to which it may be applied. The substitution of oil for rollers gives us a better result than rollers could possibly do, and at the same time eliminates any possibility of accident common to their use. If by any chance there should be a stoppage of the flow of oil under pressure, the only result would be that the bearing would revert to its former condition, running with the ordinary method of lubrication until the pressure is restored. The pressure of oil is maintained uniform, and at any degree by an accumu-



By Courtesy of "American Shipbuilder."

Anderson's Frictionless Thrust Bearing.

lator, operated by the boiler pressure, governed by a regulating valve; and it will keep so under any conditions within the capacity of the pump. In backing, the ordinary method of lubrication is used, unless the service is very intermittent when the system is applied in duplicate. The valves governing the admission of the oil to each thrust collar, are set to a pressure slightly above the maximum required by the thrust, and will operate from zero to that point, and are so designed that, upon a release of pressure on the collars, the valves close automatically and open gradually in proportion to the pressure applied. The gauges fitted over each valve show the resistance of each thrust collar, and by this means an absolutely perfect adjustment of each collar is possible, by equalizing the pressure on each.

A full size model of this device has been made representing an 18" shaft, with thrust rings and collars 26" in diameter and is now in Columbia University, where it has undergone a series of tests to prove and establish the claims of this system, the results of which were as follows:

Style of Thrust Shoe	Horseshoe (Babbitted)
Area of Thrust Shoe	208 Square Inches
Pressure Between Surfaces	68 Lbs. per Sqr. Inch
Revolutions	100 R. P. M.
Power Required with Ordinary Lubrication	9.00 H. P.
Power Required with Forced Lubrication.	1.93
Power Saved with Forced Lubrication	7.07
Power to Operate Force Pump....	.35
Net Power Gained by Forced Feed	6.72 H. P.

From this it will be seen that a conventional thrust bearing of this size, containing ten shoes and operating under the same conditions with ordinary lubrication, absorbs 6.72 H.P.; which can be entirely recovered by the aid of the Anderson system. This excess represents a large outlay in coal if economy is the objective point in operating a ship, and on the other hand, an increase in engine revolutions if speed is desired proportional to this expenditure. Tests as to its actual value on board ship were made on the U. S. Mail S. S. "Admiral Farragut," on February 17th, 1906, while on a voyage from Jamaica to Boston, when a comparative test demonstrated that the increase in revolutions due to its use was 4 per cent. The installation in this case, occupies but a small space, is absolutely automatic and requires no attention but starting and stopping at the beginning or end of a voyage. The oil used is passed through a filter each time it makes a circuit and there being no opportunity for any loss, none is wasted, the addition of a small quantity from time to time to freshen it and keep it active, being all that is required. Under these conditions, it is apparent that a thrust fitted with this system when once adjusted, will remain so for a very long period, there being no wear. It is also impossible to overheat a bearing so fitted and the use of water is entirely avoided; the application is so designed that it presents no obstacles to the engineer in overhauling, being readily detached; it is flexible in construction, as the pump or filter can be placed in any convenient position at any distance from the thrust.

This bearing is the invention of James A. Anderson, C.E., and is manufactured by Montauk Engineering Co., New York.

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 IV.—Continued.

ELECTRIC FURNACE DESIGN, CONSTRUCTION AND OPERATION.

Having considered the rate of heat production, in kilowatts per cubic foot, of several electric furnaces; we are now to deal with design, construction and operation.

The furnace recently employed at Sault Ste Marie, for smelting Canadian iron ores ("The Canadian Engineer," vol. 13, pp. 221 and 254), had an interior volume of 18.4 cubic feet, and consumed about 166 kilowatts of electrical power, or 9 kilowatts per cubic foot. This is only a little larger than the figure for the Héroult steel furnace: 6.3 kilowatts per cubic foot, and the Stassano furnace,—6.9 kilowatts per cubic foot; but the meaning of the figure is not quite the same. The whole interior of the Stassano and Héroult steel furnaces is heated to about the melting temperature of the steel, and the rate of heat production for each cubic foot of the furnace is of the first importance in determining the temperature to which the furnace can be heated. It should be noted, however, that in the Héroult ore-smelting furnace the temperature is far from uniform throughout the interior, only the lower part being heated to a smelting temperature, and the volume of the upper part of the furnace, where the ore is gradually heated during its descent to the smelting zone, could be made very much greater without the change having any material effect upon the temperature in the smelting zone of the furnace. In such a furnace it is consequently of less importance to consider the total volume in relation to the electrical power, a more significant figure being obtained by dividing the kilowatts by the volume in cubic feet of the fusion or smelting zone of the furnace. This zone is necessarily difficult to define, but assuming that the electrode, C, in Fig. 22, which is copied from Dr. Haanel's illustration, p. 254, is in its normal working position, the smelting zone would occupy about 7 cubic feet, making the electrical power 24 kilowatts per cubic foot of the zone.

In this furnace, the rate of heating, measured in this

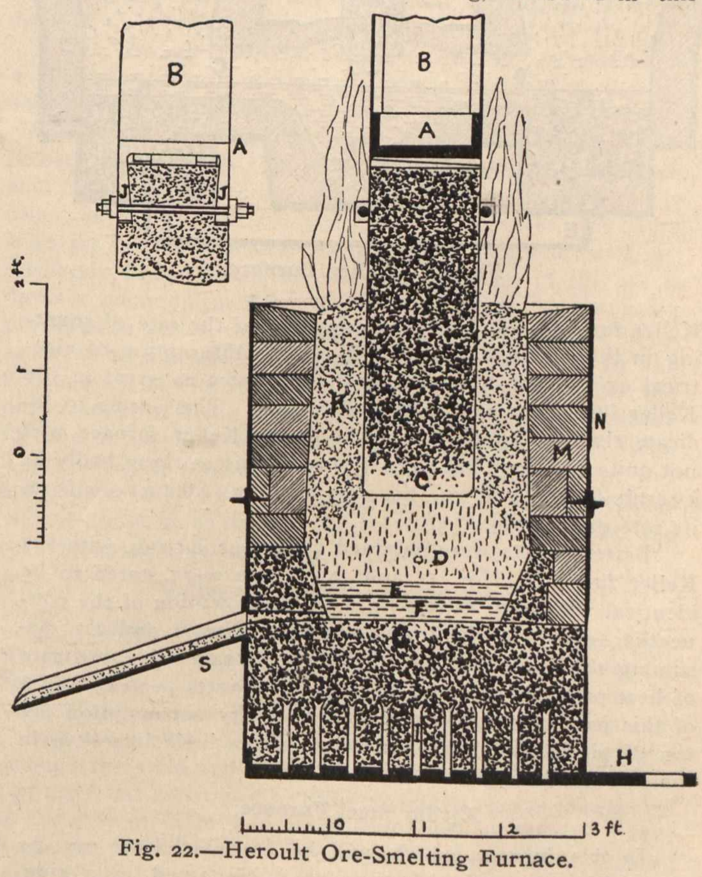


Fig. 22.—Heroult Ore-Smelting Furnace.

way, can be greater than in the steel furnaces, as the constant supply of cooler material absorbs most of the heat. The efficiency will tend to increase as the furnace is driven faster; but, with the more rapid smelting, the zone of fusion will tend to become enlarged, thus corroding the walls of the furnace. There is consequently a limit beyond which it is not desirable to increase the rate of heating in electric furnaces.

Taking the dimensions from Figs. 11 and 12 of Dr. Haanel's report, the smelting zone, AB, of each shaft, omitting the connecting passage, CC^1, which acts as a reservoir for the fused iron and slag, will occupy about 19 cubic feet. The power used, in the first run of furnaces, Nos. 11 and 12, was 616 kilowatts, or 308 kilowatts for each of the two shafts. This corresponds with 16 kilowatts for each cubic foot of the fusion zone. If the whole volume of the shaft were considered, the power would correspond to 5 kilowatts per cubic foot, or to 6 kilowatts per cubic foot of the shaft up to the level, FG, at which the gases escape from the furnace.

These figures are less than were obtained from the Héroult furnace, the difference being due mainly to the larger size of the Keller furnace, in which the smelting zone was three times as large as in the Héroult furnace. The larger size of the Keller furnace occasioned a smaller loss by radiation and conduction per cubic foot, and a correspondingly smaller rate of heat production would be required. In this connection it should be mentioned, that the rate of smelting, per cubic foot of smelting zone, in the

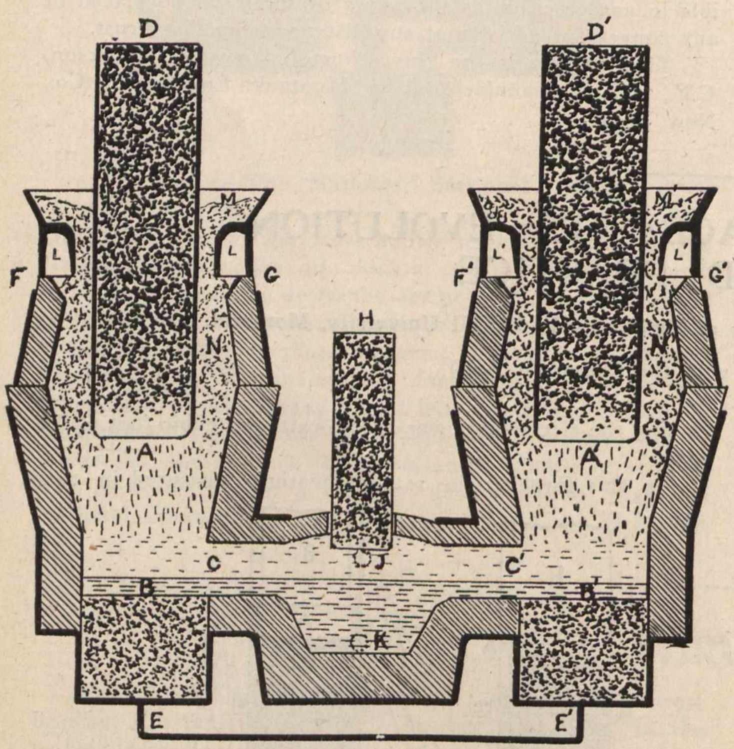


Fig. 23.—Keller Furnace.

Keller furnace, was less than one-third of the rate of smelting in the Héroult furnace, while the consumption of electrical energy per ton of pig-iron was twice as great in the Keller furnace as in the Héroult furnace. This seems to indicate that the supply of power in the Keller furnace was not quite sufficient, but as this furnace was working badly as a result of a shut-down, it is unsafe to draw deductions from its rate of smelting.

Better results were obtained in the second run, with the Keller furnaces Nos. 1 and 2. These were stated to be identical with Nos. 11 and 12, with the exception of the connecting channel, which was absent in Nos. 1 and 2. Assuming the smelting zone to be of the same size, the rate of heat production would be only 6 kilowatts per cubic foot of this part of the furnace. The energy consumption per ton of pig-iron, in these furnaces, was a little less than in the Héroult furnace.

Kjellin Steel Furnace.

In this furnace, which will be described later on, no electrodes are employed; the steel is contained in a ring-shaped trough, and an electric current is induced in the steel just as it is in the secondary windings of a transformer.

The furnace shown in Dr. Haanel's report, has a trough of 13 cubic feet capacity. The power delivered to the primary of the transformer was 150 kilowatts. Assuming the transformer losses to be 10% of this, 135 kilowatts would be supplied to the molten steel, or 10 kilowatts per cubic foot of the furnace.

This figure is larger than in the Héroult steel furnace, and the difference may be partly accounted for by the larger amount of waste space in the latter furnace. The efficiency of the Kjellin furnace is low, on account of the small cross section (6" by 18") of the trough containing the molten steel; and a somewhat small cross section appears to be necessary in this type of furnace.

The Gin Steel Furnace.

This furnace resembles the Kjellin furnace in consisting of a long trough or canal, of small cross section, containing the molten steel, only the electric current is introduced at the ends of the trough through water-cooled steel terminals. In order to reduce the loss of heat, the canal is folded upon itself like the filament of an incandescent lamp.

Mr. Gin calculates the dimensions for a number of furnaces, in a paper that has been printed in Dr. Haanel's report, and for a 700 kilowatt furnace, the volume of the steel in the trough would be 19.3 cubic feet; and assuming the trough to be half filled by the molten steel, its capacity would be 38.6 cubic feet, corresponding to 18 kilowatts per cubic foot of the trough. The trough would be nearly 30 feet long, 9¾" wide, 19½" deep, and half full of molten steel.

Acheson Furnaces.—(See Fig. 8, p. 173.)

In these furnaces the heat is produced by the passage of an electric current through a central core, or through the charge itself, which remains in the same position in the furnace until the end of the operation, as no smelting takes place. The rate of heating appears to vary from about 4 to 6 kilowatts per cubic foot of the interior of the furnace. These figures are somewhat smaller than were obtained for the Héroult steel furnaces, although the temperature attained in the Acheson furnaces is considerably higher than is required for melting steel, but the current is passed through the Acheson furnaces for a considerably longer period, and the granular charge in these furnaces will probably retain the heat better than the brick walls of the steel furnace with the openings for charging and pouring, and for the passage of the electrodes.

The results obtained above, for the power required per cubic foot of electric furnace, may be summarized as follows:—

FULL SIZED FURNACES OF ABOUT 1,000 H. P.

Acheson Furnaces for graphite, carborundum, etc., 4 to 6 kilowatts per cubic foot.

Steel Melting Furnaces.—Héroult, Stassano, etc., 5 to 8 kilowatts per cubic foot.

Steel Melting Furnaces.—Gin or Kjellin, where the steel is contained in a trough of small cross-section, 10 to 20 kilowatts per cubic foot of the trough.

Ore-Smelting Furnaces.—Keller, Héroult, etc., about 10 to 20 kilowatts per cubic foot of the fusion zone.

SMALL FURNACES OF 10 TO 100 H. P.

Moissan Furnace.—500 to 5,000 kilowatts per cubic foot.

Small-sized Furnaces for Electric Smelting, etc.—About 30 to 100 kilowatts per cubic foot.

Voltage Required for Electric Furnaces.

Having determined how many **watts** should be supplied to the furnace, the **voltage** of the supply must next be considered. The watts supplied are, for direct current, the product of the amperes and the volts, while for alternating current they are somewhat less; the product of volts and amperes being multiplied by a factor—the power factor—which is often about 0.75, in order to obtain the watts. The heat produced depends simply upon the product of volts, amperes and power factor,* so that it would appear possible to use either a high or a low voltage, provided the watts were sufficient. If a moderate current at a high voltage

*Assuming that all the energy is converted into heat, and none of it spent in chemical work, such as electrolysis.

could be employed, it would be a great convenience, but this is usually impracticable, because it is not generally feasible to construct a furnace having a sufficiently high electrical resistance.

The whole problem turns upon the electrical resistance of the resistor R, (Fig. 21.). Suppose that a furnace needs 250 kilowatts to heat it, then, taking direct current for simplicity, in illustration, if the furnace resistance were 1 ohm, a 500 volt supply would drive a current of 500 amperes through the furnace and would develop the necessary 250 kilowatts. If, however, the furnace had a resistance of only 0.01 ohm, the current, in amperes, would be one hundred times the volts, and 5,000 amperes at 50 volts would be needed. The latter case is approximately that of the experimental Héroult furnace used by Dr. Haanel, and shows what enormous currents will have to be supplied to electric-smelting furnaces, if constructed on any considerable scale, since the amperes increase with the size of the furnace far more rapidly than the volts. The use of such enormous currents is inconvenient and increases considerably the cost of cables, transformers, electrodes and electrode-holders.

VOLTAGE OF ARC FURNACES.

The voltage of a resistance furnace is nearly proportional to the current flowing through it. To double the current, nearly twice the voltage would be needed, but in the arc furnace (except perhaps in the Moissan furnace, which is so small that the arc fills the furnace) the voltage does not increase considerably with increase of current, and the voltage of the arc itself is often less as the current increases.

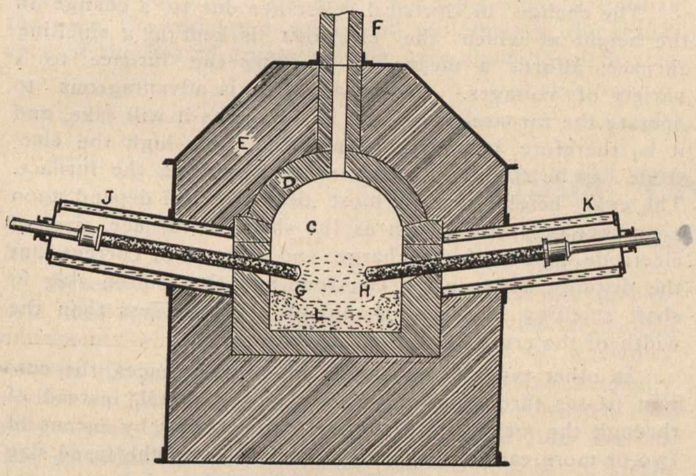


Fig. 24.—Stassano Furnace.

This sounds impossible but it is a well established fact, and points to the instability of the arc unless a steadying resistor is placed with it. In a large furnace the resistance of the cables, electrodes and transformer or dynamo is usually sufficient for the purpose, but the writer has frequently extinguished the arc in an experimental furnace by turning on too much current, that is by cutting out too much of the regulating rheostat, and so applying too high a voltage to the arc. The reason is, probably, that the resistance of arc is not constant, but as the current increases the arc becomes larger in cross section and so it's resistance decreases in about the same proportion, or even faster than the current increases, and the voltage in consequence remains about constant or decreases.

A certain minimum voltage, which varies from about 25 to 35, is needed in order to start an arc at all; and beyond this the voltage increases with the length of the arc, on account of the additional resistance that is introduced as the carbons are drawn farther apart. The voltage of an ordinary lighting arc may be obtained by the formula: $E = 40.6 + 40.1$, where 1 is the length of the arc in inches.* This expression refers to good solid carbons, and the constants would be smaller for arcs between cored carbons, for arcs enclosed in a furnace, so that the heat of the arc was retained, and for alternating current arcs. The following figures, may be given as examples of direct current arcs in small furnaces; they have been selected from the work of Henri Moissan, whose furnace is shown in Fig. 6, page 172.

Amperes.	Volts.
35-40	55
100	45
250	70, 75
300	60, 70, 85
400	80
450	60, 75
600	60
800	110
900	45
1,000	50, 60, 70, 80, 110
1,200	70, 100, 110
2,000	60, 80, 100
2,200	60, 70.

This table indicates that the voltage of the arc is not determined by the amount of current flowing through the furnace, but depends mainly upon the length of arc and the kind of vapour present in the furnace. The length of arc is unfortunately not given, but probably varied from about ½" to 2" or 3", aluminium vapour is mentioned as giving a long arc of 2" to 2½", and the 2,000 and 2,200 ampere arcs at 60 volts were obtained in the presence of iron vapour. The actual volts across the arc will be somewhat less than the figures given, on account of the drop of volts along the electrodes as well as in the connections. This drop is quite considerable in the case of heavy currents and would vary from about 5 to 20 or even 30 volts depending on the current and the size of carbon employed.

The alternating current is generally used in arc furnaces intended for industrial use and the Héroult and Stassano steel furnaces may be taken as examples.

The Stassano furnace (Fig. 24) resembles the Moissan furnace in general construction. A long arc, GH, is maintained between the ends of somewhat slender electrodes, and when the furnace becomes thoroughly hot, the arc may be drawn out until it traverses the whole width of the furnace. In one furnace* the width was 39", and an alternating current arc of 2,000 amperes at 170 volts was used.

It will be seen that this voltage is very much lower than would be required by the formula given above; the high temperature of the furnace, the presence of metallic and other vapours, and the use of alternating instead of direct current all contributing to this effect.

The Heroult Furnace, as shown in Fig. 25, resembles a Wellman tilting open-hearth furnace from which the gas and air ports have been removed, and two large carbon electrodes, C, C, enter through holes in the roof. The furnace is basic lined, but it would be possible to employ an acid lining. The arc does not play from one carbon to the other, as in the Moissan and Stassano furnaces, but there is an arc between each electrode and the slag and metal immediately beneath it. In this way the heat of the arc is directly communicated to the metal, and as two arcs are produced in series, the voltage of the furnace will be twice as great as that of a single arc. The furnace seen by the Commission at Kortfors took 4,000 amperes at 125 volts, the power supplied being about 450 kilowatts, while the smaller furnace at La Praz took about 4,000 amperes at 108 volts. The power supplied was 350 kilowatts, but the current was not measured. The voltage of each arc in these furnaces will be about 45 or 55, and the arc will be quite short, the carbons being kept just clear of the slag.

Voltage of Resistance Furnaces.

Resistance furnaces have usually a lower voltage than arc furnaces of the same size. **The Heroult Ore-Smelting Furnace** (Fig. 22) is of the resistance type, as no arc is formed; the current flowing between the movable electrode C, and the carbon lining at the bottom of the furnace, through the solid and liquid materials in the smelting zone. The electrical resistance of these materials causes the energy of the current to be converted into heat and largely determines the voltage of the furnace; the voltage being higher, for a given current, if the contents of the furnace have a higher electrical resistance. In the recent experiments

*Electro-Chemical Industry, Vol. I., 1903, p. 449.

*Electric Lighting, by F. B. Crocker, Vol. II., p. 308.

with this furnace, only 36 volts were required to maintain an alternating current of 5,000 amperes.

The Keller Ore-Smelting Furnace (Fig. 23) is equivalent to two Héroult furnaces, with a connecting passage between the crucibles of the two furnaces. This passage serves as a reservoir for the molten slag and iron, and also serves to connect electrically the molten metal at the bottom of each furnace; an alternative passage for the current, in case the reservoir were emptied at any time, is provided through the carbon plugs BE, B^1E^1, and copper connector EE^1. Electrically, the two furnaces are arranged in series, the current being supplied through the two movable electrodes DA, D^1A^1, and passing in series through the two smelting zones, AB, A^1B^1; and the voltage is in consequence twice as great as it would be in a single furnace of the Héroult type. In the experiments made for Dr. Haanel at Livet, the double shaft furnace, Nos. 11 and 12, took a current of 11,000 amperes at 59 volts, and the double furnace, Nos. 1 and 2, took 7,250 amperes at 55.3 volts.

For a given size and shape of furnace, and distance between the electrodes and the molten iron in the bottom of the furnace, the voltage of the furnace will increase with the current that is passed through it. The voltage will increase less rapidly than the current, however, because at the higher temperatures produced by the increased current, the electrical resistance of the furnace contents will be less than

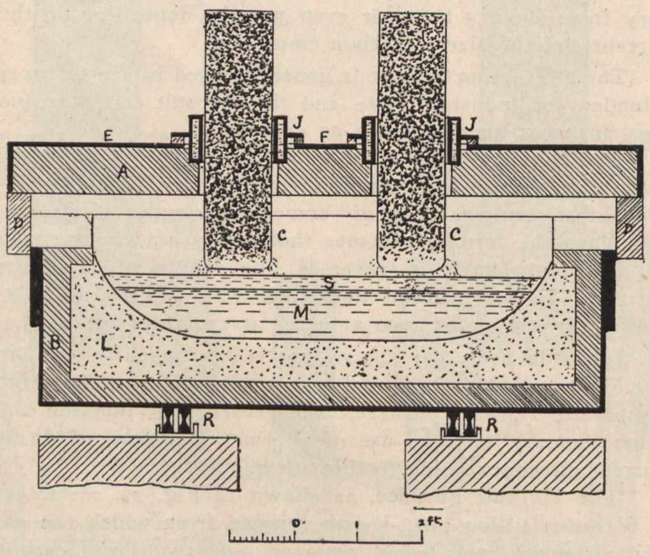


Fig. 25.—Heroult Steel Furnace.

it was with the smaller current, and so the ratio of voltage to current will be reduced. If the cross section of the furnace were increased, so that the current density remained constant, i.e., the number of amperes for each square foot of cross section of the furnace was the same as before, the voltage would remain constant; and if the height of the furnace and the distance between the movable electrode and the bottom of the shaft were increased proportionately, the voltage would increase in the same ratio. That is to say, in furnaces of similar shapes, but of different dimensions and for constant current densities, the voltage will be proportional to the linear dimensions, and the current will be proportional to the square of these dimensions. It follows from this, that the voltage is proportional to the square root of the current, and as the size of electric furnaces is increased, the voltage necessary to operate them will also increase; but with far less rapidity than the electrical current which must be supplied. In practice, the voltage will tend to increase less rapidly than the dimensions of the furnace; because in large furnaces the same current density would produce a rather higher temperature, and so would make the charge a better electrical conductor; or, smaller current densities could be employed which would need a lower voltage.

The voltage of an ore-smelting furnace of the Keller or Héroult type, depends mostly upon the height to which the electrode is raised from the bottom of the furnace, and this can be easily changed during the smelting operation, thus affording a convenient means of regulating the electric current. If the current were supplied to such a furnace at an absolutely constant voltage, any change in the resistance of the furnace would lead to a change in the amount of current, the voltage remaining constant; and in running a furnace under such conditions, the electrode would be lowered to increase the current, and raised to decrease it. In practice, though, the voltage at the furnace terminals is not absolutely constant, but decreases with an increase of current, on account of the resistance of cables, transformers, etc., and, in consequence, the volts and amperes supplied to a furnace will usually vary in opposite directions. This refers, of course, to changes in the current produced by changes in the furnace itself; external changes such as a change in the speed of the dynamo supplying the current would reduce or increase both the volts and the amperes. The drop of voltage that accompanies an increase of current is not objectionable in electric smelting, and it serves to some extent as an automatic regulator of the current.

The regulation of an electric smelting furnace, is usually effected by electric motors which raise or lower the movable electrodes. The motors are started, stopped, and reversed, by instruments operated by the voltage of the furnace, in such a manner as to keep this constant. In the Keller furnace, Fig. 23, and the Héroult steel furnace, Fig. 25, there are two movable electrodes; and each of these is independently regulated so as to keep a constant voltage between itself and the molten metal in the furnace. The automatic regulating apparatus for the Keller furnace is described in Dr. Haanel's report.

The change in electrical resistance due to a change in the height at which the electrode is kept in a smelting furnace, affords a means of adapting the furnace to a variety of voltages. Electrically, it is advantageous to operate the furnace at as high a voltage as it will take, and it is, therefore, important to ascertain how high the electrode can be raised without causing trouble in the furnace. The exact height that is most desirable will depend upon a number of factors, such as the shape of furnace, size of electrode, nature of the charge, and amount of current, but the distance between the electrode and the molten slag in shaft smelting furnaces should probably be less than the width of the crucible of the furnace.

In other types of resistance smelting furnaces, the current passes through the molten slag and metal, instead of through the melting ore the current entering by means of two or more carbon electrodes which dip into the fused slag —as in the Harmet furnace; by electrodes of fused metal lying beneath the slag—as in the Laval furnace; or by induction, without the use of electrodes. In such furnaces, the slag becomes heated above its melting temperature, by the passage of the current, and melts or dissolves the ore which rests upon it. The voltage depends upon the shape and size of the furnace, but on account of the low specific resistance of molten slags, it will usually be lower than in furnaces in which the current passes through the melting ore, as well as through the fused slag. The molten metal accumulating in the bottom of the furnace will also tend to lower the voltage, by carrying, on account of its greater conductivity, a large part of the current. Furnaces, in which the electrodes dip into the fused slag, are also less easily regulated; and changes in the amount of molten slag and metal affect very greatly the amount of current that flows through such furnaces.

In the **Kjellin** and **Gin** furnaces, the electrical resistance of the steel itself is relied upon for converting the electrical energy of the current into heat. The specific resistance, or resistivity, of steel, even when molten, is so small that the metal must be contained in a trough or canal of considerable length and moderate cross section, in order to obtain any appreciable electrical resistance, and even then, the voltage is very small, and enormous currents must be supplied, in order to heat the furnaces. In the Kjellin furnace, already referred to, a current of 30,000 amperes is supposed to circulate around the ring of molten steel, the voltage required to drive such a current being only 7. In the Gin furnace, the voltage is also very small, the calculations already referred to being for an electrical supply at

15 volts, the currents ranging from 10,000 to 100,000 amperes. Furnaces of such low resistance are very unsatisfactory electrically; but the absence of carbon electrodes, and the production of the heat directly in the molten steel, render them very suitable for steel-making.

Acheson Furnaces.—In these furnaces, the resistor consists of a special core of carbon, surrounded by the charge, or in other cases the charge itself is the resistor. In either case, the resistor remains solid during the operation, and cannot be lengthened or shortened in order to regulate the current. Moreover, as the furnace is intermittent in action,

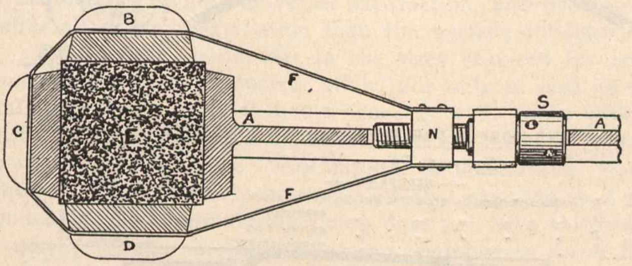


Fig. 26.—Electrode Holder.

the temperature of the resistor is not constant, as in a smelting furnace, but rises continuously during the run. This rise of temperature reduces very considerably the resistance of the furnace, and hence, the relation between the volts and the amperes. For example, supposing the furnace had a core of coke, the resistance would fall to about one-half its original value when the furnace became thoroughly hot, and if the heat were sufficient to graphitize the coke, the resistance would fall still further, the resistance of the heated graphite being only about 1/8 of that of the cold coke from which it was originally produced. Such a furnace would be very difficult to operate with a constant voltage supply; because if it were proportioned so as to draw a suitable current when heated, the current that would flow through the cold furnace would be so small (only 1/8 of the final current), that the furnace would heat up very slowly, and the consumption of power would change very considerably during the run. The price paid for electrical energy is usually based upon the maximum rate at which it will be used, and a furnace which only used 15 to 25 per cent. of its maximum power for a large proportion of the run, would be very inefficient financially. It is necessary, therefore, to change the voltage of the supply during the run, and for this purpose a special induction regulator has been devised, which will change the voltage from about 210 volts at the beginning of the run to 70 or 80 volts at the end of the run, maintaining the same power (about 1,000 H.P.) all the time.

It will be noticed that the change in the voltage is less than the change in the resistance of the furnace. This follows directly from the relationship between volts, amperes, and watts, because (omitting any consideration of inductance), the voltage must vary, for constant power, as the square root of the resistance of the furnace. Thus, if P is the power in watts, E the voltage, C the current in amperes, and R the resistance in ohms:—

$$P = EC, \text{ and } C = \frac{E}{R}$$

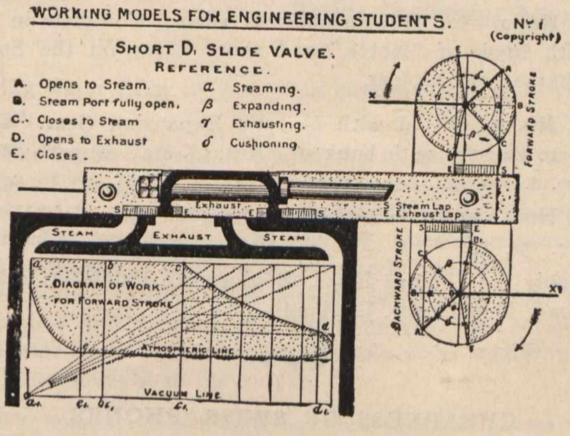
therefore $$P = \frac{E^2}{R}$$

or, for constant power, E must vary as the square root of R.

STEAM ENGINEERING

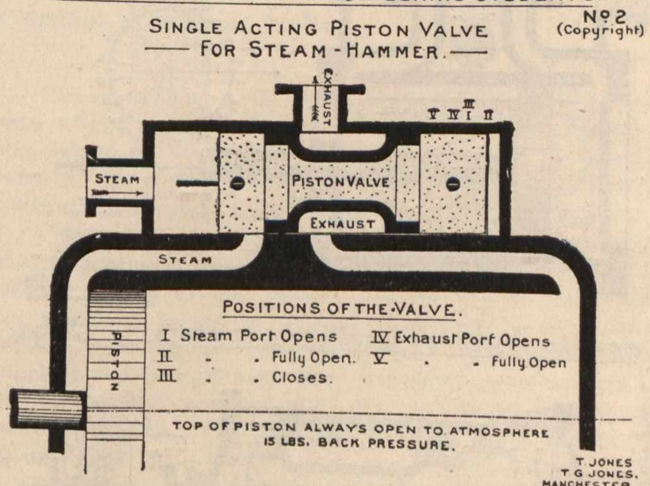
How to Teach the Slide Valve.

Recently, we visited a large Technical School in Ontario, and found that the Professor taught the mechanical movements of the steam engine by means of a clumsy wooden model, made by a carpenter who had evidently worked on Noah's Ark. This ancient device consisted of a yellow pine board about 6′-0″ x 3′-0″, upon the smooth face of which was represented the section of a steam cylinder, with moveable wooden crank, connecting rod, cross head, guides, piston and common D slide valve. Of course this primitive method of teaching first principles is not to be despised, but, if in the wisdom of those in charge,



they prefer to let American and British up-to-date Technical Schools teach in addition the theory of the gas engine and steam turbine, keeping the Canadian youth on the old fashioned steam-engine only, then at any rate, give the boys the best insight, and widest foundation knowledge they can get. We have seen a class of 80 young men aroused to enthusiasm in the study of the steam engine, because the teacher placed in their hands eight models of the different forms of slide valves, and thus enabled the students to get a thorough practical knowledge of the principles and operation of the various forms of slide valves. Due to the thoroughness of that teaching, and the earnestness evoked in that class of young men, many of them are now holding responsible positions, well paid positions in the engineering world.

Through the courtesy of the inventor and author of the models mentioned we are enabled to reproduce the series graphically. The models are 6″ x 4″, and printed on thin cardboard, the important parts being tinted in various colors.

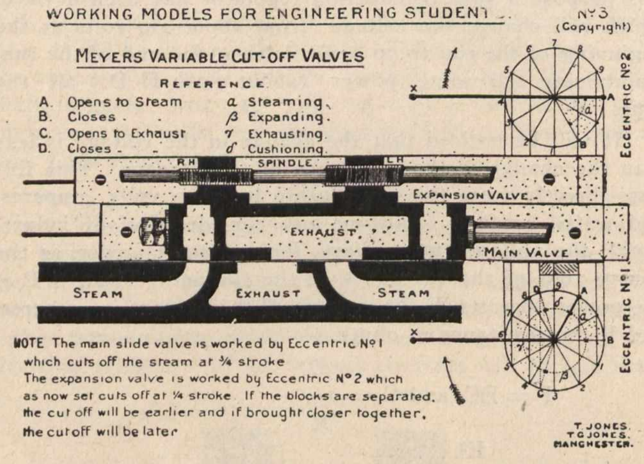


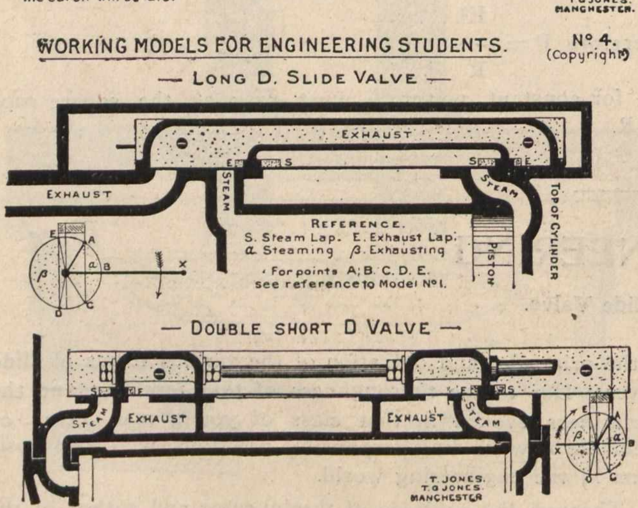
The valve portion works backward and forward in slots, and can be set in various positions for steaming, expanding, exhausting, etc., and its connection with the cylinder is visibly shown, more completely and intelligibly than by a series of diagrams showing the various positions and cut offs. We have no hesitation (after years of practical use of these models) in endorsing the verdict of our British contemporary, "The Practical Engineer," that: "The series constitute one of the most compact and efficient illustrated essays on the operation of the various kinds of slide valves used in steam engines, that has ever been published."

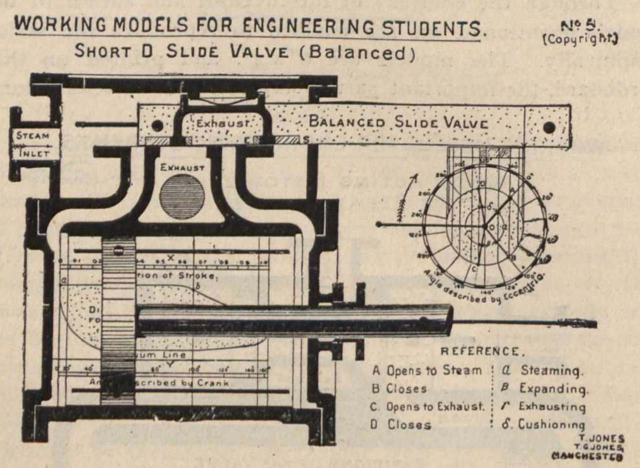
These models are extensively used in the Technical Institutions of Great Britain, and are now in a 4th edition.

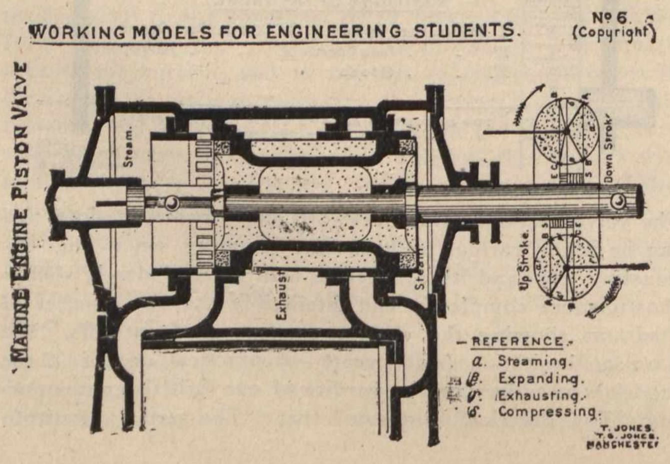
We must not omit to mention that in addition to the slide valve models, the author, Thomas Jones, M. I. Mech. E., (England), has also published a series of models 9½" x 6" of simple steam engines, with all the working parts connected together as in an actual engine.

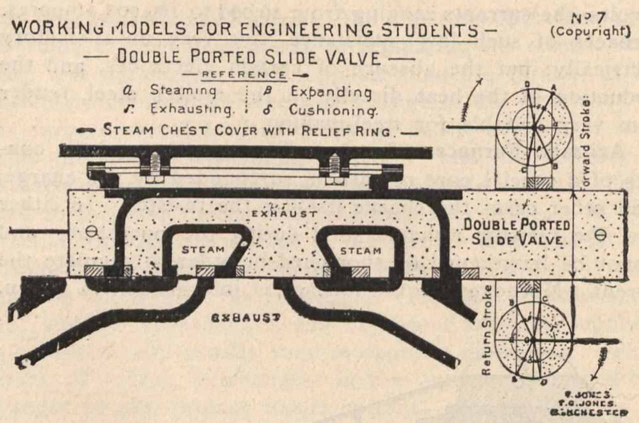
Every technical school and every engineering student in Canada should get a set of these models straightway.

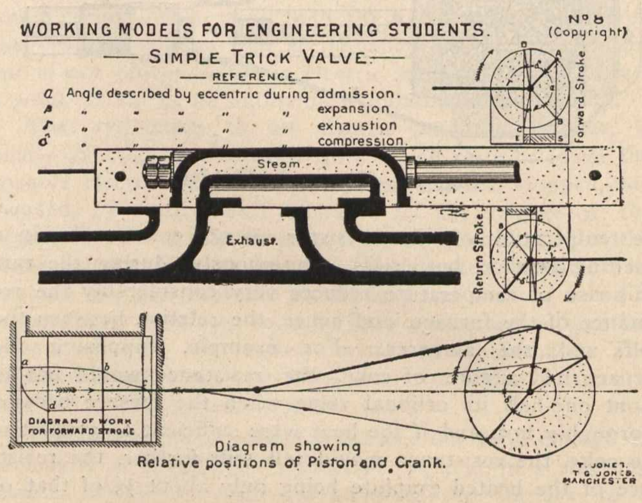












WORKING MODELS.

Engines and Engine Slide Valves.

Series 1 and 2.—Show at a glance the working of the various types of slide valves used in modern steam engines. Eight cardboard models, in box with full explanations. Post free, 2s. 8d. net.

Series 3.—Comprising six cardboard models (9½" x 6") of **Modern High Speed Engines,** specially constructed for driving dynamos. Complete in box, with full explanatory notes. 5s. 3d. net.

"X" Series.

These models (9½" x 6") are of simple steam engines, with all the working parts connected together as in an actual engine. The joints being accurately fitted are free from **Backlash,** and the correct positions of piston and slide valves are shown for all positions of the crank pin.

Model No. 1.—Fitted with short D valve. Complete in box with book of "Notes," and short Essay on the Steam Engine. 2s. 9d., net.

Model No. 2.—Fitted with Meyer's Expansion Gear. Complete in box, with book of "Notes," etc., as with model No. 1. 3s. 3d., net.

Model Nos. 1 and 2.—Complete in box, with book of "Notes," etc. 5s. 3d.

Apply to Thomas Jones, Engineering Publisher, 4 Manley Road, Manchester, England.

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CHEAPNESS OF SWISS 'PHONES.

"I was in Switzerland in June, before the rush set in," said a globe trotter, "and what most struck me there was the height of the mountains and the lowness of the telephone rates.

"The government owns the Swiss telephone system, and a 'phone costs only $12 a year. This small fee gives you 800 calls, and for excess calls all you pay is one cent each.

"The Swiss telephone system is admitted to be the best and cheapest in the world."

JET CONDENSERS FOR STEAM TURBINES

The adoption of the steam turbine, due to its ability to maintain a high economy throughout wide ranges of load has brought with it the necessity for the use of a higher degree of vacuum than has been required with the reciprocating engine.

The manufacturers of condensing apparatus have largely advocated the use of the surface condenser as best suited to the requirements; but during the last three years The Deane Steam Pump Co., of Holyoke, Mass., have developed a jet condenser for steam turbine work, which, it is claimed, is giving universal satisfaction, and proving a better all around installation than the surface condenser.

The surface condenser in the sizes required for high vacuum is a very expensive affair, not only in cost of installation, but in cost of maintenence as well. The annoyance and repairs of such an installation are too well known to require enumeration. The amount of condensing water required is considerably in excess of that required in a jet condenser. The circulating pump does not have the benefit of the vacuum in the condensing chamber to raise the cooling water from the source of supply to the point of discharge.

The outfit consists of one of the Deane regular vacuum pumps of the high pressure, direct acting, compound direct acting, or fly-wheel types. On top of the pump chamber is mounted a condensing chamber of special construction. This condenser is of the counter current type and is placed close to the turbine, thus making possible a short direct connection and assuring that the maximum vacuum of the condenser shall be attained at the only point where it is of any value, namely, in the engine.

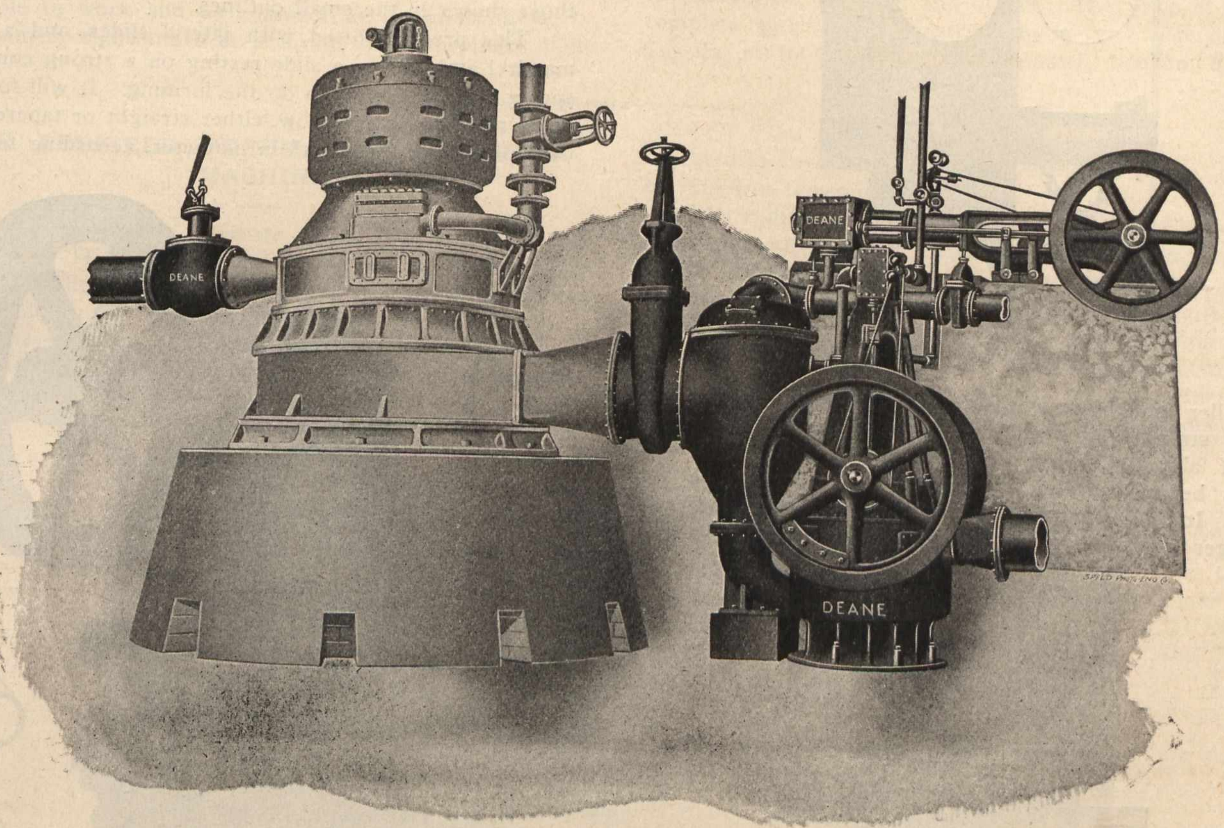
The exhaust steam entering the condenser passes down between the outside shell and an inner tube, thence up through the tube, where it is met by the falling drops of water from the spray plate. The injection water coming in above the spray plate is broken up by the plate into small drops, thus presenting the greatest amount of surface for the condensation of the steam. The injection water, together with the condensed steam, falls directly into the suction chamber of the wet vacuum pump which is located underneath the condenser. The air and non-condensible vapors entering the condenser pass up through the falling spray and are taken out through a brass tube which is entirely surrounded by the entering injection water. In this way the temperature of the air is reduced to practically the temperature of the injection water, and the work of the dry air pump reduced in proportion to the reduction of temperature. The air pipe is connected to a rotative dry air pump of the most approved construction, this pump being capable of maintaining a vacuum of the highest degree.

The advantages of the above system are: High vacuum, low first cost, few repairs, simplicity, economy, and reliability.

The vacuum guaranteed is equal to that guaranteed by any other reliable maker of condensing apparatus.

The first cost is considerably below the cost of a surface condenser outfit for the same work. The cost depends upon the type of wet vacuum pump selected, this selection being made to suit the individual requirements in each case.

The maintenance of the outfit is only such as is incidental to any pump.



Deane Condensing Apparatus With Vertical Type Steam Turbine.

The amount of steam used by the auxiliaries is a small item where the plant is otherwise satisfactory, nevertheless, where proper feed water heaters are used for the exhaust of the auxiliaries the economy of the jet condenser installation is equal or superior to that of any other.

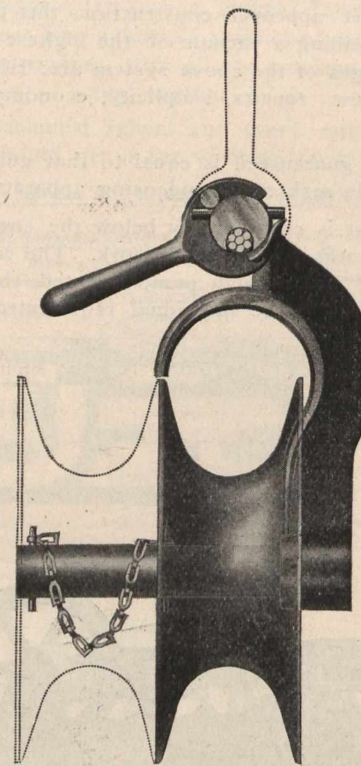
For electric lighting and power plants where uninterrupted service is imperative, the above described outfit is rapidly coming to the front. There are no leaky condenser tubes to cause trouble and there is the further advantage that in case of any accident, to the dry air pump, which in the case of a surface condenser would mean a shut down until repaired, the dry air pump may be cut out entirely and the wet vacuum pump will take care of the air and water with only a slight reduction in vacuum.

In connection with this condenser is used a patented vacuum breaker, the only one on the market suitable for such large units. A small float operates a pilot valve which controls a large valve, thus providing an opening to atmosphere of such size that the vacuum is instantly broken, if, for any reason, the water in the condenser rises above a predetermined height.

The Canadian agents for these jet condensers are The John McDougall Caledonian Iron Works Co., Limited, Montreal.

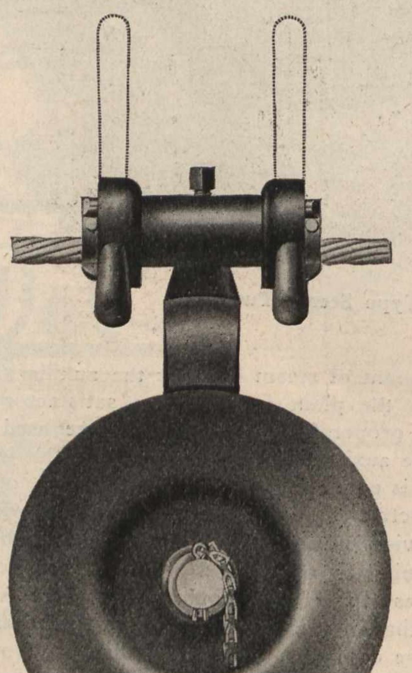
THE MATTHEWS CABLE ROLLER.

William Callahan, who for many years was connected with the Central Union Telephone Company as cable superintendent, and now with an independent company building on the Pacific Coast states that when designing



Matthews Cable Roller.

this roller his object was to gain simplicity, quick action, safety, strength, convenience, weight, and, most important of all, the saving of time and labor. With these objects before him he has perfected the roller, as illustrated. It is instantaneous in action, will fit all sizes of mesenger wire, has no clamping bolts and nuts to cause



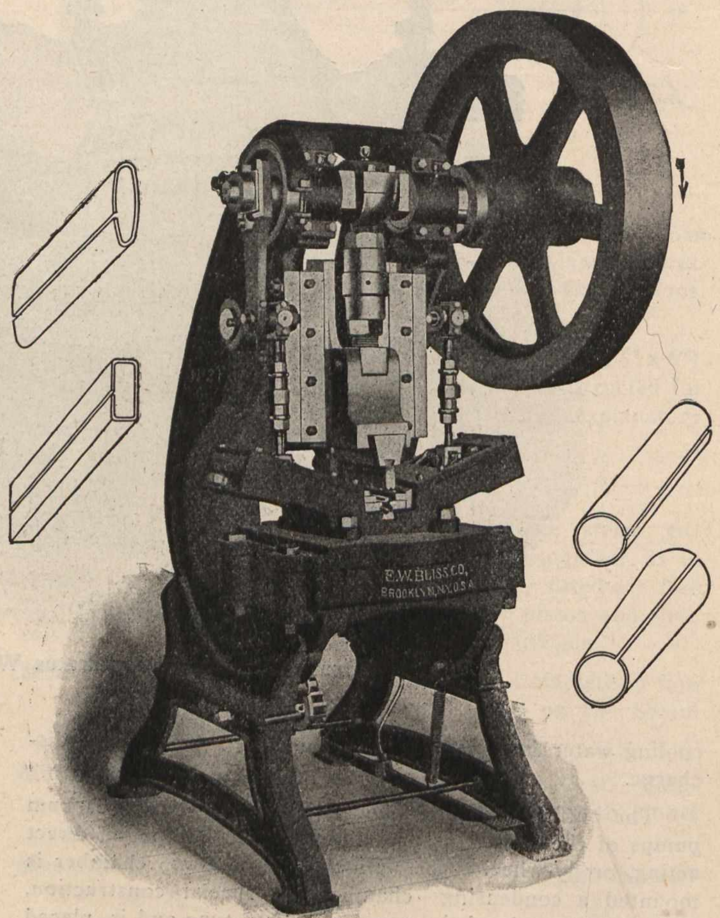
Matthews Cable Roller.

trouble and loss of time. It is made of malleable iron, and weighs only eleven pounds. The use of the roller is very simple, and may be described as follows: Turn up the handles, as shown by dotted lines, and drop the roller over the wire, then turn the handles down, thus clamping the device securely to the wire. If a small messenger is used, tighten the set screw at the top. To insert the cable in the roller, the inside cotter pin is removed, when the wheel will slide out; the cable may then be dropped into place, the wheel put in proper position, and the cotter replaced. The cable can then be pulled through without fear of its jumping the sheave wheel, or being injured in any way whatever. It is stated that any size cable can be put up by means of a set of these rollers as fast as a team of horses can walk. W. N. Matthews and Brother, 226 North Second Street, St. Louis, Mo., manufacturers of the famous Stombaugh guy anchor, have secured the patent rights, and will be pleased to furnish any further particulars.

A TUBE FORMING PRESS.

In power press work there has been in recent years a constant demand for combining the operations for doing in one handling what heretofore has required several. The various operations which have been combined are too numerous to mention, but in the accompanying illustration we present a press specially designed for doing two operations, and which is used in the manufacture of tubes similar to those shown in the small outlines.

This press is fitted with lateral slides, and a movable mandrel attached to a slide resting on a strong compression spring, heavy enough to do the forming. It will form tubes up to 10″ long at one blow, either straight or tapered, round, oval or square, ¼″ to 1″ in diameter, according to the dies



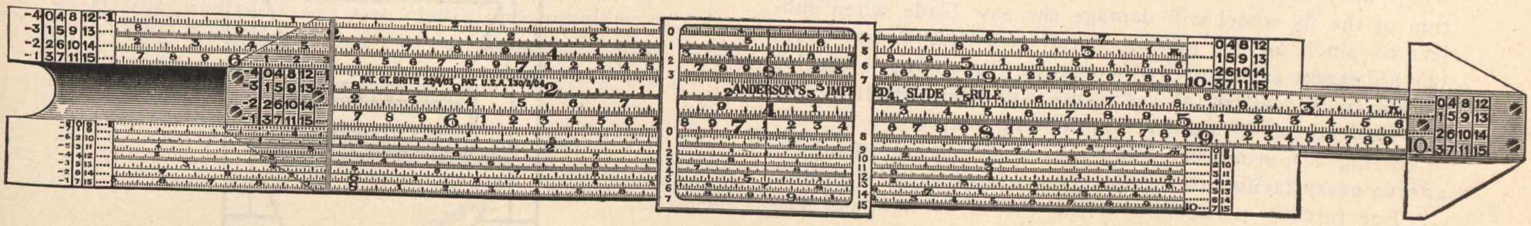
used in it. The toggle slides which operate from the right and left are cam actuated, and are easily adjusted for different shapes. The mandrel over which the tubes are formed, first descends upon the blank, bending it into U shape and carrying it against the lower die. After the lateral slides act, the press slide continues its stroke and the punch completes the work.

The machine is particularly adapted for the manufacture of spouts, pen-holders, small can bodies, either round or square, pan handles, either oval or round, and many articles of a similar nature. The principles embodied are such that they may be adapted to much larger presses for forming tubes of considerable length. The press as shown by the E. W. Bliss Company, Brooklyn, New York, weighs, complete, about 3,600 pounds.

ANDERSON'S SLIDE-RULE.

The saving of time and mental effort which the use of the slide-rule ensures has resulted in a growing tendency among engineers, architects and surveyors to utilize its advantages to the full. There is, however, still an idea current that it is both a difficult and a tedious matter to arrive at calculations by this method; whereas the reverse is the case, a few minutes' study of the hand-book which invariably accompanies the instrument sufficing to place the manipulator fully in touch with its working. The latest slide-rule is the invention of Lieut.-Col. F. J. Anderson, and, while as simple to work and as compact as its forerunners, is, it is claimed, eight times as accurate as the ordinary slide-rule, length for length; or, in other words, it gives results to one decimal place farther than the ordinary rule.

By its use multiplication, division and proportion sums may be worked, squares and cubes calculated, square and cube roots evolved, and areas and radii of circles arrived at—all with the greatest simplicity, ease and accuracy. From the hand-book which accompanies the instrument we select the following worked examples: .0105 × 467, 7.635 ÷ .0217, and .$1435 : 64 : : 5. 3.37 : . In the appendix to the book the theory of the slide-rule is dealt with, and valuable tables of constants for use with the rule are given. By the aid of conversion tables the instrument may be used for duodecimal calculation, an important consideration for quantity surveyors, builders and others. The price of the rule, complete with book of instruction, is 21s. Sole maker, L. Casella, of Rochester-row, Westminster, London, Eng.



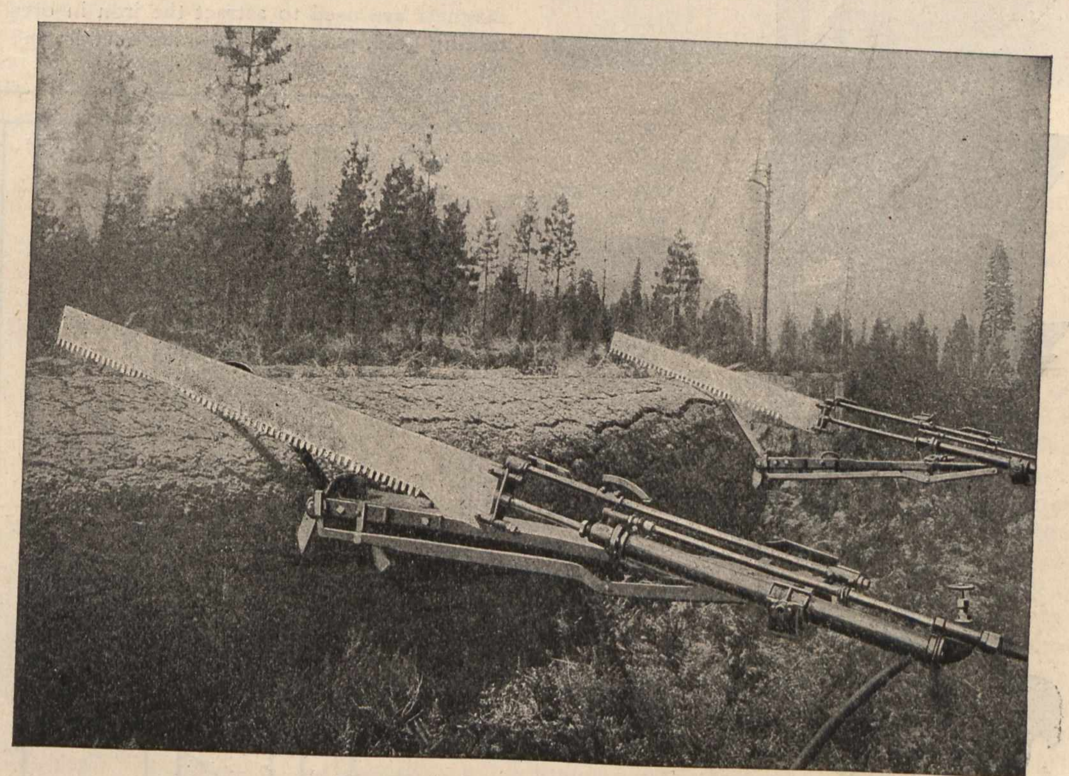
THE REDFIELD PNEUMATIC LOG-SAWING MACHINE.

The saw, complete, consists of an engine, frame and saw blade. The constructive details of the machine are such, that although light in weight it is exceedingly strong and durable.

The frame serves as a hanger, and is provided with an adjustable hook to grip any size log, and requires no other support. On each side of the frame is a bar with a spring and roller attachment, the roller being applied on top of saw blade, acting as feed and guide to blade. The weight of frame complete is 85 pounds. The frame is manufactured in two sizes suitable to cut 16″ and 24″ lengths.

The 16″ frame is suitable for cutting logs and stove wood, and since the engine can be operated on each side of the frame, two cuts can be made in one setting. The 24″ frame is suited to the cutting of locomotive wood, shingle bolts, etc. An ordinary 5′-0″ to 8′-0″ drag saw is used in connection with this device. Owing to the adjustability of the frame, and oscillation of the engine, the saw can be operated in any position relative to the log. The frame can be raised or lowered in an instant.

The engine is constructed entirely of solid drawn brass and steel tubing. Its main feature—in addition to its weight (65 pounds)—is the tubular valve, which is perfectly balanced under all conditions, permitting the engine to work in any position. The valve motion and running gear are simple and easily repaired, hence, there is no complication of valves and parts. The tubular valve is actuated by a rocker arm that raises its motion from two cams fastened to the guide rod.



Pneumatic Log-Sawing Machine.

Weight of frame 85 pounds.
Weight of engine 65 pounds.
Capacity of saw in logs 500 per day of 10 hours.
Twenty cords of 4-foot wood or ten cords of 2-foot wood per day of 10 hours.
Ordinary working pressure required 75 pounds.
Normal number of strokes per minute 65.
Maximum number of strokes per minute 150.
Cubic feet of free air consumption at 65 strokes per minute, 33.

Cubic feet of free air consumption at 150 strokes per minute, 75.

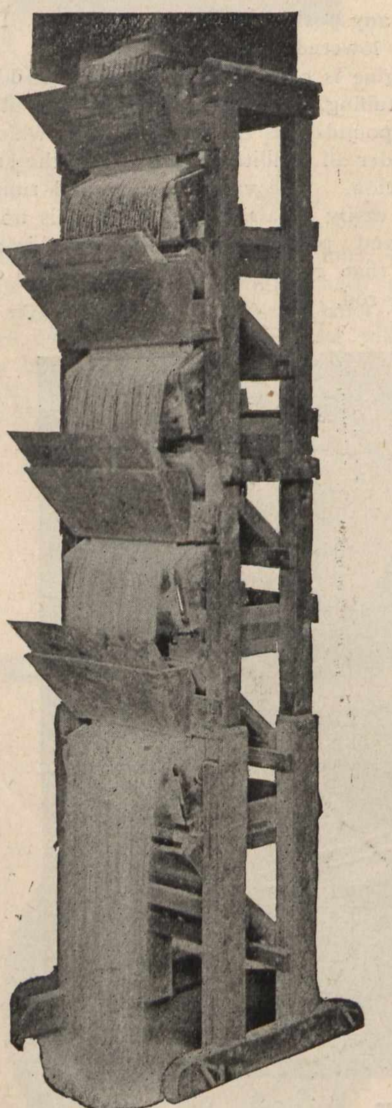
The following special advantages are claimed for the Redfield pneumatic engine and frame:—(1) A balance valve permitting the engine to work in any position; (2) the only engine that does not buckle the saw blade when obstructed in any way; (3) the balance valve does not require a fly-wheel, as in other wood-sawing machines, where the momentum of the fly-wheel will damage the saw blade when subject to pinch, or its motion interfered with in any way; (4) no expert is required to operate the engine, owing to simplicity in design; (5) the frame will adjust itself to any size log and can be quickly applied and removed.

Being a pneumatic tool the transmission of power affords every facility to operate over a large area of ground.

For further particulars write the Westinghouse Air-Brake Company, Pittsburgh, Pa., U. S. A.

MAGNETIC ORE SEPARATORS.

This separator is manufactured of any required capacity and is operated without artificial power; requires no dynamo, engine or electric current. Has no gears, journals, bearings, belts, drums or other moving parts, consequently no friction or wear. Requires no skilled labor, absolutely



Type A.

automatic in its action. No repairs required. First cost the whole cost. The only concentrator that will thoroughly, rapidly and economically separate magnetic from non-magnetic substances.

Being simple in construction it can be readily set up or taken down and easily moved from place to place. As no power is required, any number of these machines can be run without additional expense.

The separator will not only operate upon iron ore but is also especially adapted to separate or remove iron from

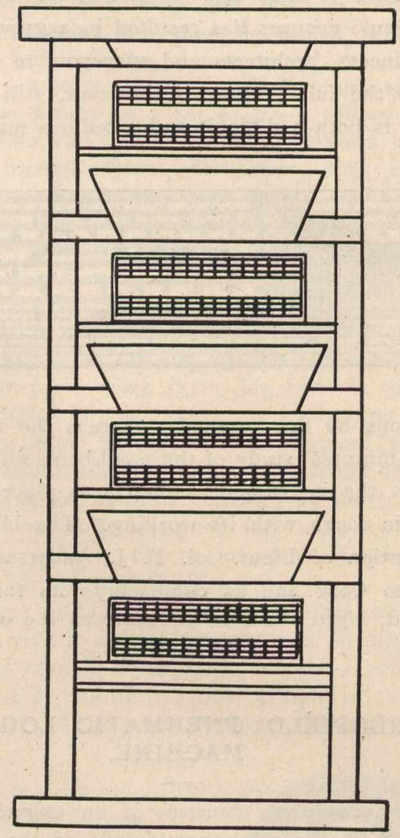


Fig. 3.

gold or platina bearing sand from crushed quartz, from emery; from kaolin or fine clays; from brass or copper filings or from any substance where an admixture of iron is objectionable or injurious.

This separator is operated by gravitation, and permanent magnets are used to attract the iron in ores and sands containing gold, platinum and other metals, and to free crushed

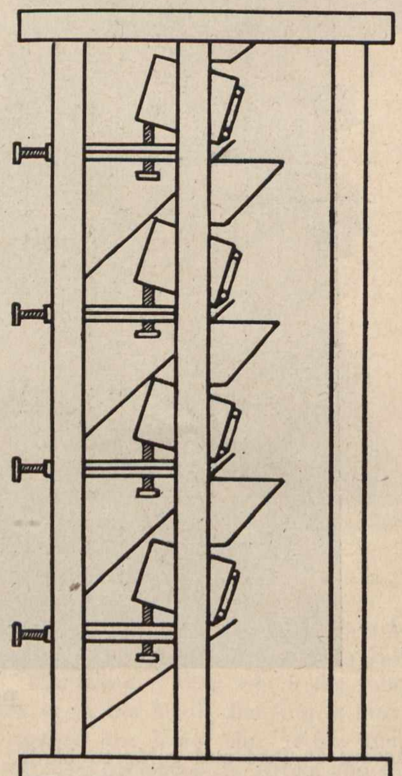


Fig. 4.

quartz, emery, kaolin, brass and copper filings from the adhering iron. In construction the Carter Separator is very

Auto-Magnetic Concentration.

simple, as may be seen by the accompanying illustrations. It is economical to operate, and its efficiency may be judged by an analysis of Canadian magnetic sand made by Mr. J. Obalski, inspector of mines of Quebec, which showed 70.49% iron; 0.65% titanium, and 0.75% iron in the tailings.

The machine consists of a strongly built frame of hard wood, which supports a specially designed feed hopper to contain the material to be treated. Under this hopper and in the frame of the separator are sets of permanent magnets which are enclosed in a septum or armature of either tin or sheet iron, and there are also chutes and metallic septums. The chutes are slanted and the septums extend downward and over the faces of the magnets, also backward and under

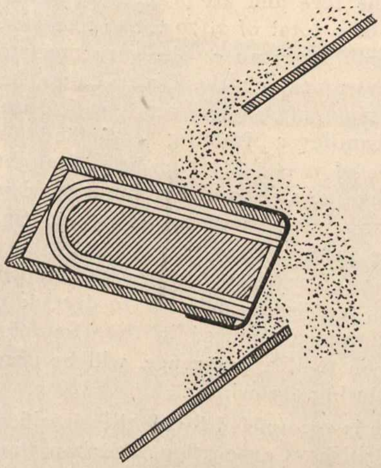
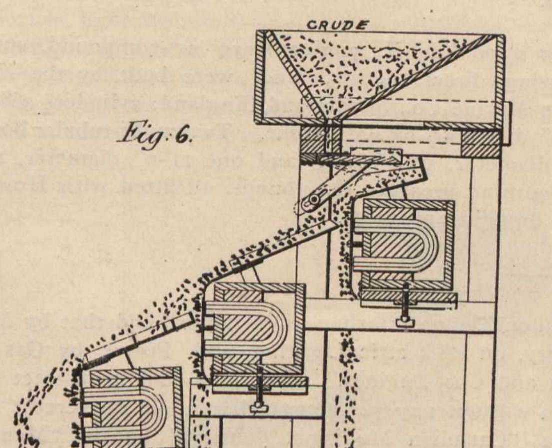


Fig 5.

the magnets. The magnets project beyond the frame and in front of each set is placed a small hopper for the purpose of agitating such material as may be precipitated from the chutes or magnets above. In the passage from the feed hopper over the various chutes and septums through the agitating hopper, the material is turned over and stirred, and is spread out so that the magnetic particles are brought in contact with the magnets. The operation is as follows: The crude material falls from the feed hopper on to the chutes of the first set of magnets, and spreads out over the chutes and glides down to the septum on the top poles of the magnets, where some of the iron adheres and is retarded and falls down the septum. The septum extends down and

Fig. 6.



over the poles of the magnets, and backward under them. The magnets are so adjusted that the top poles project beyond the lower ones. The iron as it glides downward (see Fig. 4) is carried inward and back of the lip of a chute which is designed to catch the separated material, and this it does when the load accumulates so that gravitation overcomes magnetism. The magnets drop a part of the load, and the unseparated material falls into the hopper below where it passes to the next chute and set of magnets.

The operations are constantly repeated at the top set of magnets, and are continued as the material passes over each set of magnets, chutes and agitating hopper, until the material reaches the bottom, a product practically free from iron.

The machine can be built for any capacity by multiplying the number of magnets, and increasing the width of the frame.

Type B as shown in Fig. 5, was developed so that the hopper could be conveniently filled from the ground with a shovel, when used in foundries and machine shops for the separation of brass and iron borings and filings. It is also well adapted for cleaning up and testing at mines. Manufactured by the Carter Auto-Magnetic Ore Separator Co., 123 Liberty Street, New York.

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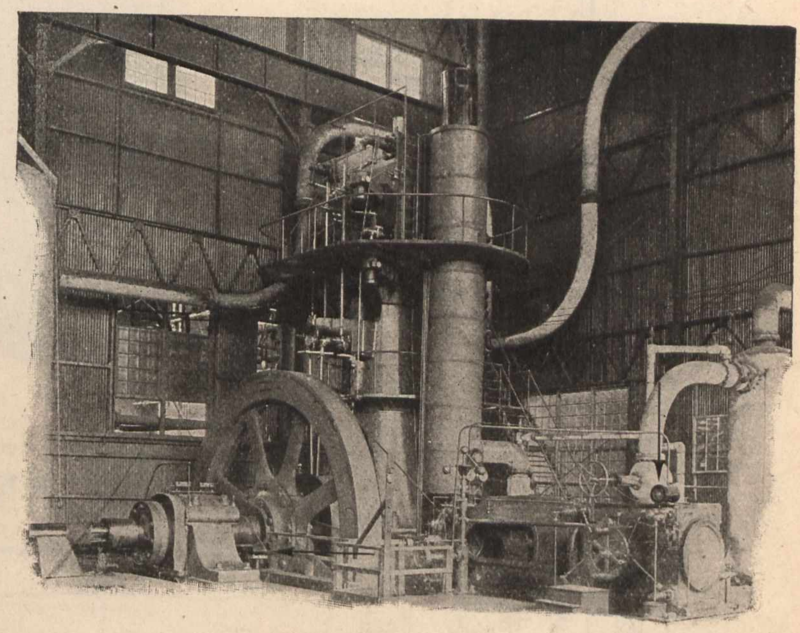
MONARCH ENGINE STOP DEVICE.



In our last issue we described in detail the Monarch engine stop and speed limit device, but omitted to give an illustration of its practical application. The above picture shows this unique apparatus connected to an Allis engine.

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—The two electric locomotives which were borrowed from the Valtellina Railroad, which has been worked by such engines for several years, to haul trains through the Simplon Tunnel, have proved inadequate for the work, and have been sent to the shops. Each of these engines had two motors of 450 H. P., which could be urged up to 1,100 H. P. for the engine. There is some difference of opinion as to the cause of the failure. One theory is that as the engines have a section equal to two-thirds that of the tunnel itself, they act as pistons in a cylinder, and waste a large part of their power in compressing the atmosphere in the tunnel. This atmosphere is saturated with moisture from the hot springs which discharge 2,000 gallons per second at a temperature of 111 degrees, while the temperature of the tunnel walls is 93 degrees. This compressed saturated air is believed to penetrate the insulation of the motors and cause an important leakage of the current and consequent short-circuiting.

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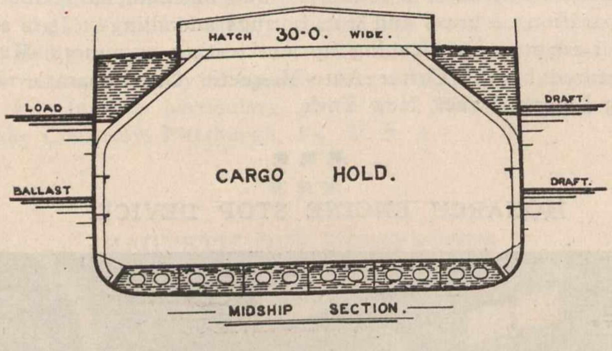
The holding of the 17th Annual Convention of the Canadian Association at Galt, resulted in the formation (August 8th) of a new Lodge, No. 27, with 27 charter members. The officers are: President. P. Cowan; Vice-President, J. Taggart; Financial Secretary, J. Jerdon; Recording-Secretary, W. Fulton; Treasurer, T. Cowan; Conductor, G. Peddie; Door-keeper, A. Ritchie.

S.S. "BORGESTAD"

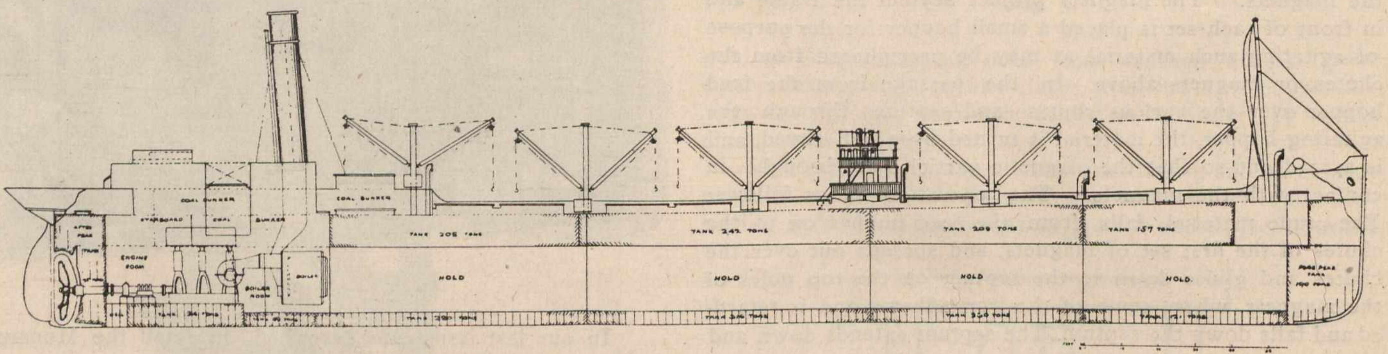
The Latest Achievement in Freight Steamer Design.

The latest and most up-to-date freight steamer in the Canadian Merchant Marine Service is the S. S. "Borgestad," which has just recently arrived from across the Atlantic, and is now chartered by the Dominion Coal Company, Sydney, N. S., for their important coal trade between that port and Montreal.



She has been specially designed for the Canadian coasting trade, and was built by Sir Raylton Dixon & Co., Limited, Middlesbrough-on-Tees, England, to the order of the Statsraad Gunnar Knudsen, of Porsgrund, Norway, for the Aktieselskabet Borgestad.

Her leading dimensions are: 372′-0″ long over all, 51′--0″ beam, and 29′-0″ depth, and has a bunker capacity for 741



Longitudinal Section.

tons of coal on a draught of 23′-1″, at an average speed of over 11 knots per hour when loaded, and steams over 12 knots when light. The freight capacity being 344,430 cubic feet grain: 323.030 cubic feet bales; or, a gross tonnage of 3,944; net tonnage, 2,531.

A remarkable feature about this vessel is, that she is a perfect self-trimmer, no coal trimmers being required either in loading or discharging, which is done at the rate of 1,000 tons per hour.

For the return voyage she is provided with 75% more water ballast than usual, which is carried in tanks at each side of the holds under the deck, as shown in Fig. 2, and so incorporated with the frames as to add immensely to the longitudinal strength of the ship. The water ballast tanks next the deck = 815 tons; the cellular double bottom, 1,090 tons: while the fore and aft peak tanks = 190 and 75 tons respectively: or a total of 2,170 tons of ballast.

In outward appearance she very much resembles the large freight steamers on the Great Lakes, having her engines placed right aft, and is very wide hatchways. The system of cantilever framing embodied, makes it the strongest type of vessel afloat on light draught, and renders it ideal for lake service, and her immense capacity suitable for either grain, self-trimming, iron ore, timber or wood pulp, etc., are further recommendations.

Her rig and general appearance is extraordinary, for she has no masts, and is fitted with 10 derrick posts in pairs, which, although not required in the Dominion Coal Company's trade on the St. Lawrence, will be necessary in general trading during the winter.

This type is recognized by all the classification societies, "Lloyds," British Corporation, Veritas, and Norwegian Veritas; to the rules of the last of which, the "Borgestad" has been built under special survey.

Her 2,200 I. H. P. engines are tri-compound, surface condensing, direct acting, and were built by the North Eastern Marine Co., Sunderland, England: cylinders 26″, 42″ and 70″ diameter, by 48″ stroke. Two multi-tubular boilers, 15′-0″ diameter, 11′-6″ long, and one 11′-0″ diameter, 10′-6″ long, working pressure 180 pounds, all fitted with Howdens forced draught apparatus.

WARNING

For years past it has been common for correspondents to refer to "The Canadian Engineer" as "The Leading Engineering Journal of Canada." Our late advertising representative has started a sheet **using our old sub-title.** The following extract from the August issue of the "Canadian Municipal Journal" shows the business methods upon which it is being run:—

"Warning."

"As the Journal has had a great deal of matter reprinted from its columns without any acknowledgement, by other papers with loose ideas about what belongs to other people, the precaution of copyrighting the whole number was taken in June last, and the registration was duly secured.

"Notwithstanding this, the "Engineering Journal of Canada, published in Toronto by Messrs. Arch'd. W. Smith & Partners, re-printed, without any permission, two articles which were specially written for the Journal, namely, that by Mr. Fellowes, town engineer of Westmount, Que., on "Westmount, Que., Garbage Destructor" and that by Mr. J. deClercy, on "Electric Lighting and Power by Gas Producers and Gas Engines." Not only did it abstract these articles without any permission, but it did not credit them to the "Canadian Municipal Journal," but to "Municipal Journal," which is a non-existant paper. Further, the "Engineering Journal of Canada," had the calmness to get the copy containing the abstracted articles copyrighted.

"We do not wish to drag our personal business with any paper that may infringe our copyright before our readers; another place is more proper. But we wish to warn those interested, that if they use either of these articles, taking them from this "Engineering Journal of Canada," they will have to hold themselves responsible to the "Canadian Municipal Journal," whose copyright they are infringing.

"Let us repeat that we do not wish to be selfish, and shall be glad to give permission to use what we have secured for the benefit of the muncipalities. Of course, every respectable paper would ask for permission of a copyrighted article, and would credit any re-printed article to its proper source, and not try to hide where it had secured it."

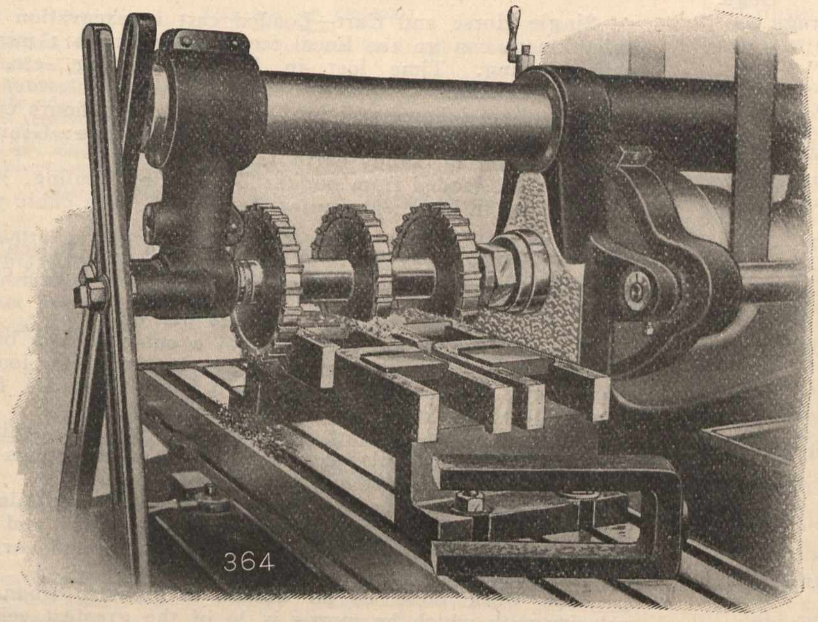
MACHINE SHOP NOTES FROM THE STATES

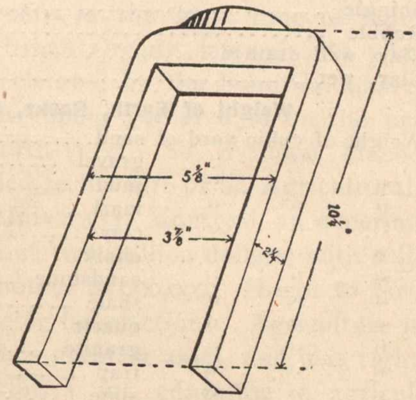
By Charles S. Gingrich, M.E.

XXVIII.

Steam Engine Work.

Supplementary to the illustration shown last month, I am pleased to be able to show below, the second operation on connecting rod straps as finished by the Frick Company, Waynesboro, Pa., on a No. 3 plain "Cincinnati" Miller. This consists of milling the sides of the strap as shown in the illustration. Four straps are held in the fixture at one time, and the work is done by three inserted tooth side mills, 8½" diameter with high speed steel blades, working at 50 ft. cutting speed, and a table travel of 1" per minute. The straps are conveniently spaced on the fixture, and the blades of the middle cutter are adjusted endwise, so that it can finish the side of each one of two straps at the same time; each one of four surfaces being milled at one time is 2¼" wide and 10¼" long. This makes the total width of the cut 9". The depth of cut is from ⅛ to 3-16". The line cut herewith gives the actual dimensions of the finished strap. This operation is completed on 12 straps per hour.

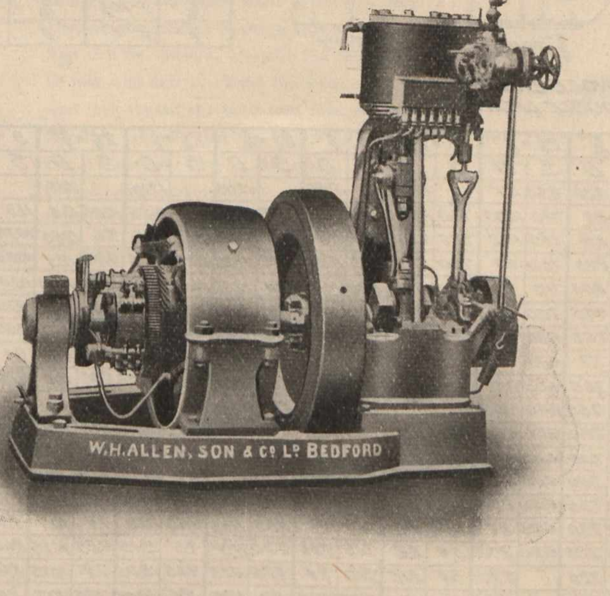




(To be Continued.)

A NOTABLE ELECTRIC LIGHT INSTALLATION.

A few days ago we had the pleasure of inspecting an electric light installation, which is something new in this country. It was at the factory of the Major Manufacturing Company, Limited, makers of paper boxes, egg fillers, and wire goods, 600 Craig Street, Montreal. The type of engine and dynamo is shown in the accompanying illustration.



It consists of a single, open crank engine, direct coupled to a continuous current multipolar dynamo, either shunt or compound wound. The engine is 8" x 7", with an output in kilowatts of 19.8 and 285 revolutions per minute.

The complete engine and electrical outfit was made by W. H. Allen, Son & Company, Queen's Engineering Works, Bedford, England; while the installation was made by the Hall Engineering Works, of Cote Street, Montreal. The owners declare that this unique electric lighting plant has worked like a charm ever since its completion. The writer inspected the engine when it was running at top speed under full load, and it was almost noiseless. In fact, upon holding a watch near, the ticking was actually louder than the noise made by the combined movements of the whole engine! Another feature is the remarkably small space required for the entire installation. A large number of these engines and dynamos have been furnished to the British and Japanese Navies, where economy of power and space are a necessity, hence the selection of the Allen electric lighting plants.

THE SLIDE RULE.

It is very strange that builders and mechanics generally ignore the use of the slide rule. There is no tool, scale, or set of tables in existence that has such capabilities, and that will lead to such satisfactory results, as the slide-rule when in competent hands.

—It is with very great regret that we announce the death of Mr. E. T. Hannam, of the Atlas Engine Works, Indianapolis, Ind., the inventor of the Atlas water tube boiler, in Chicago, at 4 p.m., Saturday, August 18th, due to heart disease. Mr. Hannam had been with the Atlas Co. three years, and he had grown steadily in their esteem, having only recently been promoted to assistant manager of sales of the water tube boiler department, his exceptional ability as a salesman warranting the company in taking him out of the Philadelphia office and placing him in the broader field.

EXTRACTS FROM AN ENGINEER'S NOTE BOOK

STANDARDS OF EARTHWORK.*

Angles of Slopes.

Slopes ½ to 1 = 63°30′	Slopes 1¾ to 1 = 29°44′
" ¾ to 1 = 53°00′	" 2 to 1 = 26°35′
" 1 to 1 = 45°00′	" 3 to 1 = 18°25′
" 1¼ to 1 = 38°40′	" 4 to 1 = 14°12′
" 1½ to 1 = 33°42′	

Natural Slopes of Earths with Horizontal Line.

		Degs.
Gravel	Average	40
Dry sand	"	38
Sand	"	22
Vegetable earth	"	28
Compact earth	"	50
Shingle	"	39
Rubble	"	45
Clay, well drained	"	45
Clay, wet	"	16

Weight of Earth, Rocks, etc.

Weight of cubic yard of sand	about	30 cwt.
" " " gravel	"	30 "
" " " mud	"	25 "
" " " marl	"	26 "
" " " clay	"	31 "
" " " chalk	"	36 "
" " " sandstone	"	39 "
" " " shale	"	40 "
" " " quartz	"	41 "
" " " granite	"	42 "
" " " trap	"	42 "
" " " slate	"	43 "

Quantity of Earths Equal to a Ton.

Sand, river, as filled into carts		21 cu. ft.
Sand pit	" "	22 "
Gravel, coarse	" "	23 "
Marl	" "	28 "
Clay, stiff	" "	28 "
Chalk, lumps	" "	29 "
Earth, mould	" "	33 "

Earth and clay increase in bulk ¼ when dug, but subside 1-5 in height and decrease ⅙ in bulk when formed into embankments.

Sand and gravel increase in bulk 1-12 when dug; sand subsides in embankment ¼ in height; gravel from 1-10 to 1-12, according to coarseness.

Rock increases ½ of its original bulk when excavated.

Cost of Labor on Embankments.

ELLWOOD MORRIS.

Single Horse and Cart—Loaded cart in excavation and embankment can go 100 lineal feet and return in 1 minute while moving. Time lost in loading, waiting, etc. 4 minutes per load.

A medium laborer will load in a cart in 10 hours cubic yards of earth measured in the bank as follows: Gravelly earth 10, loam 13, sandy earth 14.

Carts are loaded from banks: Descending hauling, ⅓ of a cubic yard in bank; ascending hauling, ¼ of a cubic yard in bank.

Loosening in Loam—A 3-horse plough will loosen 250 to 800 cubic yards in 10 hours; cost of do., from 1 to 8 cents per cubic yard, when wages = $1.05 per day.

Trimming and Bossing = 2 cents per cubic

Scooping—A scoop load=1.10 of a cubic yard in bank. The time lost in loading, unloading and turning per load = 1⅓ minutes. Time lost for every 70 feet of distance from excavation to bank and returning = 1 minute.

Hauling Stone—A cart with horses over an ordinary road will travel 1.1 miles per hour. A four-horse team will haul 25 to 36 cubic feet of limestone per load.

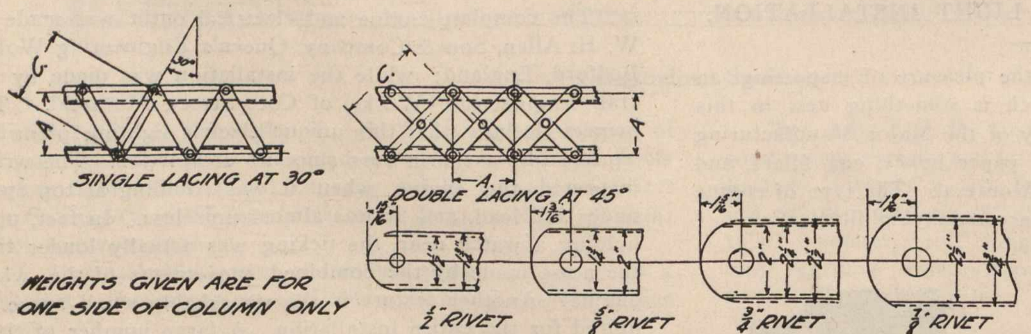
Time of unloading, loading, etc., averages 35 minutes per trip; cost of do., with horse crane at quarry and unloading by hand, when labor = $1.25 per day and horse = 75, is 25 cents per perch (24.75 cubic feet).

The work done by an animal is greatest when the velocity with which he moves is ⅙ of the greatest velocity he can move when unloaded, and the force then exerted is equal to .45 of the force the animal can exert at a dead pull.

*Browning's Industrial Magazine, May, 1906.

TABLE OF WEIGHTS OF LACING.

Computed by Charles T. Lewis, Chicago, Ill., U.S.A.



MAXIMUM DISTANCE C FOR GIVEN THICKNESS OF BAR

Single Lacing $t = \frac{c}{40}$		Double Lacing $t = \frac{c}{60}$	
THICK t.	DISTANCE C.	THICK t.	DISTANCE C.
¼	0′-10″	¼	1′-3″
5/16	1′-0½	5/16	1′-6¾
⅜	1′-3	⅜	1′-10½
7/16	1′-5½	7/16	2′-2¼
½	1′-8	½	2′-6
9/16	1′-10½	9/16	2′-9¾
⅝	2′-1″	⅝	3′-1½

S = WEIGHT FOR SINGLE LACING.
D = WEIGHT FOR DOUBLE LACING

A. in.	1½"×¼"		1½"×5/16"		1¾"×¼"		1¾"×5/16"		2"×¼"		2"×5/16"		2"×⅜"		2¼"×5/16"		2¼"×⅜"		2½"×5/16"		2½"×⅜"		2½"×7/16"		2½"×½"		2¾"×⅜"		3"×⅜"		A. in.
	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	S	D	
5"	3.45	4.65	4.30	5.8	4.04	5.4	5.05	6.75	4.95	6.6	6.2	8.2	7.45	9.85	6.95	9.25	8.35	11.1		10.7		12.85		15.00		17.15		14.15			5
6	3.30	4.45	4.10	5.55	3.85	5.2	4.8	6.5	4.70	6.3	5.85	7.85	7.00	9.4	6.55	8.8	7.90	10.55	7.60	10.15	9.15	12.2	10.65	14.2	12.2	16.25	10.05	13.4	11.3		6
7	3.20	4.3	3.95	5.4	3.7	5.05	4.65	6.3	4.50	6.05	5.60	7.55	6.75	9.05	6.30	8.5	7.55	10.2	7.25	9.75	8.75	11.7	10.2	13.65	11.65	15.6	9.6	12.85	10.75		7
8	3.10	4.2	3.85	5.25	3.6	4.95	4.5	6.15	4.35	5.9	5.40	7.35	6.50	8.8	6.10	8.25	7.30	9.9	7.00	9.45	8.45	11.35	9.85	13.25	11.25	15.15	9.25	12.5	10.35		8
9	3.05	4.15	3.8	5.15	3.55	4.85	4.4	6.05	4.25	5.75	5.30	7.20	6.35	8.65	5.95	8.05	7.15	9.7	6.80	9.2	8.20	11.1	9.51	12.9	10.9	14.75	9.00	12.15	10.0		9
10	3.00	4.1	3.7	5.1	3.5	4.75	4.35	5.95	4.15	5.65	5.15	7.05	6.2	8.45	5.80	7.95	7.00	9.5	6.65	9.00	8.00	10.85	9.30	12.65	10.65	14.45	8.8	11.95	9.75		10
11	2.95	4.05	3.65	5.05	3.4	4.70	4.25	5.90	4.05	5.55	5.05	6.95	6.10	8.35	5.70	7.85	6.85	9.4	6.50	8.85	7.85	10.65	9.15	12.45	10.45	14.2	8.6	11.75	9.55		11
12	2.90	4.00	3.6	5.00	3.4	4.65	4.2	5.80	4.00	5.5	5.00	6.85	6.05	8.25	5.60	7.7	6.75	9.25	6.40	8.75	7.70	10.5	9.00	12.25	10.25	14.0	8.45	11.55	9.4		12
13	2.85	3.95	3.6	4.95	3.35	4.60	4.15	5.75	3.95	5.45	4.95	6.80	5.95	8.15	5.55	7.65	6.65	9.15	6.30	8.65	7.60	10.4	8.85	12.1	10.1	13.85	8.35	11.4	9.25		13
14	2.85	3.95	3.55	4.9	3.3	4.60	4.15	5.70	3.90	5.4	4.90	6.70	5.85	8.05	5.50	7.55	6.60	9.05	6.25	8.55	7.50	10.3	8.75	12.00	10.0	13.7	8.25	11.3	9.1		14
15	2.80	3.90	3.5	4.85	3.3	4.55	4.10	5.70	3.90	5.35	4.85	6.65	5.80	8.00	5.45	7.50	6.55	9.00	6.15	8.45	7.40	10.2	8.65	11.9	9.9	13.55	8.15	11.2	9.0		15
16	2.80	3.90	3.5	4.85	3.25	4.55	4.05	5.65	3.85	5.30	4.80	6.6	5.75	7.95	5.40	7.45	6.45	8.95	6.10	8.4	7.35	10.1	8.55	11.8	9.8	13.45	8.05	11.1	8.9		16
17	2.80	3.85	3.45	4.8	3.25	4.50	4.05	5.6	3.80	5.25	4.75	6.55	5.70	7.9	5.35	7.40	6.40	8.85	6.05	8.3	7.30	10.00	8.50	11.7	9.7	13.35	8.00	11.00	8.85		17
18	2.75	3.85	3.45	4.8	3.25	4.50	4.05	5.6	3.80	5.25	4.70	6.55	5.65	7.85	5.30	7.35	6.40	8.85	6.00	8.3	7.25	9.95	8.45	11.65	9.65	13.3	7.95	10.95	8.75		18
19	2.75	3.85	3.45	4.8	3.2	4.45	4.00	5.55	3.75	5.2	4.70	6.50	5.65	7.8	5.30	7.30	6.35	8.8	5.95	8.25	7.20	9.9	8.35	11.55	9.55	13.2	7.9	10.9	8.7		19
20	2.75	3.8	3.4	4.75	3.2	4.45	4.00	5.55	3.75	5.2	4.65	6.45	5.6	7.75	5.25	7.25	6.30	8.75	5.9	8.2	7.15	9.85	8.30	11.5	9.5	13.15	7.85	10.85	8.65		20
21		3.8		4.75		4.45		5.55		5.15		6.45		7.75		7.25		8.70	5.9	8.15	7.10	9.8	8.25	11.45	9.45	13.05	7.8	10.75	8.6		21
22		3.8		4.7		4.4		5.50		5.15		6.4		7.7		7.2		8.65	5.85	8.10	7.05	9.75	8.2	11.35	9.4	13.00	7.75	10.7	8.55		22
23		3.75		4.7		4.4		5.50		5.1		6.4		7.65		7.2		8.6	5.80	8.05	7.00	9.7	8.2	11.3	9.35	12.95	7.7	10.65	8.5		23

From "Engineering News."

Weights are given in pounds per lineal foot of member laced, for single and double lacing, for ONE SIDE OF MEMBER only. The weight includes the wastage in cutting the lacing bars, but does not include rivets.

The Canadian Engineer.

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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OFFICES—62 Church St., Toronto. TELEPHONE, Main 1392.

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 advertisements should be in our hands not later than the 10th of the preceding month.

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TORONTO, CANADA, SEPTEMBER, 1906.

CONTENTS OF THIS ISSUE.

TO A FRIEND AFRAID OF CRITICS.

Afraid of critics! an unworthy fear:
Great minds must learn their greatness and be bold.
Walk on thy way; bring forth thine own true thought;
Love thy high calling only for itself,
And find in working recompense for work,
And envy's shaft shall whizz at thee in vain.
Despise not censure;—weigh if it be just;
And if it be—amend, whate'er the thought
Of him who cast it. Take the wise man's praise,
And love thyself the more that thou couldst earn
Meed so exalted; but the blame of fools,
Let it blow over like an idle whiff
Of poisonous tobacco in the streets,
Invasive of thy unoffending nose:—
Their praise no better, only more perfumed.

The critics let me paint them as they are.
Some few I know, and love them from my soul;
Polished, acute, deep read; of inborn taste
Cultured into a virtue; full of pith
And kindly vigour, having won their spurs
In the great rivalry of friendly mind,
And generous to others, though unknown,
Who would, having a thought, let all men know
The new discovery. But these are rare;
And if thou find one, take him to thy heart,
And think his unbought praise both palm and crown,
A thing worth living for, were nought beside.
Fear thou no critic, if thou'rt true thyself;—
And look for fame now if the wise approve,
Or from a wiser jury yet unborn.
. . . . —CHARLES MACKAY.

TECHNICAL EDUCATION: A SHORT-SIGHTED POLICY.

A revolution in engineering practice is taking place before our eyes, and all countries but Canada are preparing adequately to meet it. Even now, our universities and schools of science ought to be equipped with miniature steam turbines, suction gas producer plants, electric furnaces, electric locomotives, and models of hydro-electric installations, so that our young men can be ready to design, manufacture or operate these new motive powers and appliances, which will be utilized in factories, foundries, steel-works and railroads in the good time of industrial prosperity which has already dawned, and which is bound to be accelerated by the bountiful harvest of golden grain now being gathered in on the prairies of the great North-West. Sir William Macdonald has recently added to his gift of an Agricultural College at McGill University, Montreal, an experimental farm, to cost about two million dollars, with a liberal endowment of another $2,000,000. Honor to Sir William for these noble benefactions. Agriculture is undoubtedly Canada's greatest asset, and it is right and proper that facilities for education in agricultural science should be as extensive, and the equipment as complete as possible. But the country has immense mineral resources, which are about to be opened out to commerce; waterfalls which will be harnessed for power; and steel-works and furnaces built which will be operated by an entirely new metallurgy. We unhesitatingly affirm that our great institutions of learning are lamentably lacking in facilities for up-to-date **practical** technical training to meet these new industrial conditions. Take metallurgy at McGill for example. The academic teaching is of the highest order. The series of copyright articles on the electric furnace now appearing in our columns is proof positive that the young man who graduates in metallurgy under the tuition of Dr. Stansfield will go out into the industrial world, with a thorough **theoretical** knowledge of the latest metallurgical science. But the practical application of first principles, will have been gleaned from demonstrations made with the merest toy furnaces and appliances. It is the defective sense of proportion and false perspective which these unpractical object lessons impart that cause so many college students to be a laughing stock when they begin operations in our best workshops. We have before us photographic prints in a Canadian Mining Institute paper, showing the equipment in the metallurgical section, and a sorry figure the apparatus cuts, when compared, say with Sheffield University. 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 thereabout 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 the practical teaching of 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? In fact it is only fooling with the destinies of our embryo metallurgists. An endowment of $1,000 a year for supplies in this important branch of technical education would work wonders. But we understand that the **total** available allowance for supplies in the metallurgical department is less than $500! If Sir William Macdonald can endow agriculture with $2,000,000, surely we have public-spirited millionaires enough in Canada to endow metallurgy with $1,000 per annum.

In making the foregoing criticism we are not impeaching the McGill authorities, for we assume that, according to their light, they are doing the best with the funds they have. In view of the coming importance of metallurgy, however, and especially along the lines of electric-smelting, we have deemed it a public duty to make the foregoing plea.

CANADA: AS SEEN BY A DISTINGUISHED VISITOR FROM INDIA.

In another column appears "Impressions of Canada," from the pen of a scholarly and learned barrister and man of science from India. Mr. Daru—with the characteristic pride and intellectual subtility of his race—first refers to a recent Montreal criticism of his native city of Bombay—evidently resenting it; then, based upon six months' special investigation in Ottawa, Montreal, Quebec, Toronto, Hamilton, the Maritime Provinces, and now Northern Ontario, picks out the good things he has seen: fertile agricultural lands, rich mineral resources, numerous waterfalls laden with cheap power for manufacturing purposes; gifts of Nature ready to the hands of a virile people, whom he predicts are bound to be great, since they are almost free from that bane of the older countries, the strong drink habit. Our visitor's critique, however, is not all pleasing affirmation, for his views of our banks, foreign loans policy, and system of Protection are trenchant enough in all truth, while his grief at the influence American manners and morals are exerting on Canadian society is almost pathetic. But we wish he had said something about our summer weather, if only to dissipate the false notion which Kipling's "Our Lady of the Snows," has created in England. Yesterday in Toronto it was 88° in the shade, and yet, as the porters at the University were opening the crates of material for exhibition at the great meeting of the British Medical Association next day, they were amazed to see on one large box this warning: **"Please Protect from Frost!"** This reminds us of an incident that occurred in New York harbor sometime ago. A lady with five boys had crossed the Atlantic. As the steamer sailed past the Statue of Liberty, in sight of the immense sky-scrapers and places of business, the oldest boy, with eyes wide open, turned to the mother and exclaimed: **"Where are the Indians and the huts?"** Inasmuch as "The Canadian Engineer" is gradually getting a good circulation in Britain, affirmative "Impressions" like Mr. Daru's, will serve to show those remaining in the "Old World," that in many respects, Canada begins where they left off: while as to climate, one of Britain's greatest divines, the Rev. George Jackson, of Edinburgh, comes to Toronto next month, for three years stay in search of health.

EDITORIAL NOTES.

Combination of Reciprocating and Low Pressure Steam Turbine Engines.

One of the best examples of sound business instinct we have come across recently, is Goldie & McCulloch's acquisition of the Canadian rights to manufacture the Rateau low pressure steam turbine. In our January issue, referring to the inroad which the steam turbine was making in recent engine practice, we said:—

> Although the steam turbine has proved its suitability as a prime mover in electric lighting plants of magnitude, etc., there are fields where the reciprocating type of steam engine will hold its own for many a long day; in huge rolling mills for example, where the rolling of heavy steel slabs and blooms demands an enormous sudden torque, or turning effort. No steam turbine yet designed can be governed to meet this severe, erratic work. And since Professor Rateau, of Paris—by his invention of the low-pressure turbine generator—has made it possible to utilize the exhaust steam from reciprocating engines, converting the rejected heat into useful electrical power, it is certain that costly first-class, reciprocating engines, in plants of magnitude, will not—on the score of economy—be suddenly torn out, and steam turbines substituted in place thereof.

Since this generalization of ours, has appeared Mr. Henry G. Stott's notable paper on "Power Plant Economics," read before the American Institute of Electrical Engineers, January 26th, 1906, in which this eminent authority says:—

> The present type of steam power plant can be improved in efficiency about 25 per cent. by the use of more scientific methods in the boiler-room, by the use of superheat, and by running the present types of reciprocating engines high pressure, **and adding a steam turbine in the exhaust between the engine and the condenser.** At the same time the output of the plant can be increased to double its present capacity at a comparatively small cost for turbines and boilers.

It is gratifying to know, that as in the early advocacy of electric-smelting, so in the case of the low pressure steam turbine, events have confirmed our outlook. In October, we purpose describing and illustrating a power plant in which high pressure reciprocating engines are working in combination with a Rateau low pressure turbine, and giving remarkable economic results. Messrs. Goldie & McCulloch are to be congratulated on their new departure.

That Westinghouse Formula

Our contemporary, "The Monetary Times," seems to have reached the somnolent stage, judged by its tenth article on the power question, entitled **"Puzzling Power Situation"** (August 3, 1906). After a somewhat pharisaical exordium about "name-calling," this noted authority on "blundering" says:—

> 'The Canadian Engineer' bases its assertion of a two million dollar error upon the Westinghouse formula. The average man would like to see the Westinghouse formula.

This would be very amusing, if it were not serious; for if our good friend, the editor, will waken up, he will find that the only place in the controversy where the formula has appeared, is on page 1577 of "The Monetary Times," May 25th, 1906. It occurs in the letter of J. Stanley, Richmond, C. E., and reads thus:—

Westinghouse Formula.

> An approximate rule for the cost of copper, based on 10 per cent. line loss, three-phase transmission, 100 per cent. power factor, and copper at 15 cents a pound:
>
> **If the voltage of line in thousands of volts is equal to miles of distance, the cost will be $4 per kw., delivered.**

The per cent. line loss is the actual power lost in line in per cent. of true power delivered. For a per cent. loss other than 10 per cent. the cost will be increased or decreased in inverse proportion. For example, a 5 per cent. loss under same conditions means a cost of $8 per kw. For other power factors the increase in cost is inversely proportional to the square of the power factor. For example, if the power factor is 85 per cent., the cost will be 1.4 times that given by the foregoing rule. For other price of copper the cost is in direct proportion.

[See Westinghonse Pocket Book p. 26.]

To the foregoing may be added the rule well known to electrical engineers, that, all other factors accounted for, the cost for copper, in so far as distance is concerned, is directly proportional to the square of the distance—with direct current anyway, but somewhat higher with three-phase current, owing to what is known as capacity trouble. For convenience and to favor the findings of the Commission, allow that the rule holds good for three-phase transmission.

Now, taking the Commission's report, the first move necessary is to find out from its details what total loss has been assumed and what proportion of this loss occurs in the line. Then it will be possible to estimate on the basis of their figures—not mine, mark you—what the cost for copper alone would be in order to compare such cost with their cost for all equipment.

Turning to "Table XVII., First Report, Niagara District," it will be found that, allowing $12 per 24-hour Horse Power per year at Niagara, the Commission has stated that it would be necessary to buy $13.08 worth of power at Niagara in order to deliver one Horse Power in Toronto; that is, out of every 13.08 Horse Power purchased at Niagara only 12 Horse Power would be available at the low-tension bus-bars in Toronto, or 1.08 Horse Power out of every 13.08 Horse Power would be lost in transmission and owing to transformation. This is equivalent to 8¼ per cent. loss of power purchased, or to a 9 per cent. greater amount of power required than the amount of power which would have to be delivered. To again favor the findings of the Commission, let us assume that they have allowed the higher percentage, that is, 9 per cent.

The next move is to find out what the losses due to transformation would be. Power at Niagara is generated at approximately 10,000 volts. After its purchase, therefore, step-up transformers would be required to raise the voltage to 60,000 volts. In my letter of the 18th of April to the editor of the "Globe" I allowed 5 per cent. loss for each transformation. The highest efficiency claimed by any manufacturer of transformers for their apparatus is about 97½ per cent.; that is 2½ per cent. loss. The next loss would take place in the line; and, in my letter before referred to, I allowed 10 per cent. With long-distance transmission, from 10 to 20 per cent. line loss is generally allowed, the actual loss allowed being obtained by a series of trial calculations based somewhat on Lord Kelvin's law:

That the most economical expenditure for copper is that which results in the annual charges not being greater than the annual value of the power lost.

For the time being, however, let us ignore the line loss and travel further. At the outskirts of Toronto the power would be received at high voltage—somewhat under 60,000 volts. This would require another set of transformers, step-down in this case, and another 2½ per cent. loss would result—I allowed 5 per cent. Power would then be available at about 10,000 volts, which would still be high-tension current, and require another set of step-down transformers to reduce it to—say for convenience—1,000 volts. This would deliver the power in a suitable state for motors, and involve another 2½ per cent. loss. For lighting purposes another set of step-down transformers would be required in order to have low-tension current available. To favor the findings of the Commission again, however, allow that they referred to power at 1,000 volts when they compiled "Table XVII.", vide top of sheet, which reads, "At sub-station, low-tension bus-bars." This, then, would give three losses beside the line loss up to this point, each one of 2½ per cent., or a total for these three items of 7½ per cent. But, as it has been shown, they have only allowed for these three items and the line loss either 8¼ or 9 per cent., the latter having been chosen to favor their findings. Now, 9 per cent. less 7½ per cent. only leaves 1½ per cent. loss allowed for the high-voltage transmission line.

The next move is to calculate what would be the cost for copper to transmit 50,000 Horse Power at a commencing voltage of 60,000 volts from Niagara to Toronto, a distance, according to the report of the Commission, of 88 miles—Toronto to Hamilton, 42 miles, and Hamilton to Niagara, 46 miles—the line loss being 1½ per cent., the base price of copper in the Canadian market being at present 20 cents or somewhat higher per pound, and one K.W. (one kilowatt) being equal to 1.34 Horse Power. Before making the estimate, it is advisable for the reader to turn back to Westinghouse figures, before quoted.

Four dollars ($4) multiplied by $\frac{1\text{ K.W.}}{1.34\text{ H.P}}$ multiplied by $\frac{100^2}{80^2}$ (power factors—80 per cent. power factor is a high allowance) multiplied by $\frac{88^2}{60^2}$ (distances in miles—instead of the distance in miles being equal to the voltage in thousands of volts; that is, 60 miles—it is 88 miles—multiplied by $\frac{20\text{ cents}}{15\text{ cents}}$ (price of copper) multiplied by $\frac{10\%}{1\frac{1}{2}\%}$ (losses allowed on line) gives the resulting equation as simply as it is possible to give it in letter form. Simplified, this equation becomes $4 \times \frac{100}{134} \times \frac{10000}{6400} \times \frac{7744}{3600} \times \frac{20}{15} \times \frac{20}{3}$ or $89.183711. The cost for copper alone, according to the figures of the Commission, therefore, would be over $89 per Horse Power to be delivered, or 89.183711 multiplied by 50,000; that is, $4,459,185.80 for 50,000 Horse Power to be delivered.

But, turning to page 19 of the report before mentioned, it will be found that the Commission has stated that the total investment which would be required for copper, steel towers, right of way, transformer stations and equipment, interswitching devices, etc., would only be $2,117,978.

In the interest of "the average man," (sic) we have reproduced—as requested, not only the Westinghouse formula, but also Mr. Richmond's estimate of the cost of copper required for transmitting 50,000 H.P. from Niagara Falls to Toronto.

It is much easier for the engineer to the Hydro-Electric Power Commission of the Province of Ontario to describe Mr. Richmond as an "absurd person," than to disprove his mathematics.

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Ethics of Controversy.

Mr. Cecil B. Smith, in a letter to "The Globe" (August 15), bitterly resents the severe public criticisms leveled against him recently, declaring that:

> The whole attack seems to be a sad exhibition of the prevailing idea that there is now assumed to be little or no personal honor in any matter political in its nature.

Of those who have ungenerously entered the realm of motive in dealing with opponents, Mr. Smith has been the greatest sinner of all. The way in which he and the Honorable Adam Beck have been hitting their ablest critic (J. Stanley Richmond) below the belt is a public scandal. Even we have not escaped; for in his Galt speech, Mr. Smith declares that our article on the power question was:

> Apparently inspired by an officer who had been retired from the Commission.

An altogether unwarranted assumption, and typical of his distorted perspective, when subjected to legitimate criticism. For proof that our attitude towards Mr. Smith has been strictly just, he has only to refer to page 309 of our August number, where we describe his work on the Temiskaming and Northern Ontario Railway, and he will find these words:—

> We are constrained to say that from the engineer's standpoint the Temiskaming and Northern Ontario Railway is a creditable piece of work, and places the consulting engineer responsible for the planning, designing and construction of the line, viz., Mr. Cecil B. Smith, in the front rank of modern railroad engineers.

Our admiration for his eminence as a railroading engineer, however, does not blind us to his limitations as a hydro-electrical engineer—exemplified in the fallacious report of the Hydro-Electric Commission of the Province of Ontario.

IMPRESSIONS OF CANADA.

By Nanabhai Dayabhai Daru, B.Sc., B.A., A.R.S.M., Barrister-at-Law; Member Geological Institute of India, of Bombay, India; Attache of the Indian Government to the Geological Survey of Canada.

A superficially observing Canadian "Journalist" has had the cheek (impudence is not the word) to write a coarsely-worded article, full of vulgar sentiments, comparing Bombay and Montreal, all to the disadvantage of the former; and an otherwise generally sensible Montreal paper has had the good taste to publish the article. If I wrote in a similar strain about Canada, either "The Canadian Engineer" would not publish my "impressions" or if it did, I should have to seek safety in flight; for one of my chief impressions is, that if there was a class of "Leptoderms" in the Zoological System, it would not be difficult to find proper organisms to fill it, and where a Sarah Bernhardt received merely an **ovation**, and Sir Gilbert Parker's frank criticism was resented, I should consider myself fortunate if I escaped a lynching. No nation and no country is perfect. While there may be some things in Canada deserving of adverse comments, there is so much to admire and praise, that even if the reason above mentioned were not sufficient, I should be justified in writing.

What struck me most at first was the go-ahead character of this new country; so much in contrast to the conditions in the old ones. For instance, I have seen in Canada a small town of less than a thousand inhabitants, supplied with waterworks, a drainage system, electric light, telephone, and three banks working throughout the week. I have known larger towns in England where a bank did business for three hours every Friday morning; where the streets did not have the luxury of even petroleum lamps; and where the nearest public telephone call office was twelve miles away. In a country like India, for such a "town," waterworks, etc., or even metalled streets would be out of the question.

Talking of banks, I am afraid, the business of banking is perhaps overdone. Whether it be so or not, of one thing I am certain, viz., that your Canadian banks are very greedy. You hand in for the credit of your account a cheque on another bank, or for that matter, even one on a branch of the same bank as your own, and the bank charges you a certain amount for collection. I didn't find it so in England.

This brings to my mind the cry I often hear as to attracting foreign capital. I am prepared to allow that arguments suitable for an old country might not apply to a new one. Still the question remains, what does the country profit by the introduction of foreign capital? True it gets increased population to some extent, but isn't the time approaching fast when, in the interests of those already in the country, the pace of increase of population by inviting outsiders will have to be slackened. But my chief objection to foreign capital is, that the natives get only the wages for hewing wood and drawing water, while all the profits have to be exported. This is especially the case with regard to the mining industry, where for the paltry benefit in the shape of increased employment for larger numbers, the natural wealth of the country, which ought to be reserved for the natives is irrecoverably given away to foreigners; for minerals, unlike forests, don't grow again; that is, within the lengths of time we are concerned with. To my mind, the inevitable consequence of such a policy would be that Canada's prosperity would be greatly retarded, if not actually converted into indebtedness. There would be some little compensation if either the capitalists became Canadian citizens, or even entertained sentiments of affection and loyalty for the country from which they derived their wealth.

I am not a believer in a policy of **Protection**, yet apparently the policy is responsible for the great and daily increasing industrial activity in the country. It seems to me rather that the wisdom and enterprise of your captains of industry deserve the credit. What has interested me most is their willingness to place young and college-trained men in charge, and the faith they have in these men, while in England, youth and college education count for nothing, if not for a positive disqualification. Is it a wonder then that industries should prosper.

A person like myself, coming from India, cannot fail to remark the rich and varied mineral deposits scattered over the Dominion; the innumerable lakes, large and small, together with the magnificent rivers, which carry an immense amount of power in store, ready to be utilized when and where required. The extensive forest wealth, not to mention the highly productive prairies, fitly called the granary of the Western World, and last, but not the least, the splendid opportunities the configuration and the conditions of the country afford for daring engineering feats. What I do grieve to see is, the great influence exerted by the Republic to the south on the language, manners, morals, social, commercial, and political life of the Dominion on the north.

I have been often surprised at being referred to as: "Dr.," "Prof.," or even "Col." But it did not take me long to find out that in this country almost everyone is either a doctor or a professor, if he is not a colonel or a major, or one of the former combined with one of the latter. I hope I may properly seize this opportunity to disclaim all title to any such distinction, so that many good men who have kindly affixed one of the other of these titles to my name may know that I do not mean to sail under false colors.

I do not wish to refer to the topsy-turvydom of Canadian politics, neither do I wish to go on writing at great length, though I feel as if I have a great deal to say. But I cannot pass over the abstinence from intoxicating liquors so very general in some parts of Canada I best know. If anything, this, I believe, is a sign of the nation's coming greatness.

I must conclude this with an expression of the pleasure I have felt at the freedom from narrow prejudices, recognition of man as man, and liberal hospitality of the Canadian people, which I have not merely seen, but in many places and in many ways, myself experienced.

BOOK REVIEWS.

The American Steel-worker.—By E. R. Markham; Second Edition, 1906. New York: The Derry-Collard Company. Size, 8" x 5¾", pp. 339, 163 illustrations. (Price, $2.50, "mailed to any address on earth.")

The day is not far distant, when the manufacture of high grade steel will be one of Canada's chief industries, for we have the raw material and contingent cheap power in abundance. Knowledge of the best modern practice, therefore, is of vital importance to every young engineer under Canadian skies, if he is to be ready for the good time coming. The text book before us was written by a specialist, who has had "25 years experience in the selection, annealing, working, hardening and tempering of various kinds and grades of steel," and whose name is a name that counts in steel-worker circles in the United States. Every machine shop superintendent and tool-room foreman ought to possess a copy of this invaluable book, and engineers in charge can save their firms money by circulating it in their workshops where fine steel tools are used. A United States manufacturer of high grade tool steel has said that if he could have one per cent. of the value of steel spoiled by improper hardening, he would not exchange his income for that of the President of the United States. But while Mr. Markham's text book is perhaps the most exhaustive practical treatise on tool steels extant, and gives tables for the proper chemical constituents, and formulæ for the necessary tempering heats of steel for various uses; we still look in vain for a description of some simple appliance for determining accurately the temperatures of tempering ovens, oil and acid baths, annealing furnaces, etc. At the recent meeting of the British Association for the advancement of Science (Aug. 3rd) a paper was read describing experiments with a magnetic induction balance used for ascertaining the critical temperature in the heating of steel for hardening, also a simple magnetic attachment to a muffle furnace used for giving an audible signal when the steel heated in the muffle has reached its critical temperature.

This book is not the product of a scientific testing laboratory, but evidently the outcome of a wide and varied experience in the practical working of tool steels. It is printed on good paper, in clear brevier type and is strongly bound. The illustrations are excellent: many from well prepared drawings in isometrical projection. While the style is clear and singularly free from academic affectation, it is profitable reading and well worth buying. The master mechanic who masters its contents, will be worth 50 per cent. more to his employers than he is now.

The Battles of Labor.—By Carroll D. Wright, Ph. D., LL,D., former United States Commissioner of Labor, president of Clark College, and author of "Industrial Evolution of the United States," etc., Philadelphia. George W. Jacobs & Co. Size, 7½" x 5¼", pp. 220. (Price, $1 net.)

Here is a book that should be in the hands not only of every employer of labor, but of everyone who loves his fellowmen; for it sets forth with the hand of a master, a panoramic view of the struggles of labor to secure social and economic freedom or advanced and improved conditions. The author is one of the foremost sociologists of the age. He is not a Socialist; for he looks upon socialism not as a system, or a method, but as a criticism. His attitude towards the levelling policy of trades unions is crystalized in one apt sentence: "The immorality of equal compensation for unequal services." The author shows historically, that most strikes have been ordered in accordance with David Harum's golden rule of horse trading, "Do unto others as you think others are going to do unto you, but do it first." He evidently has not much faith in legislation as a means of closing the ever widening chasm between capital and labor; for he says:—

"How often we have been told that certain laws would solve the labor question, and yet, beginning with the act known as Sir Robert Peel's Act of 1802 to the present time, we have had 104 years of distinctive labor legislation in the mother country and in this; we have had the inspection of factories here by law; we have had legislation regulating employers' liability, the hours of labor, sanitary conditions, and yet, I think, no one would hesitate to say that the labor question is as intense to-day as at any time during the whole 104 years."

His panacea for labor troubles is along the lines of conciliation boards and co-operation. Intense love of personal liberty, and at the same time recognition of the universal law of **interdependence** leads him to quote with approval Abraham Lincoln's immortal saying: "No man is good enough to govern another man without that other's consent." Summing up the whole vexed question of the relation of employer and employees, he demurs to the claim of the political economists that these relations are **identical**, but alleges that they are **reciprocal**, and illustrates this contention by a quaint old fable: "Once upon a time the other members of the body conspired against the stomach; they declared that they had all the work to do, while the stomach lay quietly in the middle of the body and enjoyed, without any labor, everything they brought to it. So they all quit work and determined to starve the stomach into submission. But soon they discovered that while they were starving the stomach, they, too, were being starved, and that the whole body was wasting away." The clarity of style, restraint of statement, historical value, and sound ethical teaching of this book, render it a liberal education in labor economics. To our subscribers we say, get it, and everyone who reads it will thank us for the suggestion.

BOOKS RECEIVED.

Technical Education in Evening Schools.—By Clarence H. Creasey. London: Swan Sonnenschein & Co., Limited, 25 High Street, Bloomsbury, W. C. Size, 5¼" x 7⅜", pp. 309. (Price, 3s. 6d. nett.)

Industrial Furnaces and Methods of Control.—By Emilio Damour; translated by A. L. J. Queneau, B.S. (Paris), E.M., A.M. (Columbia), Consulting Engineer, The New Jersey Zinc Co. New York: The Engineering and Mining Journal. Size 6½ x 9½, pp. 317. (Price $4.00)

Machine Drawing.—For students preparing for the science examinations in technical institutes and evening schools. By Alfred P. Hill. London: P. S. King & Son, Orchard House, Wesminster. Size 11 x 8½, pp. 83. (Price 2s. 6d. nett.)

Metallurgical Calculations.—Part 1, Introduction, Chemical and Thermal Principles, Problems in Combustion. By Joseph W. Richards, A. C.. Ph. D. New York: McGraw Publishing Co., 1906. Size 9¼ x 6¼, pp. 201. (Price $2 nett.)

Iron and Steel Manufacture, the Principles and Practice of.—This work gives sound instruction for technical students, metallurgists, etc. By Walter MacFarlane, F.I.C. London and New York: Longmans, Green & Co., 1906. Size 7¼ x 5½, pp. 249, 96 illustrations. (Price 3s. 6d. nett.)

The Principles of Electric Wave Telegraphy.—By J. A. Fleming, M.A., D. Sc., F.R.S. London: Longmans, Green and Co., 39 Paternoster Row. Size 9 x 6½, pp. 671, illustrated. (Price, 24s., nett.)

Mechanical Draft.—A practical handbook for engineers and draftsmen. By J. H. Kinealy. New York: Spon and Chamberlain, 123 Liberty Street. Size 6⅞ x 4½, pp. 134, 13 illustrations. (Price, $2.00.)

Steam Turbine Engineering.—By T. Stevens, C.E., and H. M. Hobart, B.Sc. Toronto: The Macmillan Co., of Canada, Limited, 27 Richmond St. West. Size 6½ x 9¼, pp. 814. (Price $6.50 nett.)

City Roads and Pavements.—By Wm. Pierson Johnson. New York: Engineering News Publishing Co. Size 6 x 9, pp. 197. (Price $2 nett.)

CATALOGUES AND CIRCULARS.

Silica Graphite Paint.—Joseph Dixon Crucible Co., Jersey City, N. J. "Through Frisco's Furnace" is the title of an interesting booklet, showing seven fine views of modern steel-frame buildings at San Francisco that withstood the recent earthquake. It shows the originality of the American architect and engineer, and the soundness of steel-constructed buildings under severe test; also showing that Silica-graphite paint protects the steel work.

Engines.—Atlas Engine Works, Indianapolis. Illustrated bulletin No. 131 describes fully "Atlas" throttling and automatic single valve engines. It is claimed that these engines are simple and durable in construction. Size 8x10½, pp. 16.

Steam and Electric Locomotives.—American Locomotive Company, New York, N. Y. A paper read before the New York Railroad Club, by J. E. Muhlfeld, General Superintendent of Motive Power, Baltimore and Ohio Railroad, describing large steam and electric locomotives. Size 9x6, pp. 28.

Electrical Conductors.—The Wire and Cable Co., Montreal. A handbook of electrical conductors has been issued by this company giving much valuable data regarding electrical transmission apparatus. No electrician should be without one of these useful handbooks. Size 3¼x6, pp. 67.

Buyers' Reference.—This reference contains the names of all electric light and power central stations on this continent, being revised to date. The Buyers' Reference Co., Inc., 123 Liberty St., New York, N. Y. Size 8½x9½, pp. 114.

Penberthy Bulletin.—The Penberthy Injector Co., Detroit, Mich., are now issuing a monthly publication, called the "Engineer and Fireman." This publication is the advertising medium of the Penberthy Company, and is made interesting with valuable reading matter. Size 6x9, pp. 24.

Alternating and Direct Current Motors. Westinghouse Electric and Manufacturing Co., Pittsburgh Pa. Special catalogue No. 7049 sets forth their alternating and D. C. motors by description and illustration. Size 6x9, pp. 16.

Telephones.—The Dean Electric Company, Elyria, Ohio. In bulletin No. 102, Common Battery Telephones, as manufactured by the Dean Company, are shown by half-tone engravings, accompanied by graphic descriptions. Size 7¾x10, pp. 32.

Pictorial Post Cards.—We have just received several sets of pictorial post cards from C. E. Grasemann, Outdoor Goods Manager, London and Northwestern Railway, Euston Station, London, England. There are four sets in the series, viz., Stratford-on-Avon; Central Wales; Lake Windermere and Killarney Lakes. These are among the best pictorial post cards we have seen, being printed in three colors. Up to the end of May 4,500,000 were sold, which shows that they are sought after. Canadians visiting the "Old Land" should not fail to secure some of these excellent views of the country. Price 2d. for six cards.

CORRESPONDENCE.

APPRECIATION.

Editor, "The Canadian Engineer":

Enclosed find one dollar, to apply as my subscription for your valuable journal for this year. I am pleased to tell you that I find it greatly improved; some of the numbers are worth the whole year's subscription. You need not send receipt, as I shall send post-office note, and you will credit me on the label.

Yours truly,
(Signed), R. WILLIAMSON.

Ingersoll, Ont., August 6th.

[Extract.]

Editor, "The Canadian Engineer":

Dear Sir,— . . . "Even though I am not an engineer, I read almost every word of your journal every month, and I find it extremely interesting and useful, as an ordinary business man connected with, and interested in, the affairs of this great Dominion. Wishing you continued and increasing success,"

Yours very truly,
(Signed), J. F. MAGUIRE.

Vancouver, B.C., August 9th.

Editor, The Canadian Engineer:—

Sir,—In the April issue of "The Canadian Engineer," which a friend kindly sent me from Montreal, I noticed under the heading, "Light, Heat and Power," that the electric power plant, of which Senator William Mitchell is the head, will be the first to take up Edison's idea of generating electric power right at the mines, and transmitting it by wire.

My purpose in writing is to call your attention to the fact that the Lethbridge Electric Company has been generating electricity for light and power at the pit-head of the mines here since 1893, using the screenings for fuel, at a very low cost; they have at the present time about 575-H.P. in boilers, and 450-K.W. in generators; consisting of one 250-K.W. and one 200-K.W., 60 cycle two-phase, 2,200 volt alternators, the boilers are equipped with Jones Automatic Underfeed Stokers, and they consume about 15 tons of coal per 24 hours. The city waterworks pumping plant is operated entirely by electricity from the above-mentioned power-house. The plant consists of two 150-H.P. induction vertical motors, each direct coupled to a vertical three-stage turbine pump, and two 50-H.P. motors, each direct connected to a single stage horizontal turbine pump. The pumps operate against a head of 400 feet. The power-house is situated quite close to the mine shaft, which has since been abandoned and at present the coal is hauled about three-quarters of a mile. The pumping plant is one-and-a-half miles from the power-house.

ARTHUR REID.

Lethbridge, Alta., May 22nd, 1906.

ELEVENTH HOUR BUSINESS NOTES.

Montreal, 24 Fraser Building,
August 27, 1906.

The only thing that is holding back steel construction here is the lack of raw material, and especially pig-iron. It was not long ago that foundry iron was reduced about $1 a ton: the price then being $13, but now the figure is $15 a ton. Even at this rate it is almost impossible to get the deliveries made. Scrap iron is being substituted in some cases, but this is not always available. There is the same old story of imports, but the market is still some distance from any free receipts from abroad. The orders for structural steel are many, but specifications for early dates, do not find ready sellers, and many firms are compelled to refuse orders that must be filled by a certain date, since fuel as well as pig-iron is scarce: all showing the need of increased development along those lines.

There is a popular legend here, read of all men—"Canada for Canadians," and it is being worked to the satisfaction of at least one of our Montreal firms. The Allis-Chalmers-Bullock Co., Limited, is to install the hydraulic development plant at Soulanges for the Montreal Light, Heat and Power Co.

The question of changing the upper floors of the permanent wharf sheds from scoria blocks to concrete paving has lately been discussed in this city by the authorities, and there is a likelihood that this matter will be decided at an early date in favor of concrete.

One has not to travel far in Montreal to see the sign of Peter Lyall & Sons. This firm is one of the largest excavating and building concerns in this city, and they have recently secured the contract for the construction of a large grain elevator at Port Colborne, Ont.

Among the Canadian patents recently secured through the agency of Messrs. Marion & Marion, patent attorneys, Montreal, Canada, and Washington, D. C., is an excavating apparatus by John A. Marion, No. 100503.

There has been much press comment on the usefulness of the new Galveston dredge in operation below Quebec, but it is at this date working well, and has been since its installation. The rumors as to its ineffectiveness have their foundation in the fact that the dredge had been docked, but this was in order that its hoppers might be tightened for use in fine sand. Every test it has been put to has been successful, and the Hon. Mr. Brodeur denies all statements in the Canadian press to the contrary. He says:—

"Regarding the rumors that the dredge is unable to perform the work of the removal of the shoals at Beaujeu bank below Quebec I will say they are quite unfounded. This dredge only arrived in Canada in July after a sea voyage of four thousand miles, and actually commenced work on August 14th. She was not discarded by the authorities in Galveston, but was to be returned to the owners in Europe as being too large for the Galveston Canal. The contractors in Galveston not only have four dredges of this same type actually at work, but a fifth is building under the same construction."

The bridge Montreal has longed for is now a sure thing, as the ground will be broken for same next month, and by Christmas, the construction will be well under way. This bridge is to extend from the lower end of the harbor at Longueille to St. Catherine Street, and is to be a two decker: affording accommodation for three locomotive tracks, two street railway tracks, two roadways, and two foot paths. The space on the upper deck will be taken up entirely by the railway, and this part of the bridge will continue past St. Catherine Street about three quarters of a mile, where the railway terminal will be erected. St. Catherine Street is to be the terminus of the lower deck, so that the street cars will have easy access to the city.

It will be of cantilever design, 1,500 in the main span, a clear heading of 150'-0", and about 1½ miles long.

The promoters of this enterprise: The Montreal Bridge and Terminal Company, are to erect a Union Station at the Montreal end, as there are two or three roads on the south shore who are looking for an opportunity to run their trains into Montreal, and this gives them the chance. The company have also planned to build an hotel of the first class which is sadly needed in this quarter.

Sir Douglass Fox is the designer of this bridge, and Mr. F. Stewart Williamson, of New York, is associated with him in the construction. Mr. Fox was the designer of the bridge that spans the Victoria Falls in Zambezi, South Africa, of which the July issue of "The Canadian Engineer" gave full account.

The Dominion Government is making some very marked improvements in the national canals.

Along the banks of the Lachine Canal, concrete walls are being built, and electric appliances are being attached to the lock gates for operating same.

At the foot of the Soulanges Canal three buildings for lodging the workmen and electricians engaged in building a new wharf, repairing the canal gates, and in building a small tug for Government use are under construction.

Along the Chambly Canal a macadamized tow path is under construction, and the banks are being strengthened by dry masonry.

Boom piers are being placed at St. Ours Locks, and at Grenville a new wharf.

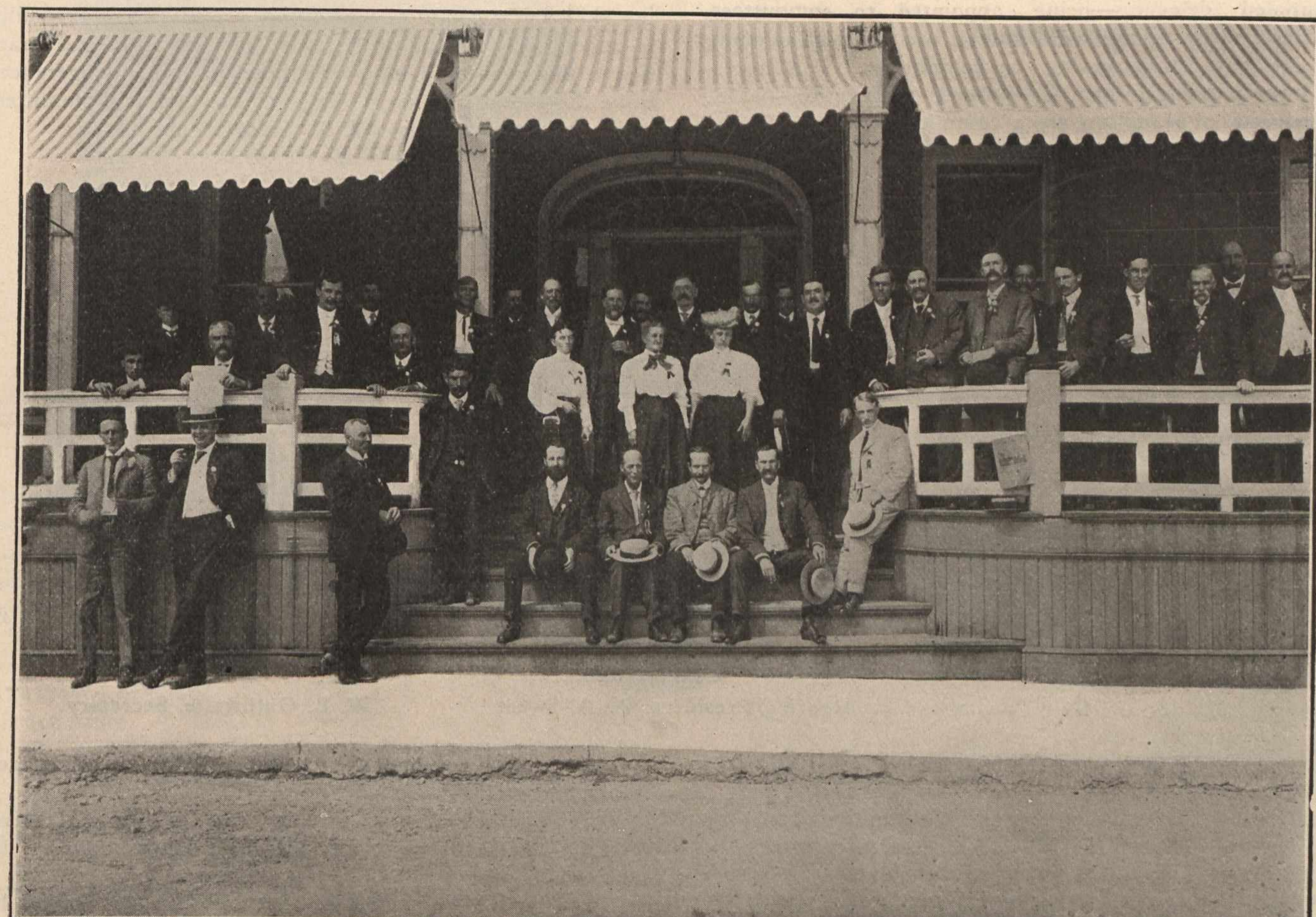
HUBERT GROVES.

CANADIAN ASSOCIATION STATIONARY ENGINEERS

Seventeenth Annual Convention.

The members of the C. A. S. E. held their annual convention in Fraser's Hall, Galt, Ontario, on August 7th, 8th and 9th. It was very appropriate that a Stationary Engineer's convention should be held in this enterprising town of 9,000 inhabitants, situated on the banks of the River Grand; for it is the centre of stationary engine building in the Dominion. It is also noted for its woolen industries and textile factories, hence is known far and wide as the "Manchester of Canada." It was on the special invitation of Goldie and McCulloch, the well-known engine builders, that the annual meeting this year was held at Galt, and the generous hospitality of that company contributed not a little to the pleasure and profit of perhaps the most successful Convention ever held in connection with this national organization of Stationary Engineers.

After the roll call, Mayor Thomson heartily welcomed the Association to Galt, and extended the freedom of the city. F. B. Utley, on behalf of Messrs. Goldie & McCulloch, reported that Mr. Alex. R. Goldie, would not be present, owing to his recent bereavement, and Mr. McCulloch was sick, but the firm hoped the arrangements made for their entertainment would show that they were in thorough sympathy with their educational movement. A. M. Wickens, who was introduced as "The father of the Association," replied on behalf of the C. A. S. E., saying that their motto was: "Learn more, earn more," and with this aim in view they endeavoured to hold their annual meetings in places where they would be most benefited. He pointed out that the number present was no criterion of the strength of their organization, as many of their members could not always get away for two or three days to attend a convention.



Stationary Engineers at Headquarters Hotel Grand.

Tuesday, August 7th.

The convention opened at 11 a. m., with President W. A. Sweet, of Hamilton, in the chair. The following is a partial list of delegates and visitors—

Toronto:—W. McGhie, J. Hughes, G. A. Black, S. Groves, Editor, "The Canadian Engineer; P. W. Ball, Assistant Editor, "The Canadian Engineer;" J. G. Bain, N. V. Kuhlman, C. Moseley, A. M. Wickens, W. L. Outhwaite, J. M. Dixon, A. W. Smith, F. M. Allen, W. G. Blackgrove, G. Fowler.

Hamilton:—J. Johnston, T. Prichard, F. Sculthorpe, R. C. Pettigrew, H. H. Clark, W. A. Crockett, W. A. Sweet, J. Ironsides M. F. Jones, C. Truedell, S. Burgess.

Chatham:—T. Stephenson, E. Grandbois, W. Prout, C. Kelley.

Berlin:—P. Uttley, C. Emmrich, E. J. Philip, E. Fitzgerald.

Galt:—G. Street, J. A. Stephenson, F. B. Utley, E. F. Hetherington.

Brantford:—John Thurlow, W. Webster, A. Ames, F. W. Lane.

Waterloo:—N. Bean.

Dresden:—J. M. Steeper.

Owen Sound:—F. Smith.

Guelph:—Geo. Bennett, T. Richardson.

Buffalo:—L. H. Rumage, J. N. Gregory.

Indian Orchard, Mass.:—Herbert E. Stone.

President's Address.

President W. A. Sweet said in his address, that three subordinate lodges had been formed during the year, and made the following recommendations:—

(1) That this Executive Council prepare a proper form of travelling card, and that each subordinate lodge procure the same from the Executive at reasonable prices.

(2) In case of any officer of the Executive Council neglecting to do his duties, or permitting another officer to neglect his duties, he may be asked to tender his resignation by written request of any three officers of the Executive Council, and any three officers of the Executive may appoint a more suitable man for the balance of the term of office made vacant by resignation or by death.

(3) That some better means of organizing new associations be inaugurated in our constitution. I would recommend that a suitable fee be allowed to any engineer who will organize an association in the town in which he resides or frequently visits.

(4) I wish also to recommend that the subordinate associations be allowed to elect honorary presidents. Such honorary presidents to be prominent engine manufacturers

residing in the city or town in which the association is located.

(5) That in preparing souvenirs for the C.A.S.E. in the future, the secretary of each subordinate lodge assist in the necessary preparations.

At the afternoon session Secretary W. L. Outhwaite read the minutes of the last convention held at Chatham, following with his report for the year 1905-6, in which he strongly pleaded for an official organ of the Association; referred to the successful passing of the Stationary Engineers' License Bill, the enactment of which, was largely due to the noble championship of their cause, by Henry Carscallen, M.P.P., for Hamilton. He said the Act had increased his correspondence over one hundred per cent., and was evoking renewed interest in the work of their Association.

The report of Treasurer J. M. Dixon showed a balance in hand of $172.81.

The various convention committees were then announced, but strong objection was made by G. Fowler, of Toronto, to past presidents—who were not properly credentialed delegates—being appointed to committees, and after a warm discussion, a motion was passed excluding past presidents from serving on committees. This necessitated the removal of A. M. Wickens, of Toronto, and R. C. Pettigrew, of Hamilton, from committees appointed, and substitution of G. Bennett, of Guelph, and N. Bean, of Waterloo, in place thereof.

Joseph Ironsides, the New President.

Retiring President, W. A. Sweet.

W. L. Outhwaite, Secretary.

Excursion.

At 4 p. m., through the courtesy of Messrs. Goldie & McCulloch, the convention delegates and visitors travelled three miles by special car to Preston Springs, and there inspected the power station of the Galt, Hespeler and Berlin Railway; then another three miles on to Berlin, entering the gaily decorated, prosperous German town as the bells in the Lutheran Church tower chimed "Home, sweet home," for it was Berlin "Old Boys' Re-union." The scenes in the crowded streets: martial music of marching bands, hilarious laughter evoked by fun creating minstrels and strolling players, groups of chaste German maidens hand in hand, enjoying with old world simplicity these holiday sights of their adopted land; and all this merriment and enjoyment without the drunken revelry which characterizes many of these events—was a pleasant experience.

But from the engineer's standpoint, the most interesting event was the inspection of the Berlin Gas Company's gas producer plant, now being operated successfully and economically, under the management of E. J. Philip.

At 8 p. m. the party returned to Galt, where they were entertained in front of the headquarters—"Hotel Grand"—with an excellent concert of classical and popular music by the famous Galt Kiltie Band, terminating in moonlight at 11 p.m.

Wednesday, August 8th.

The second day's proceedings opened with the report of Committee on Stationary Engineers' License Bill. A bill of expenses incurred by the committee in guiding the bill through the Legislature was presented, amounting to $190; a startling item being the moneys paid to Archibald W. Smith and partners for printing. Then followed a paper by A. M. Wickens, entitled "The Engineer and His Boiler," in which he prophesied that the youngest men present would see at least 75% of the power used throughout the country produced by steam during the remainder of their lives. Referring to the use of electrical energy in place of steam power, he said that certain users of electrical energy were already going back to steam power. E. J. Philip, by special request, addressed the convention on the theory and practical working of gas producers, as exemplified by the plant under his charge at Berlin. He declared his belief that suction gas producer plants for small units were undoubtedly more economical than steam plants, and advised the Stationary Engineers to prepare for the invasion of this type of motive power. The address as an impromptu effort indicated great rhetorical ability, and the speaker's answers to questions evinced not only fine debating skill, but a complete mastery of his subject. Mr. Philip is undoubtedly an authority on suction gas producer practice in this country. Following these profitable deliverances came the report of the "Good of the Order" Committee, which was submitted by W. A. Crockett, as follows:

(1) That only immediate past-presidents be recognized as active members at conventions.

(2) That a travelling card be issued by the Executive.

(3) That Clause 2 of the President's address be accepted.

(4) That some means of re-organizing new lodges be adopted.

(5) That it would not be advisable for subordinate associations to be allowed to elect honorary presidents.

(6) That subordinate lodges take a part in the preparation of souvenir handbooks for conventions.

Thereupon, J. M. Dixon, moved the resolution of which he gave notice the day previous: "That immediate past presidents only shall have votes and voice in future conventions of the C. A. S. E." To this R. C. Pettigrew moved the following amendment: "That full privileges of the Executive Council be granted to past presidents, with the exception of railroad expenses, and the right of election to office."

A heated discussion took place. Messrs. Wickens, Moseley and Pettigrew putting up a strong fight for their ancient privileges as past presidents. The amendment, however, upon being put to the vote, was decisively negatived, and the original motion carried; so that, henceforth, past presidents can only participate actively in the deliberations of conventions with the special consent of the duly credentialed delegates.

The afternoon of this day was spent visiting the well-known engine works of Goldie & McCulloch, also their new boiler shops, situated outside the north-east boundary of the town. (For fully illustrated description of this plant see

"The Canadian Engineer," July 1905.) A visit was also made to the new works of the Canadian McVicar Co., manufacturers of gas and gasoline engines. Others visited the works of R. McDougall Co., makers of lathes, planers, and other fine machine tools; also the new Malleable Iron Works now in process of construction.

THE NEW EXECUTIVE.

W. McGhie. E. Grandbois. C. Kelley.
J. M. Dixon. W. L. Outhwaite. J. Ironsides. W. A. Sweet.

Banquet.

In the evening at nine, a banquet was held in the Hotel Imperial, which was a decided success. The hall was handsomely decorated, the menu excellent, and choice musical selections by the Manchester quartette party enlivened the proceedings. Past-President T. Sculthorpe, of Hamilton, acted as toast master, and the following toast list was carried out:—"The King," "Galt and the Corporation," replied to by Mayor Thomson and A. G. Donaldson, secretary of the Board of Trade. The "C. A. S. E.," by J. M. Dixon and J. Ironsides. C. Moseley, by special request, spoke on the new License Bill. "Engineers of Long Ago," A. M. Wickens, of Toronto, Dr. J. Wardlaw, of Galt, and W. W. Scane, of Chatham. "Other Societies," Herbert E. Stone, Past-President of the National Association of Stationary Engineers. The gathering broke up shortly after one o'clock, with the singing of "God Save the King."

Thursday, August 9th.

The session opened with a consideration of the report of the "Good of the Order" Committee, dealing with recommendations in president's address, etc., which was adopted as a whole, with the exception of Clause 4, where it was proposed to allow subordinate lodges to elect honorary presidents.

Official Journal.

The suggestion in the Secretary's report that a monthly official journal be established, then came up for discussion, resulting in the appointment of a select committee with instructions to consider the whole question and report to the Executive, namely, W. A. Crockett, C. Kelley, A. Ames, H. H. Clarke, E. Grandbois and G. Bennett.

Election of Officers.

The following officers were elected for the ensuing year:—

President, J. Ironsides, Hamilton;
Vice-President, E. Grandbois, Chatham;
Secretary, W. L. Outhwaite, Toronto;
Treasurer, J. M. Dixon, Toronto;
Conductor, Chas. Kelley, Chatham;
Door-keeper, W. McGhie, Toronto.

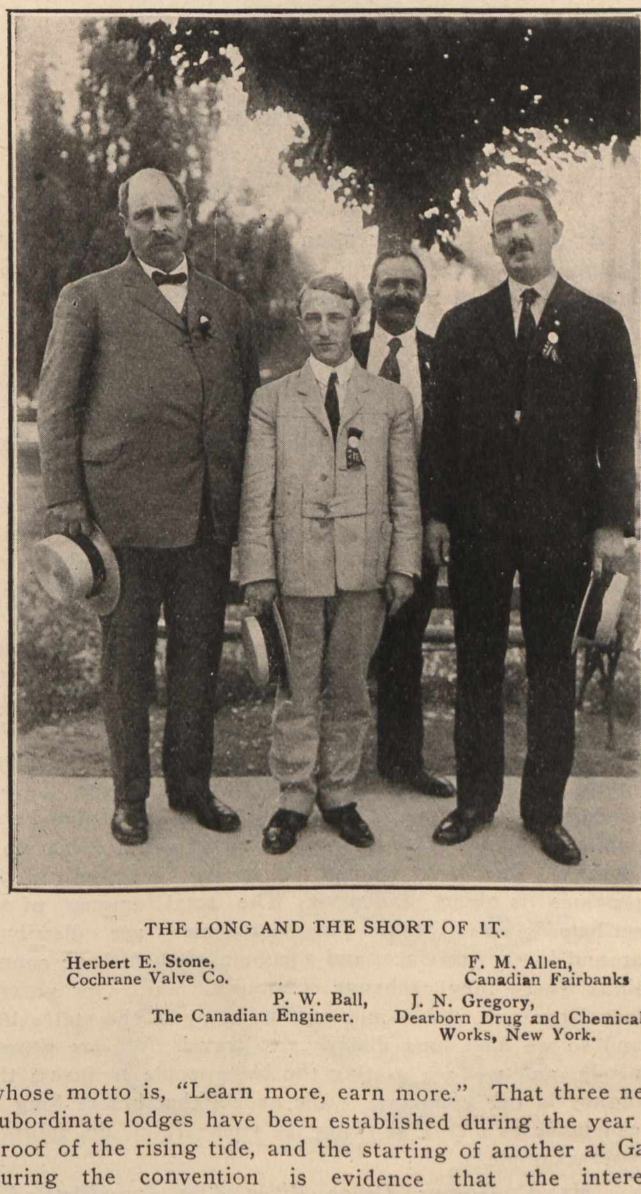
It was decided to hold the next convention in Guelph.

In the afternoon the officers were duly installed, and special valedictory and acceptation addresses delivered by the past and newly elected officers. Hearty votes of thanks were tendered to Messrs. Goldie & McCulloch and E. F. Hetherington, representing that company for their generous hospitality and entertainment; also to F. B. Utley for his ardent labors in editing the souvenir handbook of the convention and making complete arrangements for their entertainment, and thoroughly enjoyable trips to the various points of interest in Galt and vicinity. Messrs. Hetherington and Utley suitably replied. A special vote of thanks was also tendered to the technical press for attending the convention, which was responded to by P. W. Ball, of "The Canadian Engineer."

The Mayor of Galt, A. Thomson, Esq., was then called to the chair and closed the convention by presenting Past-President, W. A. Sweet, with the badge of past president. Thus ended the most successful convention ever held in connection with The Canadian Association of Stationary Engineers.

Impressions.

In some respects, the 1906 meeting of this educational organization of Stationary Engineers has been the most eventful in its history. In the first place, the enactment of the Stationary Engineers' License Bill has given new life and dignity to the engineman's craft, and we do not wonder at the Secretary's report that his letter basket pile has increased 100%; for every man desirous of holding a responsible position in connection with large power plants must now be properly qualified—personal influence and bluff will count no longer; hence, the desire to enter an organization



THE LONG AND THE SHORT OF IT.

Herbert E. Stone, Cochrane Valve Co. P. W. Ball, The Canadian Engineer. J. N. Gregory, Dearborn Drug and Chemical Works, New York. F. M. Allen, Canadian Fairbanks Co.

whose motto is, "Learn more, earn more." That three new subordinate lodges have been established during the year is proof of the rising tide, and the starting of another at Galt during the convention is evidence that the interest is unabated. (2) The meeting was not merely a convivial gathering of selfish sightseers; for the educational objects of the society were kept well to the fore. The paper of A. M. Wickens on boiler craft had many good points, as was to be expected from a man of his wide practical experience and reputation as the ablest boiler inspector in Canada. His prediction, however, that 75 per cent. of the motive power used in the lifetime of his youngest listener would be from steam, is an indication of narrowing vision. Low pressure turbines may save existing plants a while, but suction gas producers and "white coal" will largely furnish the power in new plants. And our younger enginemen will do well to get the best knowledge they can—and get it quickly, too, on these new branches of engineering. His general statement that users of electrical energy were going back to steam power was misleading. Electricity developed indirectly from black coal is a very different thing from electrical energy developed directly from "white coal," and Mr. Wickens knows it too.

In conclusion, we think the Association acted wisely in steering clear of entanglements with a certain paper having a blue cover. All well-managed trade societies run a journal of their own. After the members have formed the "Excelsior" habit they won't neglect us. In our opinion the decision to cut out their privileged caste, their irresponsible House of Lords, their ancient order of past presidents was a statesmanlike piece of work, and will have the support of all right thinking men who believe in representative government. In J. M. Dixon, the Association has a speaker, whose forensic skill, humour and eloquence would grace any assembly, and backed by able supporters, like Messrs. Fowler and Crockett, it was no wonder his plea for reform won the day. As long as the C. A. S. E. is conducted on educational lines, having as its chief aim the uplifting and betterment of the Stationary Engineers' craft, it can always count on the earnest support of "The Canadian Engineer."

INDEPENDENT TELEPHONES.

Canadians in Chicago.

At the recent Convention of the National Inter-State Telephone Association held at Chicago, June 20th to 28th, Canada was well represented, and we are indebted to the "Canadian Municipal Journal" for the following report of speeches delivered:—

Dr. J. F. Demers, of Quebec, manager of the Bellechasse, St. Maurice and Portneuf Telephone Companies, after apologizing for his inability to speak English fluently, said:

"We started in business in 1893, thirteen years ago. The start was very modest and our efforts were confined to just one county of the province up to 1900. Our company was then enlarged and up to now we have 2,750 miles of toll line construction. Our company is principally a toll line, as we wanted to cover the ground before anybody else went around to take it up. We started business in the counties where there was no connection between the lines, and then we went up between the larger cities of our province. We have about 3,000 subscribers, and the main line is a copper circuit 300 miles along the St. Lawrence River. In our province there are about twelve independent telephone companies, with a capital each invested of from $2,000 up to $350,000. The total amount of money invested in our province is about $1,000,000. The total amount of subscribers is about 7,000. The companies are distributed around in the province, and a couple of them have connections where they exchange communications. Our province is a large one, and would contain many of the states here, and so we have long distances to travel. We are growing nicely, and we are getting the best people to invest their money in our company. We expect that before long we can make as nice a showing as your states do, following your example."

Mr. A. Hoever, Green River, Ont., president of the Markham and Pickering Telephone Co.: "As president of the Canadian Independent Telephone Association, I might say a few words. I assure you it is a great pleasure for me to be here at this Convention, and to see the interest that is taken in this movement by the United States. We, in Canada, are very young, just in our infancy. Only last fall we organized an association, and we are still quite weak. However we feel that we are going ahead and have an object in view. In regard to any statistics that might be given, we have with us Mr. Wilson, the secretary of our Association. He would be in position to give you considerable information along that line if you desire to hear it. Also Mr. F. Dagger, who, I believe, was with you last year, and, I may say, was the Government expert in an enquiry that was made last year.

Mr. Wilson, secretary of the Canadian Independent Telephone Association and of the Canadian Independent Long Distance Company: "I will say Independent telephony started off at a very slow rate. The movement was entirely isolated. Last September we sent out some "feelers," and the result was so encouraging that we sent out notices for a Dominion association. At that time in Ontario we had about fifteen or twenty companies. I suppose outside of Port Arthur and a few other municipal concerns, no company had over sixty telephones. To-day, we have over sixty companies ranging from 200 to 400 each. Four hundred is a nice, easy thing to start with, and it grows rapidly. We are growing by leaps and bounds. Down in New Brunswick there were several companies that have now consolidated, with strong backing behind them. In Quebec—Dr. Demers is here; but he is altogether too modest. He told you what he was doing, but he did not tell you that down the St. Lawrence—(we consider that we are infinitely ahead of them in push and energy in Ontario)—in 1905, he put in 1,200 telephones, ten per cent. of what the Bell Company did in all Canada.

"You may know, that over Canada we have conditions that you do not have here. We haven't one single manufacturer. We haven't one expert. In spite of all obstacles, in spite of having to pay a duty, of trouble with the customs and all that, the movement has gone ahead in spite of everything. We have gone ahead in spite of the Bell Company, which, as you may know, is the third or fourth largest corporation in Canada, having its wires right up to the head sources. Before another twelve months our Independent wire will also be in similar quarters, and we can pull just as hard as they can, if I read the signs right.

"In Ontario, where we have sixty systems to-day, there was not the slightest long distance connection. About three or four months ago I was pushing government ownership. Finding that there was no prospect for government ownership, we went ahead for an Independent Long Distance Company. After six weeks in the Legislature, against every possible opposition, we got our charter. I think in three weeks we will be working, and then we will have one of the hottest fights known to the Dominion." (Applause.)

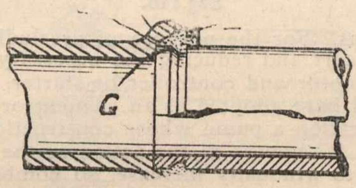
Mr. Maybury, Ingersoll, Ont.: "It is almost impossible for a man from Ontario to understand the reports that have been given by the different states of the Union at this Convention. In Ontario, as has been stated by Mr. Wilson, the situation is so entirely different. There, we have not an expert. There is nothing in the telephone business that is not the Bell. We have just organized a company in the town of Ingersoll, about 5,000 inhabitants, for the purpose of furnishing the people of that neighborhood with telephone service. The Bell people have entirely ignored the farming interests, and it became necessary for the farmers of that section to organize companies to build their own lines; but the trouble has been that in almost every town, I believe I may say in all the towns of Ontario, the Bell people have obtained exclusive privileges to install telephone services. That has become so unbearable to the people that now, where the franchises are expiring, the councils refuse to renew them, and in many towns a movement is on foot for the organization of the Independent companies. We have taken advantage of this condition and have three hundred subscribers, to start with, and we expect to be in operation before a year."

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.

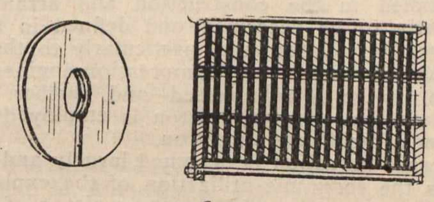
Pipe Joint. C. H. Bentley & E. H. Bentley.—97,743.—This invention is designed to provide a perfectly tight joint for earthenware and other suitable pipes. The joint is formed by a conical recess C in the pipe socket A, a seat



97,743.

D, and an internal flange or rim E at the mouth of said socket, in combination with a conical recess G in the spigot end of the pipe, so that when pipes are in position, a mitre, dovetail or arrow-head chamber is formed for the reception of a cement or other suitable filling.

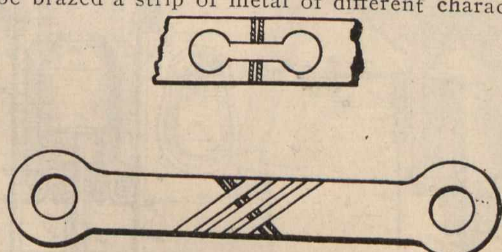
Magnet Coil.—James B. Sipe.—97,605.—This invention consists of an electro-magnet comprising a spiral coil composed of a flat strip of convolutions the flat faces of which lie in substantially parallel planes, and a series of flat pieces



97,605.

of insulating material slit from their edges toward their centres and arranged between the convolutions of the coil with their slits embracing the convolutions

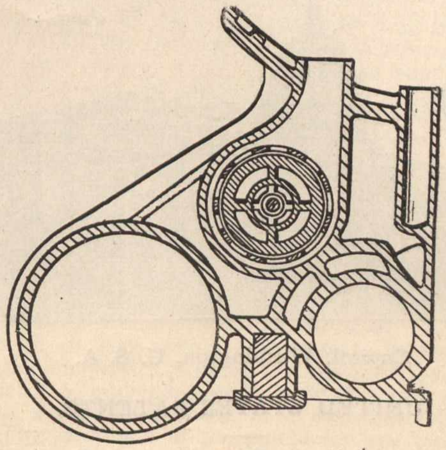
Method of Making Brazed Joints.—John F. Richardson.—97,632.—A new method of making brazed joints consisting in inserting between the adjacent surfaces of the article to be brazed a strip of metal of different character from



97,632.

the article and inserting a reinforcing piece in a recess intersecting the joint, and brazing the said strip and the said reinforcing piece in position.

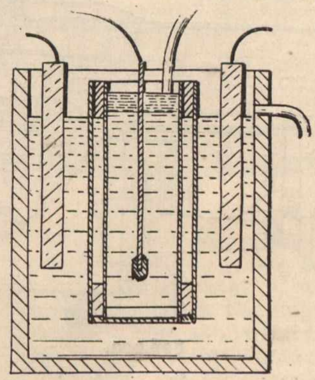
Valve for Compound Locomotives.—Francis J. Cole.—97,425.—This invention consists of a valve chest having a central supply port and end exhaust ports and common to both high and low pressure cylinders, two high pressure cylinder ports, each leading from one side of the supply port to the end of the high-pressure cylinder on the opposite side of said supply port, and low pressure cylinder ports between the high pressure cylinder ports and the exhaust ports, and a distribution valve having a central passage establishing continuous communication between the opposite end exhaust ports, a circumferential recess controlling communication between the



97,425.

supply port and one or the other of the high pressure cylinder ports, and a steam channel controlling communication between the high pressure cylinder ports and the low pressure cylinder ports, and end pistons controlling communication between the low pressure cylinder ports and the exhaust ports.

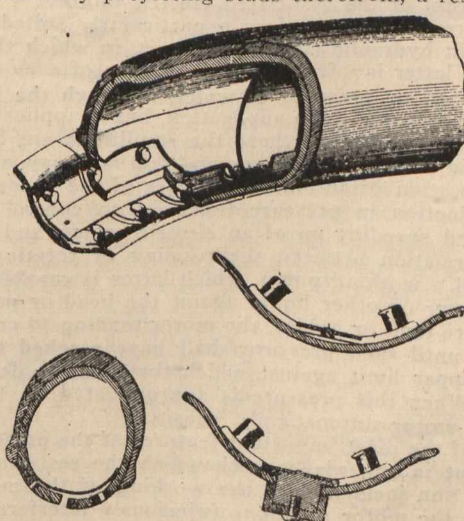
Process of Separating Metal.—Noak Victor Hybinette.—97,716.—This patent is for the process of electrically separating nickel from copper consisting in electrolyzing an alloy, circulating the solution from cathode to anode through a porous diaphragm, causing the solution surrounding the



97,716.

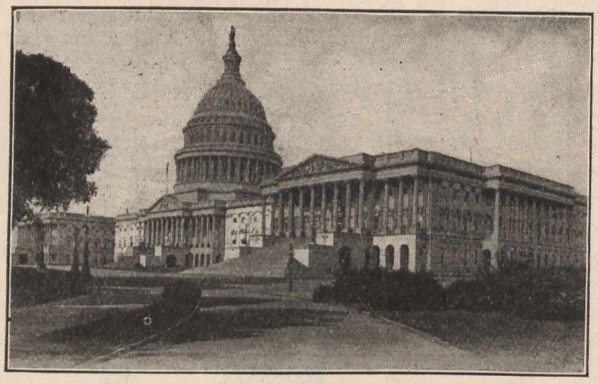
cathode to contain nickel only, the solution on the other side of the diaphragm by maintaining a pressure on the cathode side of said diaphragm and by circulating the solution from cathode to anode, regenerating the anode solution by substituting nickel for copper and returning said regenerated solution to the cathode compartment.

Automobile Tyre.—R. H. Croninger.—96,863.—A wheel rim having a concave tread surface, a metallic band extending around the periphery having transverse struts fixedly secured to said band and fitting within the rim, said struts having outwardly projecting studs therefrom, a resilient cas-



96,863.

ing having suitable eyelet holes to fit over said studs, a flap covering the point of engagement of the casing and studs and an inner tube within the said casing. The metallic band is fixedly secured to the rim in any suitable manner.



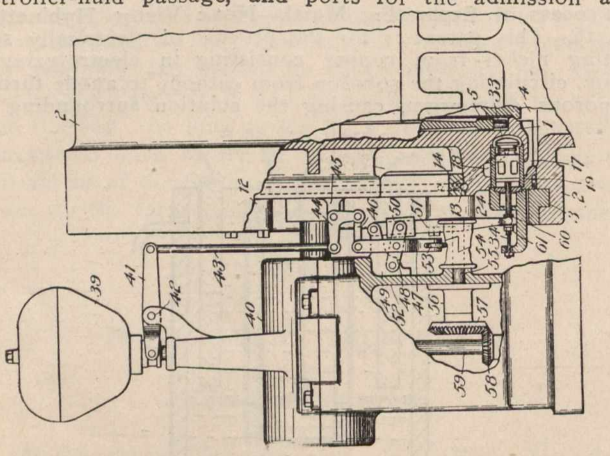
Capitol, Washington, U. S. A.

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.

Controller Mechanism for Turbines.—James Wilkinson, of Providence R. I..—826,000.—This invention relates to improvements in fluid-pressure-controller mechanism for elastic-fluid turbines.

It comprises a nozzle-passage, a shell seated above said nozzle and provided with one or more ports leading to a controller-fluid passage, and ports for the admission and



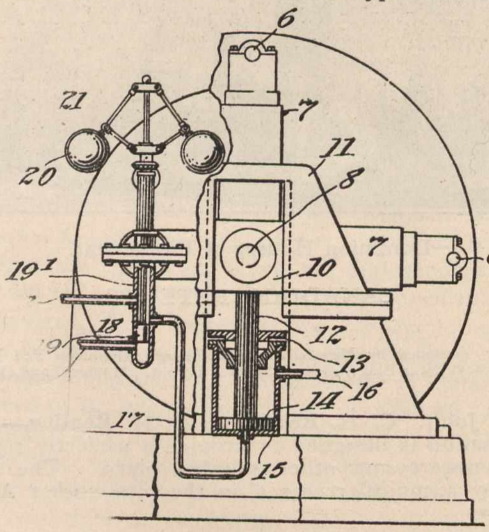
826,000.

discharge of fluid into said nozzle, in combination with a device through which the fluid-pressure, admitted to said shell, flows and is discharged as a jet with injector or ejector effect in the port or ports leading to said controller-fluid passage, said device moving responsive to speed changes and being adapted to cut off said jet fluid from said nozzle, and devices controlled by the pressure in said controller-fluid passage for varying the volume of fluid admitted to the turbine.

Electrically-Driven Pump.—Howard F. Gurney, Jersey City, N.J.—823,118.—The organization of devices constituting the subject-matter of this present invention is designed to function as an automatically-controlled electrically-driven pump adapted to deliver against a head or pressure under the driving action of the associated electric motor.

The present organization is particularly suited for employment in hydraulic elevator systems, in which the operation of the latter involves the maintenance of a more or less constant head or pressure of water, although the invention is no wise limited to such application, but is applicable under circumstances generally where the conditions are like those obtaining in such pressure systems—that is to say, as a result of the operation of automatic features of the present invention a reduction in pressure functions to control first the starting and speeding up of an electric motor, and then the operative relation between the running or rotating electric motor, and a working pump, which latter is capable of forcing the water or other liquid againt the head or pressure in the pressure tank or holder, the motor tending to continue in operation until such pressure shall have reached the maximum or upper limit against which the pump is designed to deliver. When this pressure is approximated to, the working of the motor automatically ceases.

One of the most important features of the present invention is that in accordance with which the resistance or retardant action incidental to the working of the pump is so applied to the motor as not to injuriously interfere with the rotation of the latter. The present organization of devices is therefore peculiarly applicable to use under conditions in which the motor element of the organization comprises a motor of the alternating-current type or one which is driven by single or other phased currents. Among the disadvantages attending the use of these motors for pumping against a head is that of their liability to complete stoppage or getting out of step should the load be applied too suddenly or otherwise than in a gradual manner. If started under load, moreover, they are generally characterized by high current consumption, and they require in common with direct-current motors under such conditions of starting a heavy and expensive construction, and, again, a starter or controller, whatever its construction, must be of relatively large capacity to be satisfactorily used with the various types of motor under



823,118.

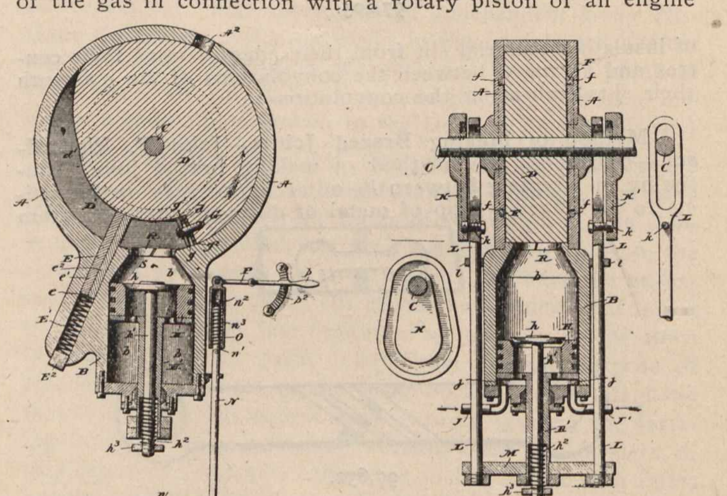
these conditions. For the purpose of precluding anv occurrences of this sort and reducing the necessary size and cost of an electric motor and controller or starter adequate for a given service, I have adopted as an element or feature of the present organization a pump whose construction is such that the load which it opposes to the action of the driving-motor may be made to gradually increase, so combining with the various features of the organization automatic devices for gradually increasing the load applied to the rotating motor after the latter has attained its proper speed.

In a general way, the present organization may be said to include a suitable electric motor, means for opening and closing the circuit or circuits of the motor, a pump of the type hereinbefore referred to, and means for (automatically preferably)increasing the resistance offered by the working thereof from zero up to the maximum load of the pump after the motor has speeded up.

Explosive Engine. Wm. W. Henderson, of Washington, D. C. 826,101.—Relating to improvements in explosive-engines; embodied in the construction and arrangement of parts presently to be described, and defined in the claims.

The invention relates more particularly to that class of explosive-engines known as "compression-engines"—that is wherein the charge is compressed—and, further, that class of engines wherein a rotary piston is employed as distinguished from a reciprocating piston.

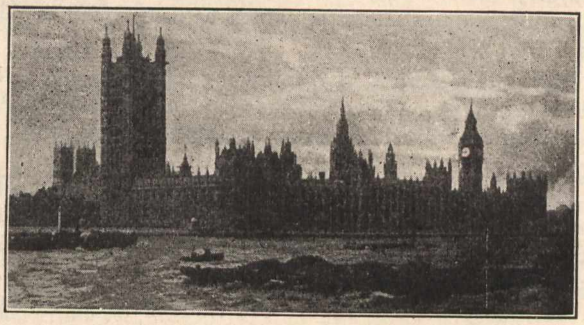
The present invention is designed largely and more particularly for the economic utilization of the explosive force of the gas in connection with a rotary piston of an engine



826,101.

or motor; and one of the principal aims of the invention is the provision of a structure embodying general mechanical simplicity with a minimum number of parts, an engine which will be effective in the utilization of substantially the major portion of the effect of the explosive charge, and, finally, an engine having provision for adjusting or varying the amount of explosive material constituting the charge.

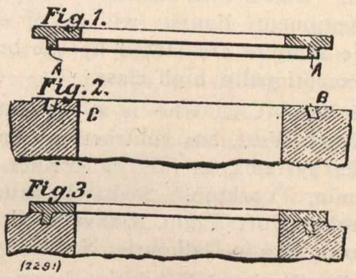
It consists of a working cylinder having a rotary piston therein and a movable abutment, of a compression-cylinder having a valveless communication with the working cylinder, and a piston in the compression cylinder for compressing the charge against the rotary piston and the abutment.



British Houses of Parliament.

GREAT BRITAIN.

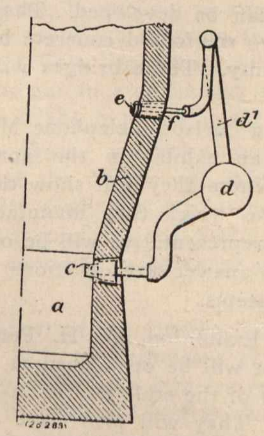
Valve Seats and Faces.—S. E. Alley, Polmadie.—2,281.—This invention has for its object to provide simple, cheap, and effective means for permanently securing valve seats and faces in position. It is applicable to many forms of valve. It may be used when the seat and face are of any material comparatively ductile. It consists essentially in forming upon the back of the valve face or seat a cylindrical web A of rectangular section, and in the valve or chamber body a parallel-sided circular groove B, the faces of which are at an angle to the axis of the valve face or seat; that is to say, the inner face of the groove is externally-conical, the



2,281.

outer face internally conical. The web upon the face or seat is then entered into the groove and is forced into it until the back of the face or seat abuts the surface of the valve or chamber made to receive it. Thus the cylindrical web is constrained to become conical within the groove and web and groove conjointly to act as a dovetail, firmly securing the valve seat or face in place. The angle of the groove necessarily depends in some measure upon the comparative ductility of the material of the seat or face, and may be varied. In the examples shown it is 15 deg. to the axis of the seat. Where material of comparatively small ductility is used radial sawdrafts may be made in the web or webs, so that it may be more readily constrained to the angle of the groove.

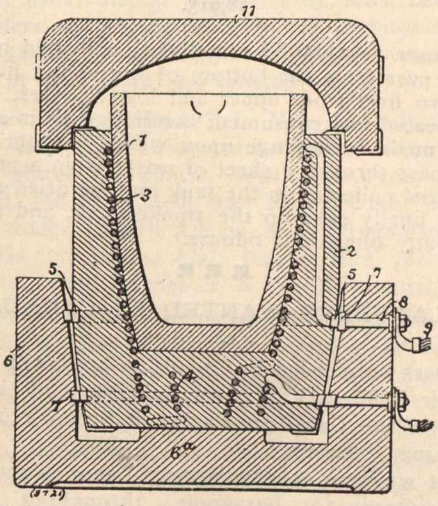
Blast-Furnaces.—Frodingham Iron and Steel Company, Limited, and M. Mannaberg, Frodingham.—26,263.—This invention relates to an improvement in blast-furnaces with a view to cleaning the bosh-walls thereof. For this purpose one or more tuyeres are arranged somewhere in the bosh-walls, with its or their nose or noses turned to the necessary



26,263.

angle to direct a blast against any obstacle that may be likely to form on the bosh-walls, the effect of which is to burn away the said obstruction and restore the furnace to its original capacity and efficiency. *a* is the furnace-hearth, *b* the bosh-wall, *c* the ordinary radial tuyeres delivering the blast into the hearth, and *d* the blast main supplying blast to the tuyeres *c*. *e* represents a tuyere arranged in a convenient position in the bosh-wall *b*, with its nose placed at an angle to cause the blast to blow tangentially into the furnace. The coolers, which are of ordinary construction, may be built into the bosh-wall at an angle as shown at *f*, in which case the tuyere *e* is made of the ordinary shape, and fits the mouth of the cooler in the manner well-understood. If desired, however, the coolers may be built into the furnace radially, as for the ordinary tuyere *c*, in which case the nose of the tuyere will be at an angle to the body thereof. The bosh tuyeres may be supplied with blast from any suitable source, but a convenient arrangement is shown in which a supplemental blast main d^1, receiving its blast from the main *d*, is connected with the tuyere *e*.

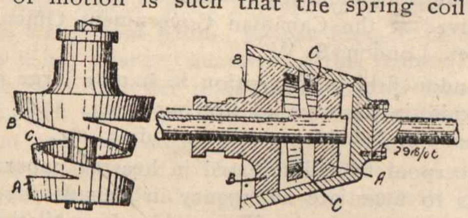
Electric Furnaces.— T. Parker, London. 5,721.—This invention relates to electric crucible furnaces, and has for its object to provide simple and effective means for heating the crucibles electrically. As is customary in such apparatus, a spiral conductor is provided within, upon, or around the crucible or furnace, within which the current is passed and a suitable ohmic resistance secured. The crucible 1 is mounted or laid within a receptacle 2, formed of non-conducting material. Around the inside of the receptacle a conductor 3 is embedded in it, a smaller coil 4 being placed in circuit under the crucible to evenly heat the same in all parts. The terminals of the conductor are brought out and



5,721.

connected to iron rings or other suitable contacts 5 on the outside of the receptacle. The receptacle 2 is placed within a base 6, which has contact rings 7, which correspond and engage with the seating rings 5, the rings being so made that a draught is allowed, and the weight of the seating and crucible tends to make a better contact. The rings 7 are joined up to the outside of the base 6 by means of bolts 8, leads 9 being connected to the bolts. The base may be provided with a seat 6a to prevent the whole of the weight of the crucible and seating falling upon the inclined contact rings. A cover 11 is provided which is clear of the crucible and rests upon the top of the seating 2.

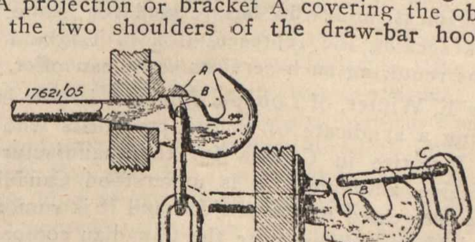
Driving Clutch.—Hare. 2,918.—On moving the spring cone towards the socket the primary clutch ring A first comes into contact towards the bottom of the socket. The direction of motion is such that the spring coil C, which



2,918.

is of smaller diameter than the remainder of the cone, contracts axially and assists the action of the clutch by drawing forward the second ring B, the relative motion between the contact giving resiliency in the application of the clutch.

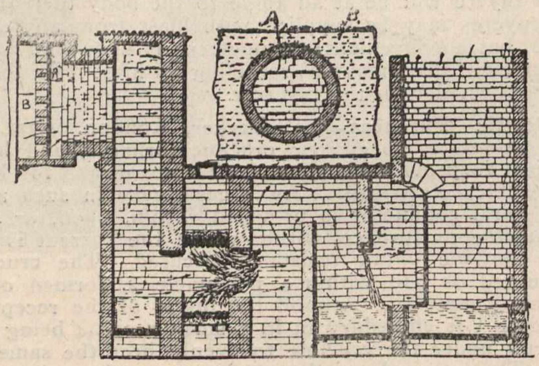
Railway Wagon and the Like Couplings.—Clegg.—17,621.—A projection or bracket A covering the oblique slot B when the two shoulders of the draw-bar hook are up



17,621.

against the face of the draw-bar plate, and thus prevents the coupling chain C from being removed without the use of a special appliance.

Consumption of the Smoke and fumes from refuse-destroying furnaces and the like.—Fairbrother (Decarie Manufacturing Co.).—18,915.—The vapours and gases from the combustion chamber are broken up by the tiles A in the preliminary chamber B. They are deflected by the wall, and pass downward, striking the surface of the water in the tank



18,915.

at the bottom. Any solid material is collected in the tank. The gases pass from the bottom of the diving flue and pass through two fires from upper and lower grates, where they are superheated and consumed; continuing their course, they are again made to impinge upon water in other tanks, and they also pass through a sheet of water from a pipe C. Any solid material collected in the tank may be dried and burned. The gases finally pass up the smoke-stack, and are entirely free from any obnoxious odours.

LABORERS WANTED IN CANADA.

Laborers are needed in Canada as well as in the United States. Sir William Van Horne, chairman of the board of directors of the Canadian Pacific Railroad, recently made the following statement:

"What we want is population. Labor is required from the Arctic Ocean to Patagonia, throughout North and South America, but the Governments of other lands are not such idiots as we are in the matter of restricting immigration. Let them all come in. There is work for all. Every two or three men that come into Canada and do a day's work create new work for someone else to do. They are like a new dollar. Hand it out from the bank and it turns itself in value a dozen or more times in a year. I quite believe that within a year Canada will be in a very serious condition as a result of not having sufficient labor."

INDUSTRIAL NOTES.

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

A London firm in a position to handle large quantities of chemicals, is desirous of hearing from any Canadian house who may be able to export iodine, etc.

A Liverpool firm, interested in heating apparatus, &c., is anxious to negotiate an agency in Canada for the suitable representation there of a system of ventilation.

A London firm is desirous of getting into touch with merchants or mine owners in Canada who may be wishing to dispose of their products. Antimony ores, &c., would be purchased if quantities available.

A London agent possessing a knowledge of the engineering business, and who has resided for some time in Canada, is seeking the representation in England of Canadian firms requiring such services as he can offer.

Harry E. Winter, of London, England, is now in Canada representing a syndicate of British capitalists who propose erecting factories in Canada for the manufacture of the new explosive, ammonal. It is understood Canadian capital will be interested in the project, and it is rumored Mackenzie and Mann will promote the Canadian company about to be organized.

Toronto.

James Wilson has been appointed assistant car distributor for the C. P. R. at the Union Station.

Harry Maisonville, secretary to Hon. Dr. Reaume, has left on his summer vacation, which he will spend in Algonquin Park.

During September the following conventions will be held in Toronto: Canadian Independent Telephone Association; International Railway Maintenance of Way Employees.

Messrs. R. J. Cluff & Company have just erected a large warehouse on Lombard Street, where they will carry a large stock of steam-heating boilers, radiators, and steam-fitters supplies.

Machinery brokers report the trade here as exceptionally good for this time of year, one firm stating that they never had so many orders on hand at one time as they have at present.

The dredge "J. Israel Tarte," which sank in Lake Ontario just a few miles from Port Hope, about two years ago, is to be raised to the surface, and put into service by the Polson Iron Works, Limited, in the near future.

The Canadian General Electric Company and the Canada Foundry Company will be at their regular stand in Machinery Hall, where they will show samples of their boiler, pump, air compressor, and structural work.

F. B. Mosure is to make a collection of mineral samples from the Cobalt region for the Industrial Exhibition. The collection, which will include samples of the ore from the Government limits, will be of a very valuable nature, and the samples are stated by the bureau of mines to be of an exceptionally high class.

Willis Chipman, C.E., who is at present looking after work in the North-West, has contracts on hand for sewage and waterworks systems, as follows: Prince Albert, Saskatoon, Moosomin, Yorkton, Saskatchewan; Portage la Prairie, Manitoba; Port Elgin, Oakville, Gravenhurst, and Steelton, Ontario; also in Dalhousie, N. B.

The Canadian National Exhibition boasts $150,000 worth of new buildings this year, the principal of which is a fine Process Building, in which a score of industries will be seen at work. The buildings on the Exhibition grounds are valued at between $1,200,000 and $1,500,000. No other annual exhibition on the American continent possesses the same accommodation.

The W. L. Miller Heating Company, of Chicago, have commenced installing the heating and washout systems in the C. P. R. shops at Toronto Junction. The Canadian Fairbanks Company having received the contract for the material. Engineers interested in gas and gasoline engines should not fail to see this company's exhibit at the Canadian Industrial Exhibition.

Messrs. Connor, Clarke and Monds are now engaged in making a report on a hydro-electric power plant at Healey Falls, for the Northumberland and Durham Power Company. According to the Hydro-Electric Commission's report 8,000 H.P. can be developed. They are also getting out designs for two reinforced concrete bridges to be erected in Simcoe County. These bridges will be about 335'-0" long.

The Stromberg-Carlson Telephone Manufacturing Company will have an exhibit in the north-east corner of Machinery Hall, where they will show the various kinds of telephone apparatus which they manufacture. Jas. S. Gibson, the Toronto representative will be on the grounds, and will be pleased to answer any questions regarding independent telephone systems.

During the Exhibition W. H. Petrie's warehouse on Front Street West will be open until 11 o'clock every evening, and members of the staff will be in attendance to show visitors through. They will also have an exhibit in Machinery Hall at the Exhibition itself. One of the special features will be an extra heavy lathe, which will be in operation one hour daily; other iron and wood-working machinery will also be in operation throughout each day.

General.

There is a large demand for labor at Klondike, on the Yukon, owing to the total exclusion of Chinese from the region.

The town of Napanee is installing a Smart-Turner independent jet condenser and duplex boiler feed pump in their electric light plant.

Cartledge's Woolen Mills, Guelph, Ontario, were destroyed by fire on August 9th. The fire was one of the largest Guelph has had in many years.

The Canadian Independent Telephone Association will hold a day convention in Toronto on September 5, when it is expected about 100 delegates will be present.

The Smart-Turner Machine Co., Limited, Hamilton, have received an order from The Amherst Malleable Iron Works, Amherst, N. S., for ten tumbling barrels.

Niagara Falls, Ont., has been chosen for the site of the new plant of the Canadian Ethinite Company, Limited.

Ethinite is a substance possessing properties similar to calcium carbide. The company has entered into a long-term contract with the Ontario Power Company for 6,000 electrical horse power.

His company will build a railway from an Alaskan coast point not yet selected to the copper fields a hundred miles inland. He denies the report that his company has bought the N. A. T. river fleet.

Dewar's saw mill, at St. John, N. B., owned by the St. George Pulp and Paper Co., was destroyed by fire Thursday night, August 2nd. The loss of sawn lumber alone is $45,000 and the mill is valued at $5,000.

The Smart-Turner Machine Co., Limited Hamilton, have received an order from the corporation of Port Elgin for their waterworks pumps, consisting of compound duplex pumping engine, boiler feed pumps, piping, etc.

Century Telephone Construction Company, Buffalo, N. Y., report the closing of contracts on magnetic switchboards for Cortland, Lodi, Belmont, Brookton, Berkshire, Orchard Park, Canaseraga, Lisle, Interlaken, Caywood, N. Y., Russell, Pa.

As telephone experts and having had a long experience in the equipment of local and long-distance telephones, the Mechanics' Supply Co., Quebec, are in a position to give their customers the benefit of the same. They are willing to send their catalogues to interested parties.

The Calgary Cement Company's plant, which had just commenced operations and which was situated about a mile out of the city, was destroyed by fire recently. The buildings and machinery cost the company $350,000. The insurance is only $38,000. Nothing is left intact except the engine house.

Armstrong Bros. Tool Co., of Chicago, have just shipped two orders received recently from the Isthmian Canal Commission, aggregating almost one thousand Armstrong tool-holders, many heavy sizes being included. They have also received recently an order for universal ratchets for use in the Canal Zone.

The Grand Valley Radial Company, whose headquarters are in Brantford, is anxious to run its cars into Galt on Sundays. At present the cars run from here to a point on the outskirts of Galt. An effort will be made to have the question of the entrance on Sunday submitted to a vote of the ratepayers at the next municipal election.

Daniel Guggenheim, executive head of Guggenheim Sons, declares that the Yukon and Alaska are an empire without people. He predicts a marvel us future. His company has experts throughout the Yukon basin and Alaska. He says he will continue to purchase what looks to be a safe investment.

The annual report of the Ottawa Car Company for the year ending June 30th, 1906, shows a gratifying increase in business, including orders for street cars from the Atlantic to the Pacific. The company begins the current year with unfilled orders on hand aggregating over $500,000. At a meeting of the directors, the following officers were elected: Mr. T. Ahearn, president; Mr. W. W. Wylie, vice-president; Mr. James D. Fraser, secretary-treasurer.

Because the experimental plant of the Cobalt Refining Company is giving satisfactory results, arrangements are being made for the construction of a plant which will cover almost five acres. The new plant, if the present scheme is carried out, will be erected on the ground immediately adjoining the experimental plant on Hamilton avenue. General plans for the new plant have already been prepared, but further information will have to be secured before definite plans can be drawn. Work on the new plant will be started some time during the coming winter.

Two thousand men are now at work on the section of the Grand Trunk Pacific Railway lying between Quebec and La Tuque, and on the M. P. Davis subcontract, running 50 miles west from the Quebec bridge. Work is going on upon every mile of the location, including the construction of the lofty stone piers to carry the steel superstructure of 3,800 feet in length over the valley of the Cap Rouge. This latter work will be finished and ready for the steel in a few weeks.

United States.

We are pleased to announce that the Buffalo Steel Company's plant, after having been closed down a short time time ago for two weeks, is now in full operation again. Aside from usual annual repairs, they have installed additional boilers and engine capacity, and automatic hot beds. They are making a specialty of steel for concrete reinforcement, in both plain and twisted bars.

The Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y., reports having closed contracts for switchboards at the following places: Palouse, Wash.; Georgetown, S. C.; Cumberland, Md.; Goldfield, Ia.; Provo, Utah; Morton, N. Y.; Parma, Idaho; North Adams, Mich.; Indianapolis, Ind.; Moultrie, Ga.; Oakman, Ala.; Newtonville, Mass.; Clyde, Ohio; Logan Utah; Rochester, N. Y.; Newcastle, Ky.

The Lunkenheimer Company, Cincinnati, Ohio, held its annual picnic on July 28th. This picnic is tendered to all the employees of the company, together with their families, and was held at Woodsdale Island, a pleasure resort about thirty miles from Cincinnati. The company furnishes all amusements, refreshments and transportation free of charge to the employees. Two bands of music were in attendance, together with a troup of professional entertainers. Two trains of ten cars each conveyed 2,500 people to the picnic grounds, and the day was pronounced a complete success.

The Stevens-Hewitt Engineering Co., of New York, has been retained as engineers for the development of a large water power on the Susquehanna River at Colliers, N.Y. The concrete-steel dam, 35 ft. high and 300 ft. long, together with the concrete-steel canal wall about 600 ft. long, will be designed and built under the supervision of the Ambursen Hydraulic Construction Co., of Boston. Work has already been commenced in stripping the foundations. This is the third dam which the Ambursen Company has supplied to the Stevens-Hewitt Engineering Company within the last three years.

The new Voltax liquid compound is being extensively used as a waterproof paint. Caspar Ranger, of Springfield, Mass., is using a large quantity of this material for painting stone work in order to prevent moisture from sweating through. This compound has been similarly used as a paint for steam and cold water pipes, as it has proven to be a preventive of moisture. The manufacturers of this material, the Electric Cable Company, of 17 Battery Place, New York, state that the Voltax liquid compound is being extensively used as a paint for furnace doors and stacks on which it has been found to withstand an exceedingly high temeperature.

Link-Belt Company. This is the new name of the firm comprising the Link-Belt Machinery Company of Chicago, the Link-Belt Engineering Company of Philadelphia and the Ewart Manufacturing Company, Indianapolis.. The Chicago concern, which was established in 1880 and opened a branch office in New York in 1882, has bought both of its associate companies. The Philadelphia firm was organized in 1888 and took over the eastern territory of the Link-Belt Machinery Co., and has continued in the manufacture of the same kind of conveying machinery. Both concerns, however,secured chains from the Ewart Manufacturng Company of Indianapolis, which has all along confined itself to its manufacture, the original "Ewart" detachable link-belting being one of its principal lines. The plants will be operated at their present locations, which gives to the new company three splendid equipments.

MARINE NEWS.

The C. P. R. Atlantic "Empresses" continue to make record time and to attract attention.

The steamer "Erindale," belonging to the North Shore Transportation Company, was burned to the water's edge on August 9th, at Newcastle. The "Erindale" was a well-known passenger boat, plying between Toronto and Whitby, Oshawa and Newcastle. It was valued at $27,000.

The Canadian Government learns that negotiations looking to the establishment of a steamship service on the Pacific between Canada and Mexico are under way. They are being conducted directly with the Mexican Government by the steamship company concerned, and, it is said, with a reasonable prospect of success.

The Collingwood Shipbuilding Company closed a contract recently with the Farrar Transportation Company of Collingwood to build a large steel freight steamer of the new arch system type of construction. The size of the ship will be 406'-0" long, 50'-0" beam and 28'-0" deep, built to the highest classification of the great lake register, and to their specifications.

The Canadian Shipbuilding Company has secured the order for the construction of the large new steamer for the Hamilton Steamboat Company, and work will be begun as soon as plans can be completed and approved of. The company hopes to have the new boat ready to go on the route on the first of May next. She will have a capacity of 2,000 passengers, and will be fast and safe.

A syndicate of lake capitalists, one of whom resides in Duluth, is planning the construction of a boat that not only will be the largest freighter on the lakes but will be unsinkable. The size of the vessel is to be not less than 650'-0". Such a vessel would carry 15,000 to 17,000 net tons cargo, and would be the largest exclusively freight carrier in the world. The cost of the vessel would be about $600,000 at the present prices of steel.

The "Cayuga," the latest addition to the fleet of the Niagara Navigation Company, made what may be regarded as her initial trip on August 15th, and the result is said to have given the management the greatest satisfaction. The "Cayuga" left the northern dock between 9 and 10 o'clock in the morning with the directors and representatives of the shipbuilding company on board, running up as far as Port Credit and returning to Gibraltar Light, from where the course was shaped to Braddock's Point, a short distance out from Charlotte. The distance covered was eighty-four miles, and the average speed maintained was between twenty-one and twenty-two miles an hour. A description of the "Cayuga" will be found on page 125 of the April number of "The Canadian Engineer."

RAILWAY NOTES.

The James Bay Railway has changed its name to the Canadian Northern Ontario Railway.

The work of erecting a Grand Trunk Pacific track-laying machine at Fort William has been completed and everything is in readiness for the laying of steel on the Lake Superior branch.

The Canadian Pacific has ordered sixty passenger cars at a cost of $400,000; 2,000 freight cars at a cost of $1,000,000, and other cars to cost $600,000. The cars will be built at the Angus shops.

The city council of Edmonton has authorized the signing of an agreement to pay the G. T. P. Railway Company a bonus of $100,000 to establish their workshops and terminals within three miles of the centre of the city.

The C. P. R. has decided to build a good-sized, modern station at Orangeville in place of the one burned down some time ago. Plans for the station are now being prepared at Montreal by the company's architects.

An agreement has been entered into between the city of Saskatoon and the C. P. R. regarding the entrance of that road into the city from the east.

The directors of the Prince Albert and North Saskatchewan Railway Company, which was incorporated at the last session of Parliament with power to build a line from Prince Albert to the Pas Mission have decided to apply to the Government to guarantee bonds, with the intention of proceeding with the construction as soon as possible.

It is rumored on what seems to be good authority that the C. P. R. has decided to have a connection with the Temiskaming & Northern Ontario Railway at North Bay, and also with its own line into that territory, and so has determined to construct another branch line into North Bay from Parry Sound, by as direct a route as it is possible to follow.

The work of grading for the Brantford and Hamilton Railway has been started, and will likely be finished by January 1 next. The contracts were let July 28. F. H. Dickenson, of Hamilton, and Nicholson, Riley & Co., St. Catharines, both tendered for the whole job, but the company decided to divide the work so that it could be rushed through.

The Toronto Street Railway Company has decided not to bring any more steel rails from England, but to have them made in the United States. The reason for this is that the company frequently has to wait several months before procuring rails from British manufacturers, who turn out a different type of rail for home use, and delay getting out the orders for Toronto.

A deal has been completed whereby the Detroit United Railway Company will acquire the Windsor and Tecumseth Electric Railway of Ontario. Surveyors in the employ of the Detroit company are now engaged in looking over the line. The franchise will probably be purchased outright. Manager Anderson, representing the Windsor interests of the Detroit company, says cars may be running in three months.

The contracts for the construction of the Brantford and Hamilton Electric Railway have been awarded. Electrical supplies will be furnished by the Canadian Westinghouse Company, of Hamilton. The railway company has opened offices in the Chancery Chambers and the following officers have been appointed: I. K. Pierson, chief engineer; Elmer T. Haines, secretary; J. W. Nesbitt, solicitor, and Miss Agnes Geddes, treasurer.

A railway to Belle Isle and thence by tunnel under the straits and across to Newfoundland is a project which is now receiving considerable attention, in fact, negotiations are said to be in progress between certain well-known and financially strong English concerns, interested, along with the Government of Newfoundland, in the development of the timber and other resources of the Labrador regions and of Newfoundland, on the one hand, and the Quebec and Lake St. John Railway on the other.

It is stated that Grand Trunk Pacific engineers, working on the new pass through the mountains give a very satisfactory account of the possibilities of railway construction along the proposed line. It is said that the grades will not be unusually heavy, and that an excellent line can be constructed at moderate cost. The Yellow Head Pass and the Pine River Pass are also both being examined, and it is not yet possible to form a definite opinion as to the route which the railway will decide to take across the mountains.

To build a narrow-gauge railroad from Juneau, Alaska, to Douglas City, crossing Gastineau channel at Salmon Creek, and thence down the east shore of Douglas Island, is the undertaking of the Alaska Southern Railroad, according to plans announced by S. D. Chittenden, president and general manager of the company, says the Seattle "Times." The road will be 12 miles in length, to cost $10,000 per mile, making a total financial output for the entire line of $120,000. Bids for the contracts to furnish material for the road have been issued, and it is expected steps toward actual work will soon be taken.

Over two thousand men are now employed on the Grand Trunk Pacific section under construction from Quebec to La Tuque. Just as soon as the harvest season is over the contractors expect to obtain the services of one thousand more men.

The Transcontinental Railway Commission opened tenders for about a dozen bridges on the line of the Transcontinental Railway from Quebec to La Tuque. Accompanying the tenders are plans and commissions. The engineers will have to examine and report upon these before the contracts are awarded.

MINING MATTERS.

The mines at Coal Creek, in the Crow's Nest Pass, are now beginning to show the result of recent development. The output is soaring away up, the record day being June 24th, when the output was 2,184 tons.

A telegram, dated August 16th, from the manager of the Montreal Cobalt Co., at Cobalt, states that the company's workers have struck gold in their operations and that the vein would yield at least $1,000 per ton.

Coal has been discovered within a few miles of this town between the Saskatchewan and Battleford Rivers. The coal is of good quality, and the finder, who is an old prospector, claims that there is lots of it.

E. Jacobs, editor of the B. S. "Mining Record," after having spent a fortnight in the boundary and Rossland states that in both camps there is general satisfaction with the mining outlook, and important development and additions to plant and machinery are being made, with the object of considerably increasing the production of ore.

O. Baker, of Sarnia, Ont., who has had experience in Yukon and in British Columbia mining districts, has found free gold 21'-0" down in vein of decomposed calcite, one foot in width, along the hill of contact between Keewatin and Diabaz. The discovery was made one and a half miles southwest of Cobalt.

The mines branch of the Department of the Interior, which after the next session will be placed under the control of Hon. William Templeman as Minister of Mines, will shortly move from the Slater block on Sparks street to the Thistle building on Wellington street, Ottawa, where it will occupy three flats instead of one as at present.

Mr. T. W. Gibson, Deputy Minister of Lands and Mines, has received from Prof. W. G. Miller samples of ore taken from the recently discovered vein on the Gillies timber limit. They are very rich in silver ore, also in cobalt. One of the smaller samples appears to be of solid silver. Another sample is of silver sulphide, and is rich in cobalt and nickle.

Numerous letters from Quatsino say the biggest strike of bog iron in British Columbia has just been made to the north of West Arm, Quatsino Sound. Messrs. Jacobson and Jackson are now locating the property, and report that the area is immense, and that the iron body on the West Arm on which development work has already been done is only a spot compared with the extent of the new find.

The latest mineral find to be added to the Province of Quebec's already long list of economic ores is red hematite. This metal has been discovered in the southern part of the Province, near Dunham, and mines are already being opened up. The belt in which the mineral appears most freely is about eight miles long, and consists of a strip of land encircling the base of the Little Pinnacle Mountain.

The gold fields of Western Ontario have interested more capitalists this year than for a long time. During the summer several parties from the East have arrived at Port Arthur bound for the western portion of the Province to look over mineral lands in which they are interested. At the head of two of these parties has been A. McLaren, of Detroit, who is perhaps one of the firmest believers in the possibilities of the gold fields of New Ontario than any other man. He recently brought up a large party of Americans to look over propositions in the Manitou country.

A strike made on the 850-foot level of the White Bear, Rossland, is the most important that has yet been made in that time. During the past week 80 tons of ore have been shipped to the Granby smelter and 50 tons to Trail. This ore is all from the newly found chute. The chute is 14 feet wide, of which at least seven feet is solid ore, carrying lots of copper. The chute has been drifted on for 30 feet, and is strong and well defined in the breast of the drift. The drift is to be continued for the purpose of determining its length. An upraise is being made from the 1,000-foot level for the purpose of intersecting this chute and also to determine how far it runs down below the 850-foot level. The ore runs from $20 to $25 per ton. In another place on the 850-foot level a chute of ore from three to six feet has been encountered. This is also an important strike, as the ore is of good grade.

Thomas Kiddie, the expert smelter manager, who has been living in Victoria for some months, has taken the management of the Hadley smelter on Prince of Wales Island. The works have a capacity of 400 tons a day, and with the development which is taking place in the north at present it is more than probable that increases to the plant will have to be made.

PERSONAL

H. K. Dutcher, M. Sc., Lecturer in Civil Engineering at McGill University, is about to take charge of the Engineering Department of the new McGill University College of British Columbia.

Chas. H. Mitchell, C. E., of Niagara Falls, Ont., late Engineer of the Ontario Power Company, has just returned from an eight months' tour of Europe. His purpose in making the trip was to inspect the various hydro-electrical developments on the continent.

P. W. Sothmann, late consulting engineer of New York City, has been appointed chief engineer of the Hydro-Electric Commission of Ontario. He is 36 years of age, and is a graduate of Charlottenburg Institute of Technology, Germany—1891.

The Canadian Engineer" acknowledges a call from J. G. Kerr, M.A., LL.D., headmaster of the ancient and important Allan Glen's School, in affiliation with the Glasgow and West of Scotland Technical College. Dr. Glen's errand is to investigate educational methods in Canada, in doing which he has spent some time in Montreal, Winnipeg and Toronto. "I have seen just enough of Canada," said the Doctor, "to make me wish to see more of it."

H. C. Philpott, who has been for several years Sales Agent for the Canada Foundry Company and the Canadian General Electric Company, of which Frederic Nicholls is Vice-President and General Manager, has resigned to accept a position with the Dominion Steel Car Co. and the Simplex Railway Appliance Co. Mr. Philpott's position with the Dominion Steel Car Co. will be that of General Sales Agent, and his headquarters will be at Montreal, although his residence for the present will continue to be in Toronto.

Mr. Philpott is well-known and is held in high esteem in business and railway circles throughout Canada.

Among the birthday honors which have fallen to various people in North Britain last month is the conferring of a Knighthood upon William Robertson Copland, C. E., of the city of Glasgow. It is an honor well deserved, for Sir William has worthily established himself in the regard of his fellow citizens by his public-spirited career. For nearly forty years a busy man in his profession, in which he attained distinction throughout the British Islands, he has found time to do valuable work as Deacon Convener of the Trades House, and ex-officio a member of the Town Council. But his most distinguished service to Glasgow has undoubtedly been rendered in his capacity as chairman of the Board of Management of the Glasgow Technical College. For the creation of this great institution, which will rival any either here or in the old country, he has literally worked night and day, and it is said that something like £100,000 sterling of the endowment fund of that splendid institution has been collected by Sir William's own hands from merchants, manufacturers and the gentry of the West of Scotland.

Mr. Graham Drinkwater, head of the pneumatic department of the Canada Foundry Company, has resigned, and leaves September 1st.

Mr. Doutre, of the Transcontinental Railway Commission, has been appointed superintendent of the Marconi Service, in the Canadian Department of Marine.

John Edward Touche, heretofore called and known by the name of John Edward Touch of Throgmorton House, 15 Copthall Avenue, London, E. C., has given notice of the change in his name, as aforesaid.

It has been decided to send Frank W. Barron, and James Bannon to the Milwaukee Convention of the International Union of Steam Engineers. The convention will be held on September 9th. There will be 338 delegates, representing 40,000 engineers in Canada and the United States.

MUNICIPAL WORKS, ETC.

Gravenhurst has just passed two by-laws; one to spend $48,000 to instal a system of waterworks, and the other $60,000 for a power plant.

St. Mary's has an opportunity to secure railway competition by voting a $400,000 loan to the St. Mary's and Western Ontario Railway.

Electricians from many parts of the country, and several from Canada, gathered in New Haven to attend the convention of the International Association of Municipal Electricians.

A $50,000 by-law to install a system of waterworks and electric light was carried by the property-owners of Oakville recently by an over-whelming majority. This means a big boom in the building trade for Oakville.

The programme for the annual meeting of the American League of Municipalities in Chicago, on September 26, includes an open discussion of municipal ownership with Mayors Coatsworth, of Toronto, Dunn, of Chicago, Adam, of Buffalo, and others as speakers.

Regina, Sask., is determined to have a street railway. Mr. W. A. Hill, who is a strong supporter of the applicants for a charter to build a street railway plant, was at one time in favor of a municipal-owned plant, but he now strongly favors a company to build and operate a road.

At the last meeting of the Water Commissioners of London a motion was made by Commissioner Saunders that the resignation of Engineer Moore be asked for, on the ground that he had not exhibited the proper amount of energy in the direction of improving the water supply, which is very low at present.

The report of the Guelph Street Railway directors for the nine months ending June 30 show a net gain over current expenses of $4,066. After paying out $4,000 in maintenance charges, which provided for depreciation, the estimated profit for the three summer months is $1,500 to $2,000 more, making 6% in all on the capital invested.

The Public Works Department has prepared plans for a new stone front to Government House, Ottawa, and will shortly invite tenders for the work. The intention is to provide a new entrance, with accommodation also for guests at the balls, receptions, etc. The design is most attractive and will give a much more dignified appearance to the vice-regal residence.

TELEGRAPH AND TELEPHONE

The Department of Marine has decided to increase its wireless telegraphic facilities. The Cape Race station, which now speaks ships 90 miles distant from Newfoundland, will be made a high power station with a radius of 210 miles. Contracts have been let for a wireless station at Father Point, and another at Seven Islands.

Experiments have begun at Lake Constance with a submarine telephone constructed under Professor Pupin's system. The cable is about seven miles long and reaches a maximum depth of 820 feet. It was laid by the Sieman-Halske Company for the Bavarian, Wurtembergian and Swiss Telegraph Departments.

Port Arthur is to have a station of the Dominion De-Forrest system of wireless telegraphy.

NEW INCORPORATIONS.

Ontario.—The Canadian Steel Post and Fence Co., Toronto, $40,000. C. S. King, W. E. Black, J. Sanders, S. Weller, E. Boissnier, Windsor, Ont.

Boston Mines, Toronto, $50,000. F. Rielly, G. Verney, J. Ross, E. E. Wallace, A. R. Clute, Toronto.

Model Paint Co., Toronto, $40,000. H. Isaacs, Thornbury; G. H. Fairles, J. Waring, J. Hill, G. Stretton, Toronto.

Niagara District Telephone Co., Jordan, $10,000. C. Wismer, A. Culp, A. Troup, Louth; A. Moyer, E. Werner, Clinton.

The Multi Scale Co., Guelph, $40,000. H. Wright, G. Henderson, D. Anderson, D. Bailey, W. Wright, G. Taylor, Guelph, Ont.

Perth Bolt and Forging Co., Perth, $50,000. J. A. Stewart, A. E. Hanna, A. W. Dwyre, W. B. Hart, J. H. Mendels, N. B. Nicoll, G. R. W. Rogers, M. Dremnan, C. J. Sewell, F. A. Lambert, Perth.

Dominion.—Monarch Motor Co., Montreal, $250,000. L. D. Robertson, J. S. MacKenzie, J. F. Warrington, J. A. Mousseau, W. F. Gingras, Montreal, Que.

The Renwick Co., Toronto, $40,000. A. W. Mackenzie, D. B. Hanna, L. W. Mitchell, G. S. Ruel, G. F. Macdonnell, Toronto.

Sydney Steamship Co., Sydney, $40,000. R. Harrington, J. A. Young, H. C. Harrington, H. W. Black, H. Ross, Sydney, N. S.

St. Canut Lumber, Light and Power Co., St. Canut, $250,000. J. A. D. Sabourin, E. F. Surveyor, J. N. Weldon, S. J. Le Huray, Montreal; J. Cyr, St. Canut, Que.

Desmarteau Plumbers Supply Co., Montreal, $195,000. J. A. Desmarteau, H. Hebert, P. Bila-deau, H. Hamel, Montreal; J. B. Robert, Ste. Scholastique, Que.

Ambursen Hydraulic Construction Co., of Canada, Montreal, $100,000. D. S. Walker, R. S. Lea, E. Bradley, Montreal; W. L. Church, Newton, Mass.; C. H. Eglu, Brookline, Mass.

The Saunderson Manufacturing Co., Sydney, C. B., $45,000. A. E. Collas, A. A. Saunderson, A. L. Melvin, R. E. Harris, H. B. Stairs, Halifax, N. S.

St. Lawrence Canadian Navigation Co., Montreal, $1,000,000. W. Paul, L. Lacouture, J. Jean, C. Robitaille, N. W. Tanguay, Montreal.

Grand Trunk Pacific Town and Development Co., Montreal, $5,000,000. C. M. Hays, F. W. Morse, W. Wainwright, W. H. Biggar, D. Tate, Montreal.

Coleraine Asbestos and Exploration Co., Coleraine, Que., $50,000. W. J. Henderson, A. W. G. Macalister, J. Rockwell, J. Jenkins, C. T. Jetté, Montreal.

The Dominion Portland Cement Co., Montreal, $1,000,000. H. Domville, J. H. Redpath, H. E. Borradaille, H. N. Chauvin, Montreal; C. A. Duclos, Westmount, Que.

The Beauharnois Navigation Co., Beauharnois, Que., $20,000. L. J. Primeau, C. A. Carter, Montreal; A. Hebert, F. Hebert, J. A. A. Desrochers, Beauharnois; A. Bazin, Montreal.

The St. Lawrence and Great Lakes Dredging and Wrecking Co., Montreal, $350,000. H. W. Prendergast, Montreal; J. E. Russell, W. J. McWhinney, E. P. Brown, J. F. Lennox, Toronto.

Manitoba.—The J. McDiarmid Co., Winnipeg, $150,000. J. McDiarmid, E. Cass, Jno. McDiarmid, P. McDiarmid, P. Muir, T. Borgford, Winnipeg.

Consolidated Elevator Company, Winnipeg, Man., $400,000. A. Reid, W. J. Bettingen, K. B. Stoddart, F. W. Cumming, E. James, Winnipeg; C. Leistikow, Grafton, North Dakota.