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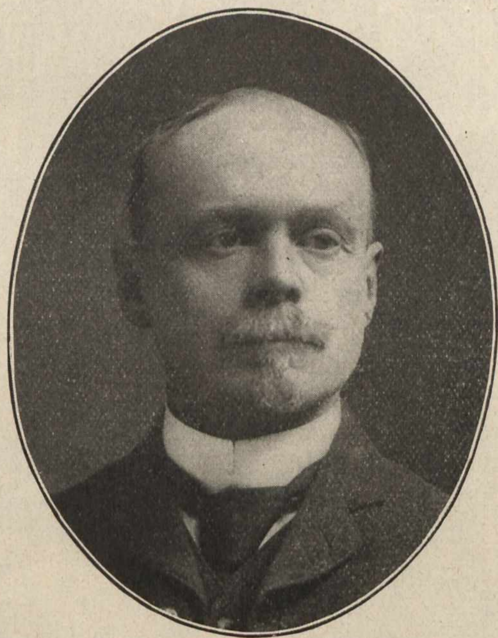
"We judge ourselves by what we feel capable of doing; but the world judges us by what we have already done."

*Longfellow.*



**R. F. TATE.**

Member Can. Soc., C.E., Ex-President of Engineers' Club, Toronto; Resident Engineer, Mackenzie, Mann & Company, Limited, Toronto.

Among the gifts of civilization, not the least is the modern luxury of travel. No agency has done more for the material comfort and social happiness of mankind than the Railroad. The solid highways laid down in Britain 55 B.C., by the Romans, were a noble contribution to progress—they form the foundations of the Royal Mail roads in Great Britain unto this day;—but this notable work was as water is to wine, compared to the blessings which have followed the inauguration of the system of steam railways begun by George Stephenson in England, 1825, and since spread like a network, over the face of the earth; bringing hostile nations and peoples into commercial intercourse; carrying the glad tidings of peace and goodwill among men, and making the very deserts "to blossom as the rose." The world owes a lasting debt of gratitude to the Civil Engineer; for the wonderful railway systems which we behold everywhere as we look out of ourselves over the globe, are the result of his creative genius and the work of his hands. The splendid system of railways laid down in Canada has won for the Dominion international renown, but the men whose inventive power and mechanical skill have made these mighty works possible are often among the *unrecognized.* It is the aim of THE CANADIAN ENGINEER to see to it that the Engineers who have been making genuine contributions to the material progress of our country—making our industrial history, are placed on the muster roll of honor. Such an one is the sterling Engineer, whose worthy life story we are about to tell.

Robert Frederick Tate was born in Belleville, Ontario, May 7th, 1854—his father's headquarters during the construction of the Grand Trunk Railway of Canada; who was in charge between Kingston and Toronto. In 1861 the family removed to Peterboro' by rail via the Cobourg, Peterboro' & Marmora Railway across Rice Lake, over the three-mile pile bridge; then a very unstable structure, so much so that the impression of that bridge journey by the seven-year old embryo Engineer is as vivid to-day as then; for he distinctly recollects the slow speed, lateral tremor, and undulating depression of the old structure over the deepest portion of the lake.

Mr. Tate may be said to be a born Engineer, having inherited mechanical instinct from his father, who was a trained Civil Engineer. His academic education was acquired in public school and Collegiate Institute, while his primary technical knowledge was gleaned under the wise practical tuition of his father and elder brother; supplemented by his own private study and research. College courses in Civil Engineering in Canada were very limited at the period when *he* began "doing things." Mr. Tate started his career in Railway Civil Engineering, and his thirty-six years of active professional life have been spent almost exclusively in that branch—assisting in the Railway development of his native country.

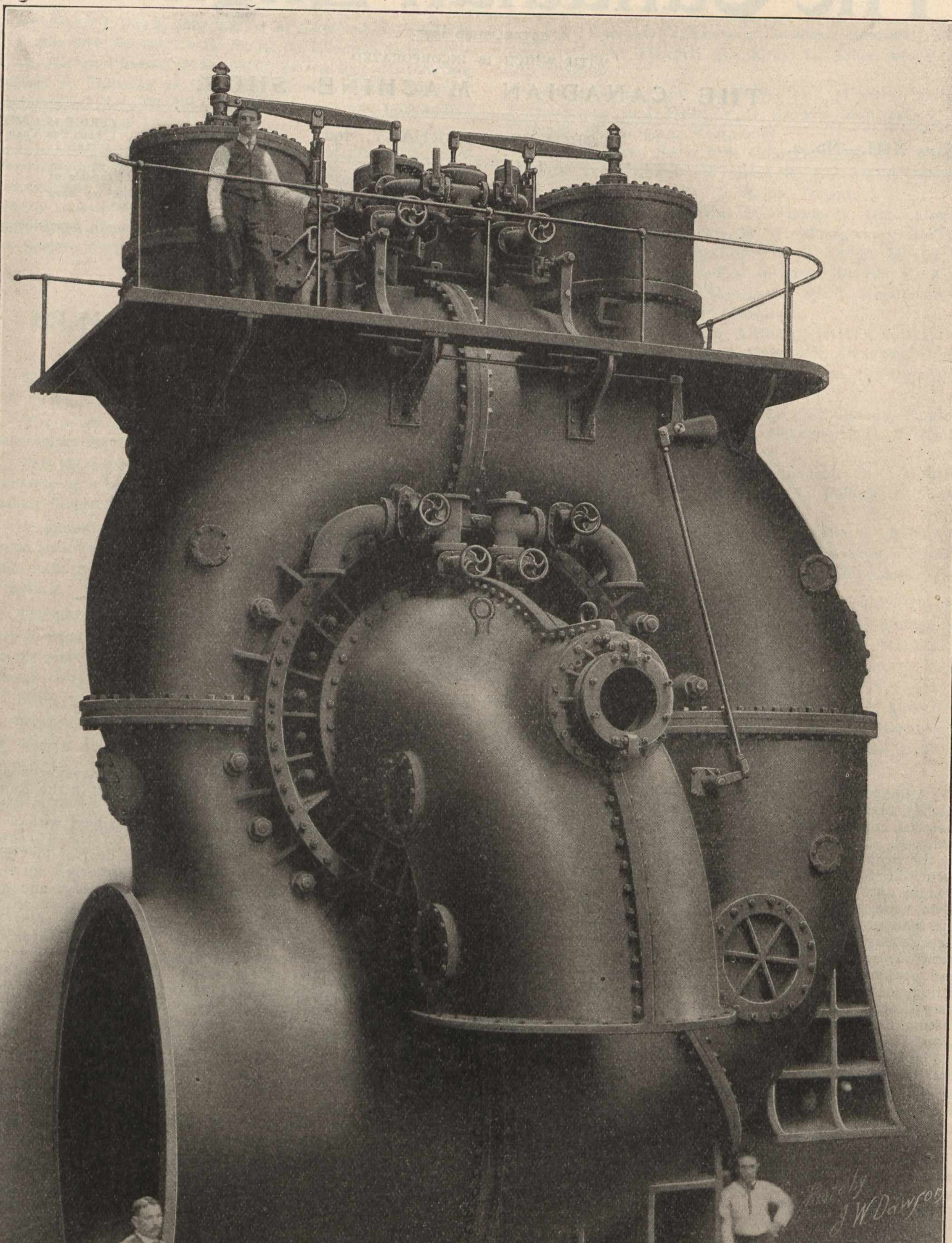
At the age of 16, he commenced business with a contractor in the construction of bridges on the Toronto & Nipissing Railway; who bought a great deal of the timber for the structure from Uxbridge northerly, cut from standing trees on lands adjoining the railway, and he remembers well, seeing them hewed on the spot to their dimensions and placed in work. A year later, (1871), he entered the employ of the Midland Railway of Canada (now part of the Grand Trunk Railway), as a chainman on surveys, and five years later was appointed Chief Engineer, although only 22, and held that position for five years, when he retired to seek a wider field for experience. During his connection with this Railway, he completed the construction of the line to Midland, together with the extensive lumber and railway yards and docks; and in 1876, changed the gauge of the Railway from 5′ 6″ to standard. Subsequent to this, he had charge of the Construction Offices of the following C.P.R. lines:—

At Montreal, Vaudreuil to Smith's Falls ....105 miles.
At Sherbrooke, Farnham to Mattawamkeag..292 miles.
At Macleod, Lethbridge to Kootenay Landing.287 miles.

He also did considerable reconnaissance, preliminary and location railway survey work in all parts of Canada for all the leading railways. In 1893, he located the line of the British Columbia Southern Railway from the summit of Crow's Nest Pass to Tobacco Plains, in East Kootenay, at the International Boundary. He was also Engineer in charge of a portion of the double track of the Grand Trunk Railway, and their Sarnia Tunnel connection from Blackwell to the east end of the Tunnel Yard.

In 1899, Mr. Tate was appointed Resident Engineer for Mackenzie, Mann & Company, Limited, with headquarters at Toronto; in charge of all the engineering projects in connection with that firm's various steam railway lines—which position he still holds. All the steel bridges purchased by that firm since his appointment, have been in his charge. In addition to the duties pertaining to this office, he has made personal examination and prepared reports on several important railway projects, in which this firm was interested,—and completed the construction of the Schomberg & Aurora Railway. He has under special supervision at the present time, a portion of the James Bay Railway, extending from Toronto to Richmond Hill.

Mr. Tate is a charter member of the Canadian Society of Civil Engineers; and has been a member of the Engineers' Club since its inception, and was President of that Society during 1905.



**THE LARGEST WATER TURBINE IN EXISTENCE**
American Work + Canadian Enterprise.

# HYDRO-ELECTRIC DEVELOPMENT IN CANADA

**Largest Water Turbine in Existence.**

The 10,500 H.P. turbine of the Shawinigan Water & Power Company, Shawinigan Falls, P. Q., Canada, is the largest and most efficient turbine wheel in operation to-day. It represents the highest type of American design and workmanship. Four and one-half months after the signing of the contract this turbine was delivered on board cars by the designers and builders, The I. P. Morris Company, of Philadelphia, Pa.

The official test of this wheel was made by experts representing both companies. The quantity of water consumed per second was determined by traverses taken in the penstock, by the pilot tube. This tube was checked by weir measurements, the results of which are slightly below the corresponding readings of the pilot tube, thus proving the accuracy of the test.

This wheel was guaranteed to have its highest efficiency at or near 9,000 H.P., and the efficiency was guaranteed to be 78%. The manufacturers received a bonus of $3,000 for excess efficiency.

The following is a brief summary of the results of the official test.

Head, 135 feet. Revolutions per minute, 180. Maximum H. P., 11,270.

| | |
|---|---|
| Efficiency at 11,270 H.P., or 7.3% overload | 84.7% |
| " " 10,500 H.P., or contract load | 86.3% |
| " " 9,735 H.P., or 92.7% load | *87.3% |
| " " 9,000 H.P., or 85.7% load | 86.5% |
| " " 7,500 H.P., or 71.5% load | 84.5% |
| " " 6,000 H.P., or 57.1% load | 83.0% |
| " " 3,000 H.P., or 28.5% load | 73.5% |

— * Maximum.

Checks on Pilot tube made by weir measurements.

| | Pilot Tube | Francis Formula | Bazin Formula | Fteley and Stearner Formula |
|---|---|---|---|---|
| Quantity | 204.7 | 200.3 | 200.3 | 201.4 |
| of water | 263.6. | 257.3 | 261.3 | 262.3 |

The illustration gives one a good idea of the principal features of the design. It is of the horizontal shaft, "Francis" inward-flow type, with spiral (or "volute") casing. The water is discharged laterally from the centre of the wheel through two draft tubes, one on either side. The upper curved segment of one tube can be seen in the illustration.

The diameter of the volute at the intake is 10′ 6″, which decreases gradually along the spiral in proportion to the amount of water flowing at different sectional areas. The height of the turbine is 30 feet, is 22 feet wide, and weighs approximately 364,000 pounds.

The spiral casing permits the penstock to be received below the floor of the power house, thus leaving room for oil switches under the switch board gallery.

The wheel is controlled by a Glocker-White mercurial hydraulic governor, and also a hydraulic hand gear. The hydraulic cylinders at the top furnish power for moving the regulating apparatus.

The guide vanes are operated by a vane ring, controlled by pistons from the cylinders. The area between the guides is regulated by the movement of this ring, and, therefore, the quantity of water entering the wheel per second is controlled.

The 10,500 H.P. is transmitted over long distance lines 84 miles to Montreal, and there used for street railways, electric lighting and general power purposes. The current is "stepped-up" at Shawinigan Falls from the 2,200 volt, quarter-phase, to 50,000 volts, three phase, and carried to Montreal over three cables, each composed of seven No. 7 aluminum wires. At Montreal it is "stepped-down," with a loss in transmission of 18%.

# THE TRINITY RIVER PLANT OF THE NORTH MOUNTAIN POWER COMPANY

Among the power transmission systems of the Pacific Coast, one of the most interesting is that of the Trinity River plant of the North Mountain Power Company, located in the central part of Trinity county, California, two miles below the town of Junction City, where Canon Creek, from which the water used for power is obtained, flows into the Trinity River. The nearest railroad point is Redding, on the "Shasta Route" of the Southern Pacific. Humboldt Bay, on the Pacific Ocean, with Eureka, the chief coast city of Northern California, lies almost due west, distant 59 miles in a straight line. The altitude of the plant is about 1,480 feet. All material, cement, and machinery were hauled in over 60 miles of the severest mountain roads, across three distinct divides or summits. It required 18 to 20 horses to pull each of the larger pieces, weighing 18,000 lbs., up the grades, and when mud was encountered it was necessary to hitch 18 horses to the fall of a block and tackle fitted with steel cables. Despite these difficulties, however, no mishap occurred to any of the machinery.

An 18-Horse Team Hauling the Lower Half of the Stator of an 750-k.w. Bullock Alternator Over 50 Miles of Mountain Road from the nearest Railroad Station to the Plant of the North Mountain Power Company.

The water used at the plant is diverted from Canon Creek, which has a drainage area of 52 square miles above the diverting dam. The upper part of the basin is a rugged, glaciated granite country, extending up from an altitude of from 9,000 to 10,000 feet above sea level. The dam is small, and serves merely for diverting the water. It is of the usual rock-filled crib form. Part of the ditch is cut in solid rock, but most of it is dug in the hill-side soil. The flumes are 19 in number, and vary in length from 30 feet to 1,200 feet. The total length of the ditch, flumes and tunnel is 7¼ miles. The average grade of all is about 9.73 feet per mile. The penstocks are each 1,165 feet long. Under a total head of 604 feet there is an effective head of 600 feet, or a working pressure of 260 lbs., per square inch.

The plant proper consists of the power house, two transformer houses and three high-tension switch houses. Each of the two hydraulic units consists of a pair of 44-in. Pelton wheels under one sheet steel housing. The nozzles are of the deflecting type. With the largest tips in service the wheels are capable of driving the generators at 25 per cent. overload.

The tail race is 6½ feet wide, and excavated for 280 feet through bed rock to the Trinity River. The generators, two in number, are of the Bullock type, furnished by Allis-Chalmers Company, of Milwaukee, being three-base 750 k.w., 500 r.p.m., 2,200 volts, 25 cycles, rev. field, six-pole. Two Bullock exciters, 125 volts 45 k.w., 900 r.p.m., are driven by belts from the generators. The power-house, 36x51 feet, is built of concrete made up with sand and gravel, taken from the river bars a few rods from the site of the plant, and with imported Portland cement. The roof is of corrugated iron supported on steel trusses. A "Cyclops," hand-operated crane spans the main part of the building, and is fitted with a one-ton "Triplex" block. This easily handles the heaviest piece of machinery.

The leads between the generators, exciters and switchboard are lead-covered cables laid in conduits with the concrete and cement floor. The transformer house is 13 feet x 51 ft. 6 in., and is also of concrete. It contains seven step-up transformers, viz., two banks of three each, and one in reserve. They are of Bullock make, 300 k.v.a., water cooled, oil insulated, 2,200/19,050 volts, 25 cycle.

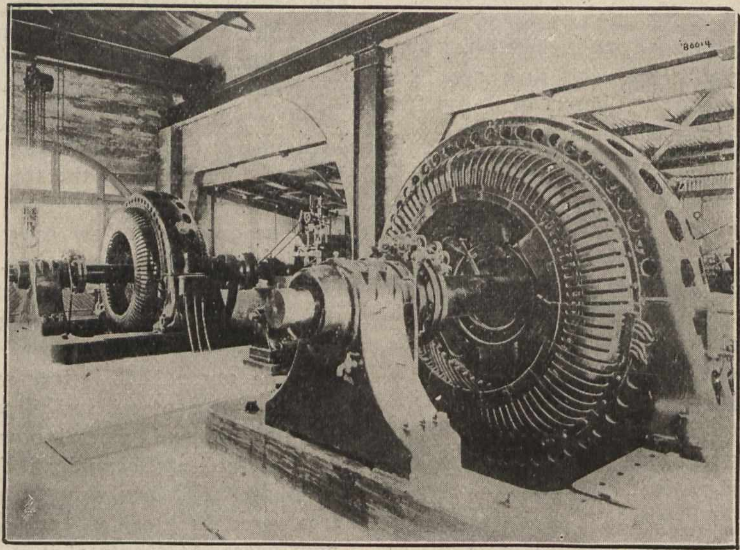
The high-tension switch house is a frame structure covered with corrugated iron. In it are two banks of "M-T" single throw air-brake switches, and G.E. alternating current multiplex lightning arresters, connected up for the three-phase circuit. The pole line extends almost due west from the plant to the sub-station in Eureka. The length is 65 miles. Of this 55 miles are over a severely rugged mountainous country; the altitude of the plant is only 1,480 feet, and Eureka is at sea-level, but the line passes over several summits ranging from 4,500 to 5,500 feet in altitude. Fifty miles of its length lie in a heavily timbered country, requiring a tremendous amount of clearing, the trees ranging from 2 ft. to 4 ft. in diameter. It was necessary to construct a trail nearly the entire length of the line. The route deviates from a straight line only slightly and only where the topography made it unavoidable. It is a "thorough" transmission, so to speak, there being no taps on the line anywhere between the plant and the sub-station at Eureka. The line is a single circuit, three-phase, averaging 35 poles to the mile. The potential at present used on line is 30,000 volts.

The sub-station at Eureka includes an auxiliary steam plant consisting of two Babcock & Wilcox water tube boilers fitted with Peabody patent oil burning furnaces duplicate oil pumping system; Goudert auxiliary feed water heater; Wheeler "Admiralty" surface condenser with self-contained steam-driven air and circulating pumps, the cooling water being taken from Humboldt Bay, and a McIntosh and Seymour tandem compound engine of nominal rating of 700-h.p. A jackshaft running at 500 r.p.m., is connected to engine by a rope-drive.

A Bullock rotary converter, 500-k.w., 500 r.p.m., six pole, 25 cycle, 550-volt, is arranged for direct connection to this jackshaft by a jaw clutch and so driven by the engine. This permits of carrying the load by steam when necessary to shut down the transmission line for repairs. The engine is fitted with a switchboard speed control device. The clutch has a synchronism indicator in the nature of a lamp, so that the engine may be connected to the rotary while it is running at full speed on the power transmitted from the Trinity River plant. For the rotary converter there are three Bullock transformers, 190-k.w. water-cooled, 25-cycle, 30,000/352 volts. For stepping down for the local distributing system are three General Electric Company's 400-k.w. water-cooled transformers.

For furnishing power to the 60-cycle incandescent and arc lighting circuits of the city of Eureka, a three-phase, 60-cycle generator is driven by the rotary acting as a synchronous motor. The sub-station is fitted with switchboards and H. T. switches suitable for handling the equipment. A fuel oil tank 54 ft. in diameter by 25 ft. deep, holding 10,000 barrels, has been built near the sub-station, and is connected to a dock on Humboldt Bay by a pipe-line.

The load at present consists chiefly of lights in the city of Eureka. Some motors are already connected to the circuits, and the motor load is being rapidly developed.



View in Power House, Showing 750 k.w. Bullock Alternator and Lombard Waterwheel Governor.

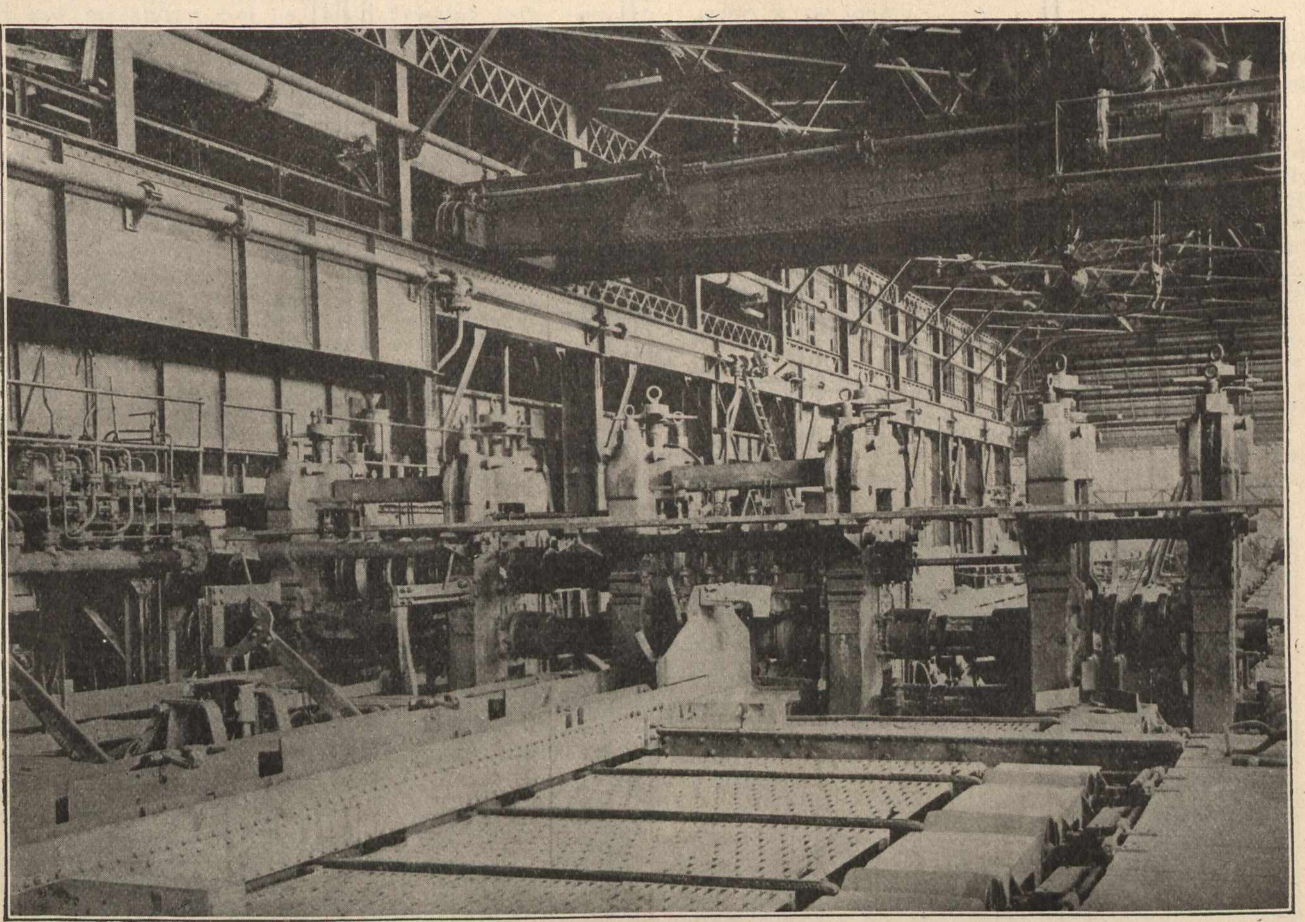
# NEW RAIL MILL OF DOMINION IRON AND STEEL COMPANY, LIMITED, SYDNEY, CAPE BRETON

The latest important addition to the immense plant of the Dominion Iron & Steel Company, at Sydney, Cape Breton, is the new rail mill and the various departments connected therewith.

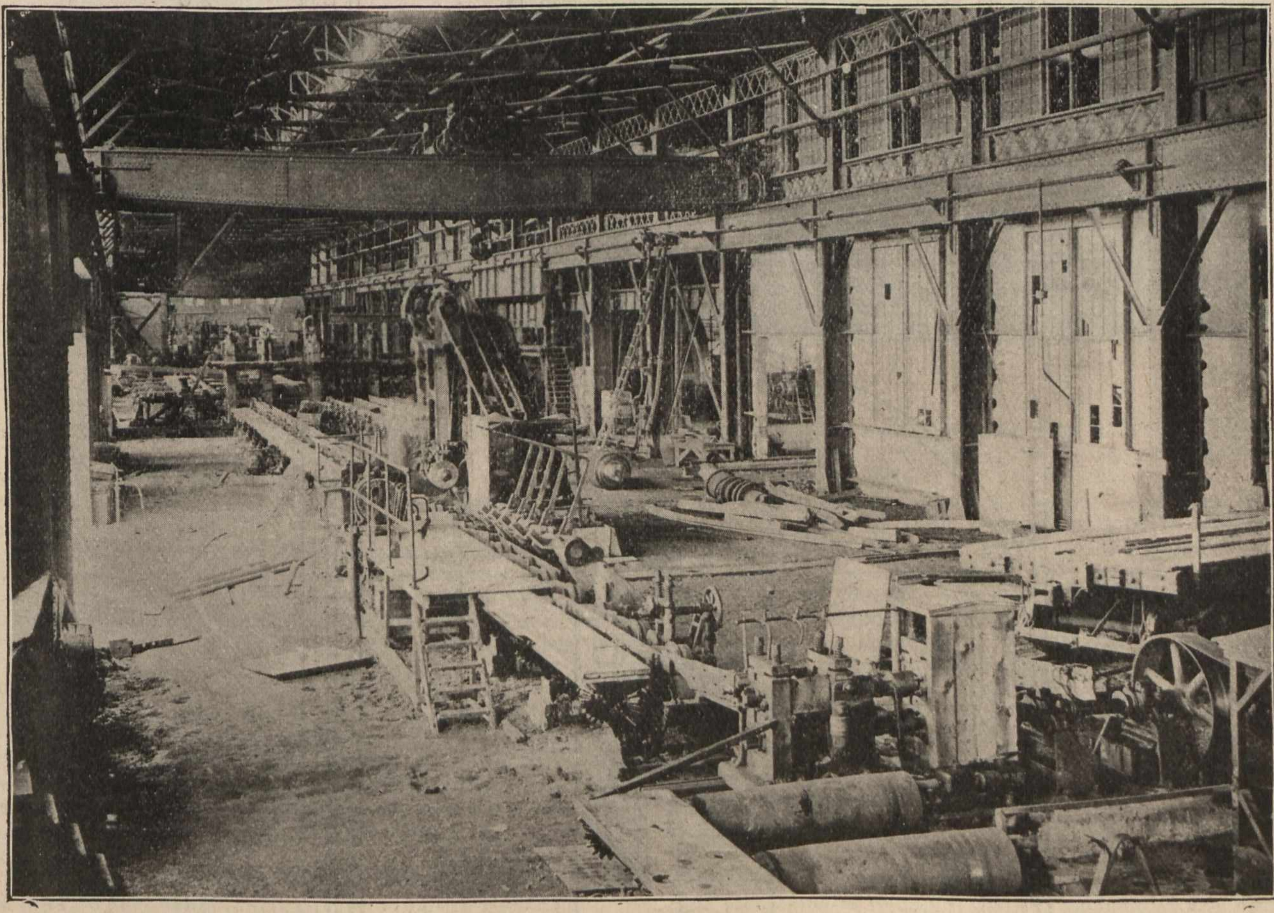
Through the courtesy of the Chief Engineer to the company, Mr. Edward Holth, M.E., we are fortunate in being able to place before the readers of "The Canadian Engineer" a comprehensive and reliable description of this modern installation.

The Mill was designed and installed by Mr. Holth and his staff of engineers and draughtsmen; fourteen months elapsing between the date the order was given to the engineering department to begin the designing and draughting, and the time the rail mill commenced operations: June, 1905. The construction was greatly hindered, both by the strike at the general works in the summer, and the severe winter, which delayed very much the freight service and the machinery from reaching Sydney in due time. With a view of accelerating the completion of the work as much as possible, the management decided to give out the manufacture of the larger part of the machinery to specialist rolling mill makers, etc., outside the Dominion.

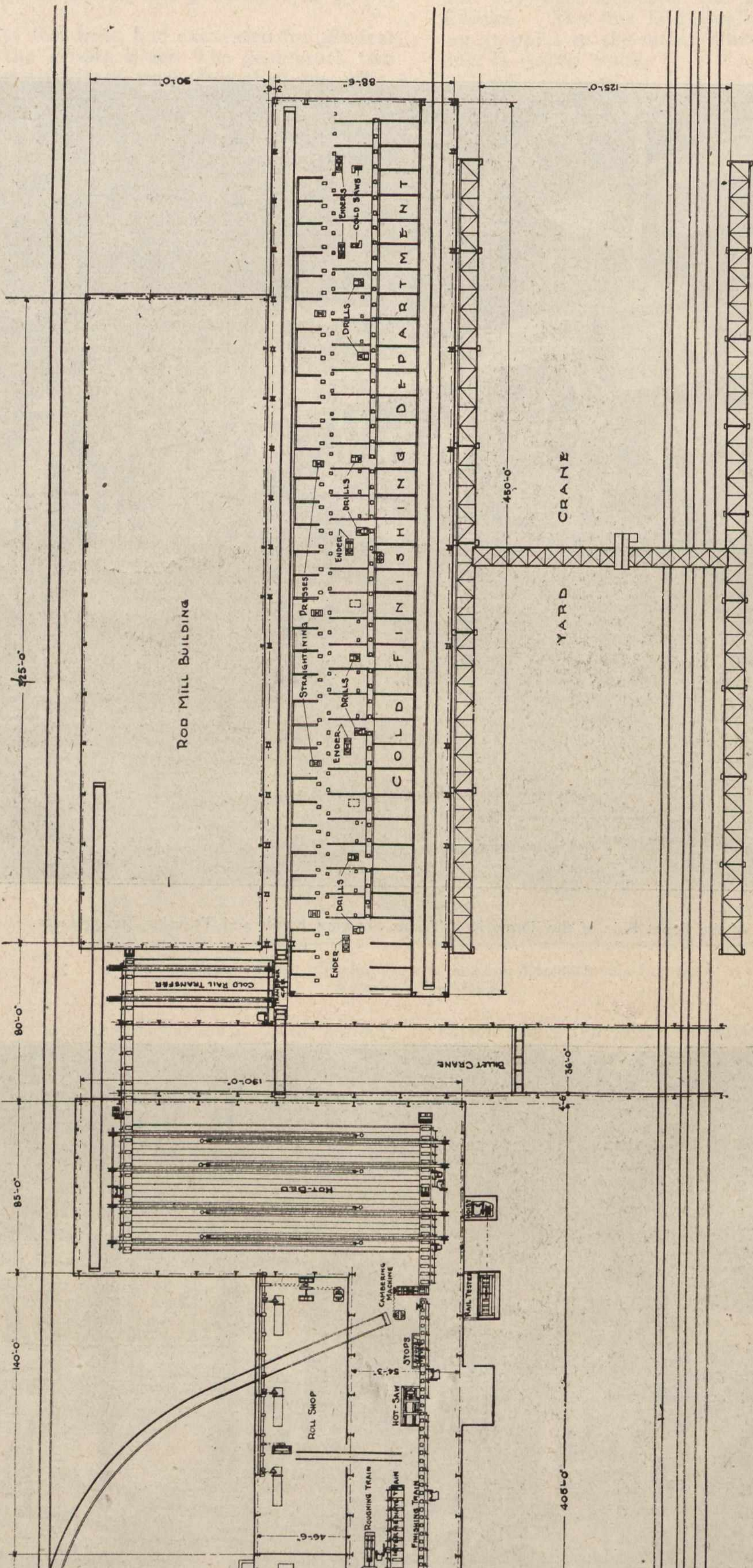
The steam engine was built by the Southwark Foundry & Machine Co., Philadelphia, Pa., but the 95-ton fly-wheel for same was made by the Laurie Engine Co., Montreal. The first roughing tables and their operating machinery were furnished by Tannett-Walker & Co., Leeds, England. The roll housings, intermediate and finishing tables, saw table, hot-bed machinery, etc., were supplied by the Wellman-Seaver-Morgan Co., Cleveland, Ohio. The pinions and pinion housings were made by the Mesta Machine Co., Pittsburgh, Pa. The roll shop, and 25-ton travelling crane for same, together with the building and some of the machinery



View of the Front Side of the Three Roll Trains Showing Pulpit and Transfer Arrangement.



View of Back Side of the Mill Showing Cambering Machine, Stamping Machine, Rail Stops, Hot Saw and Tables.




Rail Department of Dominion Iron & Steel Co. Ltd.
Sydney, C.B.

for the cold finishing department, were made by the Canada Foundry Co., Toronto. One roll lathe and some smaller machinery were made by I. Matheson & Co., New Glasgow, N.S. All the rail straightening presses, cambering machine, hot saw machinery, hot bed, cold finishing beds, transfer arrangements and continuous heating furnace, etc., were manufactured in the company's own shops at Sydney and the erection of all the machinery was also done by the company's own men.

### Description of the Mill.

The steel rail mill is what is termed a "Three high, three stands, 28" mill," having three stands of roll housings with three 28" diameter rolls in each, together with a pinion housing having three 28" diameter pinions, all set in line with the engine shaft, and all driven by one 54" diameter x 66" stroke, horizontal Porter-Allen engine, using between 140 to 150 pounds initial steam pressure per square inch, and run at a speed of between 80 and 90 revolutions per minute. The engine drives the mill through a heavy cast steel spindle coupled direct to the crank shaft at one end, and to the middle pinion at the others.

The first or roughing tram, has a lifting table on each side, which receives their up and down motion through a system of levers and rods, and a 16" heavy hydraulic cylinder. The table rollers are driven through shafting and gearing, and a 10 inch by 12 inch reversing steam engine. The table is provided with bloom manipulators on both sides.

The intermediate train has swinging tables lifting only at the end nearest the train, being hinged at the other. The up and down motion is done by levers and rods and a hydraulic cylinder 16 inches diameter, which is placed under the back table. The table on the front side is 45 feet long, and on the back side 65 feet long; both have motor driven table rollers.

The finishing table, on the front side, is 95 feet long, has motor driven rollers 5 feet apart.

The saw table, at the back of the finishing rolls, is 24 inches wide, and has motor driven rollers 4 feet apart; the distance from the centre of tram to the saw blade being 109 feet. A similar table continues from the hot saw to the hot bed.

The receiving table for the hot bed is 5 feet, 4 inches wide ,and 76 feet long, and has motor driven rollers.

The total length of hot bed is 144 feet, and the width between outside rails 63 feet. This bed is provided with 22 strings of skid rails about 3 feet apart; the four hot rail pull-up's, and four rail pull-up's for same, being 12 feet apart. These "pull-up's" consist of a wire rope device, driven by rope drums, and operated in pairs by electric motor.

The run-out table at the upper end of hot bed is 3' 6" wide, x 154' long.

The cold rail storage, and transfer beds consist of four lines of skid rails and two drag chains with pull-up fingers, all motor driven through shafting, gearing, and sprocket wheels provided with chain tighteners, etc.

The cold finishing department has 5 electric driven straightening pressers, 75 feet apart, also 10 drilling machines, and 4 rail enders, all electrically driven. The drills are placed in pairs—one right and one left, 37 feet between; there being one rail ender for each set of drills. There are 2 cold saws, also electrically driven. Between the straightener and driller beds, is a row of roller stands, 36 in number, 10 feet apart; 3 roller stands between each set of drills. Between the drills and the inspection beds, and under the skids, is a roller table to take the second and rejected rails away. This table is 402 feet long, 15 inches wide, motor driven through a line shaft and worm gearing. Each straightening press has 3 skids on each side, which receive the rails from the transfer car, and each set of drills has 3 skids forming the drillers bed. The inspection beds have skids about 12 or 13 feet apart, running the whole length of the building. The shipping track runs inside the building close to the wall and is depressed, so the rails can be loaded from the inspection skids direct on the cars.

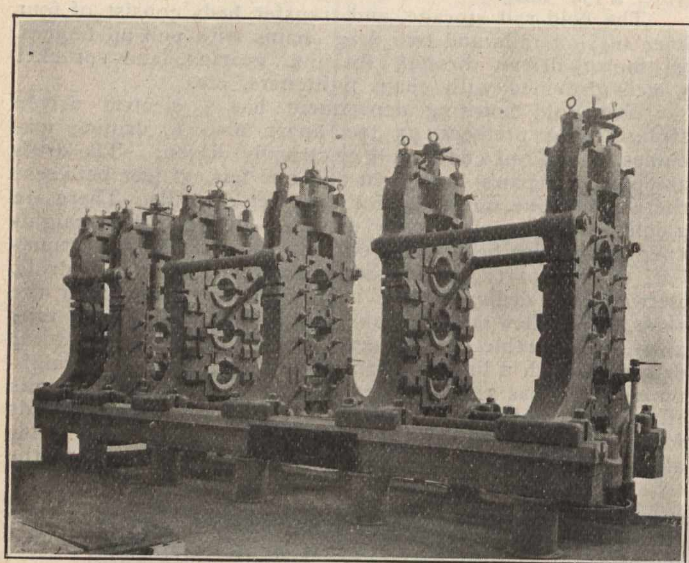
View of Rail Mill from the Blooming Mill.

The continuous heating furnace is 15 feet wide inside x 36 feet 9 inches long from inlet door to push-door, and has 6 water-cooled skid pipes for the blooms to slide on. The stack is 60 feet high, by 5' 6" diameter inside the shell, with damper on top. The air is supplied by a motor driven blower. The blooms are fed to the furnace by a hydraulic pusher, which shoves the blooms from the approach table directly into the furnace. The blooms are pushed out of the furnace by an electric driven pusher on to a small table, from which they are picked up by a small specially designed overhead travelling crane, and delivered on the approach table, thence to the mill.

The roll lathes—three in number—are belt driven through line shafts and clutches, power being furnished by an electric motor.

The rail mill building, starting from the blooming mill building, is 425 feet long, 54 feet, 3 inches wide 34 feet high, 22 feet 6 inches to top of runway rail and 52 feet from centre to centre of said rails.

The hot bed building is 190 feet long 85 feet wide, and 22 feet high. These buildings are made of structural steel framing, expanded metal, cementine walls, with corrugated iron roof. The steel frame was furnished and erected by the Dominion Bridge Co., Montreal; the expanded metal walls being furnished and erected by the Expanded Metal & Fireproofing Co., Toronto.



Roll Housings Assembled in Shop on Temporary Shoe Plates.

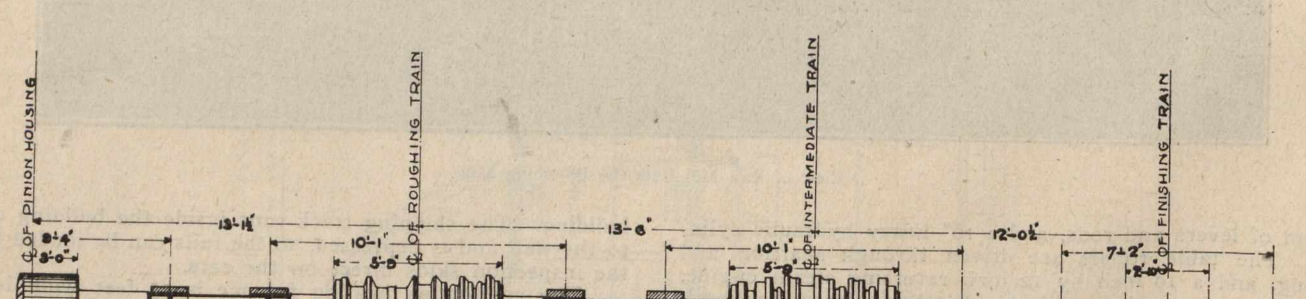
The roll turning shop and engine room is of lean-to construction, abutting on the rail mill building, and is 200 feet long, 46 feet wide, and 22 feet high, having steel frame-work, brick walls and corrugated iron roof.

The cold finishing building is 450 feet long, 88 feet, 6 inches wide, and 22 feet high, with steel framing and corrugated iron walls; the roof has a sky light on one side.

There are 46 electric motors used in operating the various machinery in the rail department; varying from 50 to 5-H.P.

**Operation.**

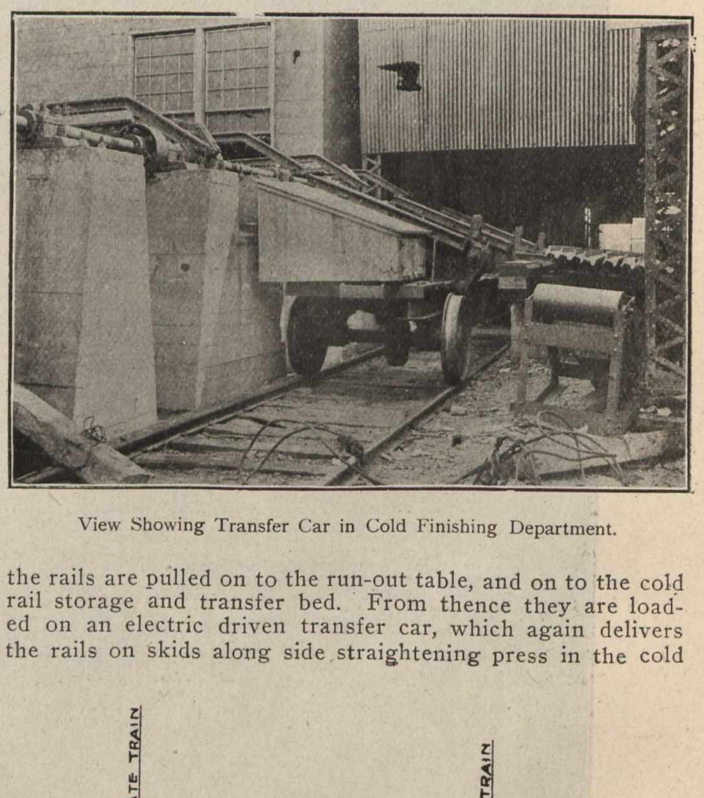
The steel ingots as they come from the open hearth plant have a section of 21" x 18", about 5' 8" long, and weigh approximately 6,000 pounds each. These are re-heated in pit heating furnaces and rolled down in the blooming mill, to 8" x 8" section. The crop ends of this bar are cut off in the bloom shear, and the whole bar is then cut in two lengths of about 13 feet each. From this bloom is made three rails 80 lbs. per yard, each 33 feet long. The bloom is transferred from the bloom shear by a swift running car and rope haulage, and delivered on the approach table, and run direct on to the roughing table, where it is—by the motion of the table and manipulators—run back and forth through six different passes in the roughing rolls; then by means of four hydraulic operated swinging arms, the bar is transferred to the intermediate table where it is run




—SIDE VIEW SHOWING ARRANGEMENT OF PASSES—

back and forth through four more passes in the intermediate rolls; at the end of which operations, the bar is between 90 and 100 feet long. Then, by a system of five racks and pinions, provided with suitable hooks, is dragged on rail skids over to the finishing table and run through only one pass (the finishing pass) in the last set of rolls, which is only two high. The rail is thus completed in eleven passes. When the mill is running at its full capacity, three of these blooms, or bars, are being rolled in the mill at the same time—one following the other. From the finishing pass, the bar runs to the hot saw, where the crop ends are cut off and subsequently cut into three lengths of rails, one after the other, since only one saw is used. The rails shrink, on an average about 6 inches in length, from the time the hot saw cuts it until cool; and great care is taken in placing the rail stops at the hot saw, so as to be sure to get the right length of the rails when cool. The rail specifications, as a rule, do not allow more than ¼ inch variation from the specified length. The bar shrinks so quickly when hot, that each of the three rails has to be cut at different lengths, the first rail is hotter than the last and gives different shrinkage. A skilled man handling the stops can, from experience, judge the precise temperature of the rail bar when cutting, and hence places the rail stops so accurately that all the rails are found to be the required length when cool.

As the rails are cut at the hot saw they pass through the stamping machine which stamps automatically on four or five places on the web of the rail, the Open Hearth heat number. From the stamping machine the rails run through the cambering machine, which gives the rail a slight curve with the flange of the rail inside, which also has to do with the difference in shrinkage of the head and flange of the rail when cooling it. A skilled man can adjust this cambering machine so as to get an almost straight rail when cooled off on the hot bed. From the cambering machine the rails are run on to the receiving table at the hot beds, and pulled up three at a time to cool. From the hot bed



View Showing Transfer Car in Cold Finishing Department.

the rails are pulled on to the run-out table, and on to the cold rail storage and transfer bed. From thence they are loaded on an electric driven transfer car, which again delivers the rails on skids along side straightening press in the cold finishing department. After the rails have been properly straightened under presses, they are shoved by hand over on the drilling beds where the fins and roughness left by the hot saw on the ends are first chipped and filed away, then the length measured. If it is found a little too long, or the end not quite square sawed, the rail has to be—what is called—ended, that is, the end planed by a machine specially designed for the purpose. The rails are next drilled for the splice plates on a special multiple drilling machine.

From the drill the rails are shoved on the inspection and shipping bed, where the final inspection by the purchaser takes place, and the accepted rails are loaded on railroad cars and shipped. The second class rails, if any, are conveyed to a separate place in the building, where they are either re-cut by cold saw and made into short lengths, or otherwise made ready for the market.

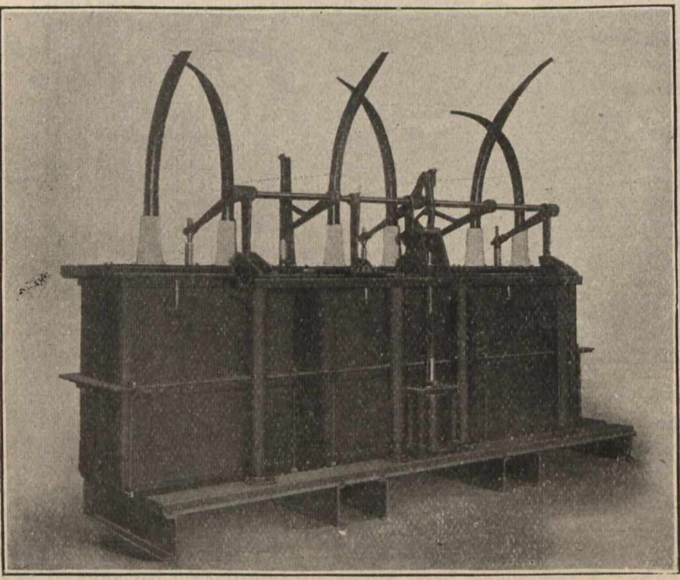
The Continuous Heating Furnace, which the mill is provided with, is for the purpose of re-heating blooms which sometimes get cold, due to unforeseen stoppages and delays in the mill. The blooms are allowed to collect in considerable number, and the furnace is started, and the process of re-heating performed.

The drawings made and dimensioned, contained 2,715 separately detailed parts, shown on 256 standard size drawings; the total number of pieces being 31,276. This record does not include the steam engine, drilling machines, rail ending machines, motors and electrical fixtures.

Having described in detail the construction and working of this substantially built, modern rail rolling plant, which has been eulogized by experts as probably "the best and handiest three-high-one-engine-mill, built anywhere"—it only remains to add that operations were commenced in June last with very little of the trouble that generally occurs in starting up new rolling mills; **for a perfect rail was made from the first bloom rolled.** The mill was originally designed to roll about 1,000 tons per day, but has lately proved its capacity of turning out 1,200 tons every 24 hours; and this output could be maintained continuously if steel ingots could be supplied with the same regularity from their 10 open hearth furnaces; as for instance, from a Bessemer plant. As it is, the results are remarkable, for up to the 31st of December, 1905, there had been rolled and finished 44,000 tons of 80 lb. steel rails. The quality has been uniformly good, and no difficulty is anticipated in disposing of all that can be produced. Shipments have been made under rigid inspection, to the Grand Trunk, the Temiskaming & Northern Ontario, and Intercolonial Railways, and contracts are now in hand which will absorb the output of the mill for months. Altogether this is a notable piece of engineering, reflecting credit on both the enterprising directorate that conceived it, and the Mechanical Engineer, Mr. Edward Holth, who designed and carried out the project to a successful end.

## TYPE G. ELECTRICALLY OPERATED OIL CIRCUIT BREAKER.

The breaker shown in the illustration was designed by the Westinghouse Electric & Manufacturing Company primarily for the Ontario Power Company's work. It is intended to handle energy up to 60,000 H.P. per three-phase circuit, and will open a circuit under any conditions of overload or short circuit which may occur with a power house capable of delivering 200,000 H.P. The insulation to



Type G Oil Circuit Breaker—Electrically Operated.

ground and between terminals is designed to withstand a break-down test of 150,000 volts, and the insulation between poles is twice that amount since the poles are electrically separate.

The three poles of the switch are closed together by means of a toggle joint operated by a single direct-pull solenoid. The switch is held in a closed position by the toggle being carried just beyond the centre and is tripped out by the tripping coil armature striking this toggle and knocking it backward, allowing the switch to open by gravity. Each pole of the switch gives a double break, each break being approximately 17 inches. The closing magnets require approximately 5,000 watts direct current, while the tripping magnets require about 300 watts.

The oil tanks, of which there are three, are made of boiler iron, lined with an insulating material, with barriers interposed between the stationary contacts. The contact parts are of their standard type C construction, having renewable arcing tips and contacts. The leads with their insulation and the upper porcelain insulators may be readily removed from the switch, giving access to the contact parts for inspection and repairs. The top covers of the tanks are made of treated soapstone slabs, part of which are also removable. Each tank is provided with an oil drain opening in the bottom and an overflow just above the normal oil level. These openings are provided with standard 3-inch pipe flange threads, but no pipe is provided. Each tank has an oil level gauge and requires approximately 160 gallons of oil.

The total weight of each 3-pole switch complete, the tanks being filled with oil, is approximately 15,000 pounds. The oil alone weighs approximately 4,000 pounds.

A 2-pole double-throw indicating switch is provided upon each 3-pole oil switch for use in connection with the controlling and indicating devices. The circuit breaker is not automatic in itself—an overload relay operated from series transformers being necessary.

## AIR FLOW THROUGH CIRCULAR ORIFICES.

At a meeting of the American Society of Mechanical Engineers recently held in New York, a paper was read by Mr. R. J. Durley, of Montreal, entitled "On the Measurement of Air Flowing into the Atmosphere Through Circular Orifices in thin Plates, and Under Small Differences of Pressure." The investigations described in the paper included heads from 1 in. to 5 in. of water, and orifices up to 4 in. in diameter, and the results were expressed by the following formula:

$$D=0.6299\,C\,d^2\sqrt{\frac{I}{T'}}$$

where

D=discharge in pounds per second.
C=an experimental coefficient.
d=diameter of orifice in inches.
i=pressure difference in inches of water.
T=absolute temperature of the air, Fahr.

The values of the coefficient C were found to be those given in the table below, the height of the barometer being 30 in.

| Diam. of Orifice in Inches. | 1 in. Head | 2 in. Head | 3 in. Head | 4 in. Head | 5 in. Head |
|---|---|---|---|---|---|
| 5-16 | 0.603 | 0.606 | 0.610 | 0.613 | 0.616 |
| 1-2 | 0.602 | 0.605 | 0.608 | 0.610 | 0.613 |
| 1 | 0.601 | 0.603 | 0.605 | 0.606 | 0.607 |
| 1 1-2 | 0.601 | 0.601 | 0.602 | 0.603 | 0.603 |
| 2 | 0.6 | 0.6 | 0.6 | 0.600 | 0.600 |
| 2 1-2 | 0.599 | 0.599 | 0.599 | 0.598 | 0.598 |
| 3 | 0.599 | 0.598 | 0.597 | 0.596 | 0.596 |
| 3 1-2 | 0.599 | 0.597 | 0.596 | 0.595 | 0.594 |
| 4 | 0.598 | 0.597 | 0.595 | 0.594 | 0.593 |
| 4 1-2 | 0.598 | 0.596 | 0.594 | 0.593 | 0.592 |

The author stated that the general conclusions to which he had come were: (1) The coefficient for small orifices increases as the head increases, but at a lesser rate the larger the orifice, till for the 2 in. orifice it is almost constant. For orifices larger than 2 in. it decreases as the head increases, and at a greater rate the larger the orifice. (2) The coefficient decreases as the diameter of the orifice increases, and at a greater rate the higher the head. (3) The coefficient does not change appreciably with temperature (between 40 deg. and 100 deg. Fahr.). (4) The coefficient (at heads under 6 in.) is not appreciably affected by the size of the box, if the ratio of the areas of the box and orifice is at least 20:1. All the experiments were made at the McGill University, Montreal, and the orifices used were straight bored in iron plates No. 15 B. and S., or 0.057 in. thick.

# CANADA ON THE WORLD'S HIGHWAY

**By Alfred J. Roewade.**

Consulting Engineer, Civic Designer, Chicago, Ill., U.S.A.

"Westward the course of Empire takes its way."
—(*Milman.*)

## II.

## CANADA'S OPPORTUNITY.

The expansion of the wheat-growing area of North America is slowly forcing most important transportation problems to an issue, and the proper solution of these problems will place Canada on the direct highway between Europe and Asia. A glance at the map shows that the true path of progress and civilization westward, is a north-west course by way of Canada; and this can be realized if the Dominion will only take a broad view of the value of international communication, and provide the necessary ways and means.

The first of these twentieth century problems will, it is hoped, be solved by a railroad from Winnipeg to Port Nelson in Hudson Bay, and a navigation line from thence direct to the Old World. A successful opening of these northern waters—especially of Hudson Strait—for the merchant marine, will be an event of no less importance to the world's traffic than was the opening of the first transcontinental railroad some forty years ago; for it will shorten the lines of communication across the continent considerably, and bring wide territories within the bounds of civilization which, ten years ago, would in the order of things, have seemed "like an idle dream." The straight line between Liverpool and Port Nelson, will, if continued, reach the Pacific Ocean at the shore of Southern California; crossing on its way, all the present main lines of transportation to the Orient, and thus considerably shorten the various traffic lines from Europe and Eastern Asia. It is evident, therefore, that this route will take rank among the important ones, even though the navigation should prove difficult and require expensive accessories, especially in Hudson Strait. The navigation line will, moreover, as shown on Fig. 4, be forced considerably southward from the direct line in order to pass Cape Farewell on the south end of Greenland. It is probable that Denmark—which claims sovereignty over this land—perceiving a golden opportunity, will establish a usable sheltered harbor near Cape Farewell. This point is just midway between the terminals of the route, hence would be a very convenient rendezvous for the merchantmen awaiting the opening up of navigation through Hudson Strait; or, as a harbor of refuge during gales, or for repairs and supplies. The Danish Government is doubtless cognizant of the manifest suitability of Cape Farewell as a modern harbor; but since it would be an expensive and difficult undertaking, it may require some diplomatic coaxing in the direction of treaty and navigation concessions from the British Imperial Government in order to have the project carried out without delay. In any case, it would be wise to include this matter in the considerations preparatory to the opening of the route—it would, for one thing, serve to give an international character to the enterprise, and bring foreign flags to Port Nelson.

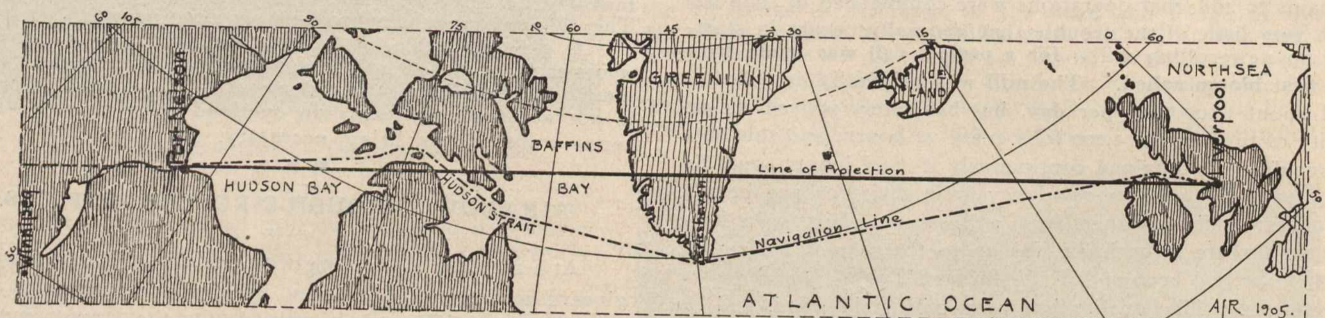



Fig. 5.
Map Sketch, Route Projection, Port Nelson to Liverpool.
(For verification of Line of Projection, use a Globe.)
The route projection equatorializes any line selected on the globe, and shows the lay of the land with same accuracy and truth on the map as if it had the equator for a centre line; provided the strip of the earth surface taken in is not too wide, and the line of projection its axis. If it exceeds 1000 kilometers to each side it will suffer from distortion, same as all other projective systems.

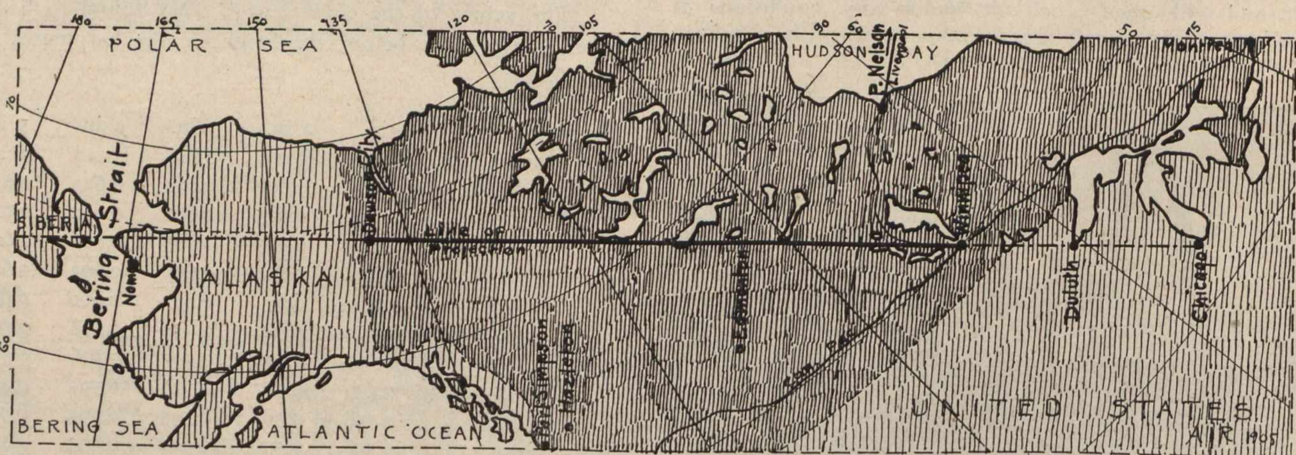



Fig. 6.
Map Sketch, Route Projection, Dawson City to Winnipeg, or the Future Trunk Line Connection between Asia and America.
(For verification of the Line of Projection use a Globe.)

The establishment of this proposed transportation line, has, I am aware, been under contemplation for several years, and its difficulties and opportunities have, in all probability, been lined up long ago for solution or realization; hence my observations may be merely reiterations of well-known facts. My main purpose in this article, however, is to call public attention to another route, which, as far as I know, has not been considered in its relation to the project set forth on

Fig. 6, nor have the general advantages it offers for opening up the natural resources of the great North-west; even if the scheme has been mentioned at all. This route is the proposed railroad connection over Behring Strait to Asia, which is destined for realization in the not very distant future

That the Canadian Pacific Railroad was made as nearly as practicable to follow the geographical degree of altitude, in order to reach the western ocean by the shortest possible route, was but natural; yet that this great line should now be paralleled by another line whose only purpose is to open the country for cultivation seems to be a mistake. Not because there is no need of a railroad at the contemplated location, for much water will run into the sea before the railroad net of the North-West is in danger of being too closely meshed; yet it is of purely domestic importance. Port Simpson—its intended Western terminus—has advantages in regard to location on the high-way to Asia, yet it will never be able to compete with the posts at Vancouver for any transit traffic; because transportation by water is cheaper than by rail. When this scheme is carried through, its realization will, to a large extent, be due to the before mentioned public sentiment favoring the following of the line of altitudes, and not to a rational desire of hitting the direct line concerned in the opening of the country to international transportation, or in following the physical configuration of the country, or the isothermes governing the forward march of agriculture.

The straight line from Winnipeg to Dawson City, which is the main part of the line from Behring Strait to the railroad centre of the continent, is, as will be seen in Fig. 6, the real axis of the vast territory now awaiting the dawn of civilization. It skirts the chains of great lakes, which, "belted" by most delightful country: forest lands, rich in game, magnificent mountain scenery; and landscapes of surpassing beauty—a permanent sportsman's paradise; beginning where agriculture ceases, and extending miles northward of this line. There can be no doubt that when Canada's northwestern railroad system is completed, this direct Behring Strait line will then be the trunk of the whole system; second not even to the C. P. R., for it will have an ever increasing international value. The comparative advantage of this line will best be understood by contrasting it with the Canadian Pacific Railway. The value of this old transcontinental route consists largely in its nationality. The universal transportation could have been served almost as well by the still older routes south of the boundary; while no such qualifications could be made with regard to the proposed Behring Strait route, since it would be a direct line by rail between the centres of America and Asia (China, India!) and even of Europe.

A line from Winnipeg to Hazleton, B. C., and thence to Dawson City—which is named as a prospective connection between the two points—will serve domestic purposes as long as no shorter route can be had, but it will be of little international advantage, inasmuch as it will lead the traffic over the Vancouver and Puget Sound region, instead of directly through the traffic's pulsating heart in the centre of the continent. As a promoter of Canada's interests; as opener of the North-West for cultivation; as a lever for raising the value of the soil, and as an inducement to settlers; this proposed direct trunk line will manifestly surpass anything done so far. It will enormously increase the value in the popular estimation—of the vast triangular territory lying between this line, viz.: the C. P. R. and Pacific shore, or western boundary. It would achieve by one step, one stroke, what otherwise might require the work of generations to accomplish in the usual creeping way, by gradual extensions of the means of communications into the wilderness. It would cut the "Gordian knot" of Canada's transportation problem. Furthermore, it is reasonably certain that Canada's adoption of this line as a fitting national task, would directly react on the U. S. Government, who would, as a matter of course, set about outdoing its past by laying down a line from the Alaskan boundary to Nome. The importance of this dominant line is too obvious to brook delay for petty reasons of jealousy. The connection then, under or above the Behring Strait, and along the eastern shore of Siberia, to the marts of Asia, would no longer appear problematical; but be realized purely as a matter of business:—*C'est le premier pas qui cout.* It is in the power of the Dominion to take the first step.

The eastern part of the proposed transcontinental line—from Winnipeg to the Atlantic coast—is considered a proper national task, and should be built by the Canadian Government. Why not take up the whole problem, and run the line through from Belle Isle to Dawson City? Build slow or quick as the means may allow, but by all means adopt the plan, and let the nations know that the Dominion of Canada is proudly conscious of her favored location on the world's highway of commerce, and is willing to take the responsibility thereof.

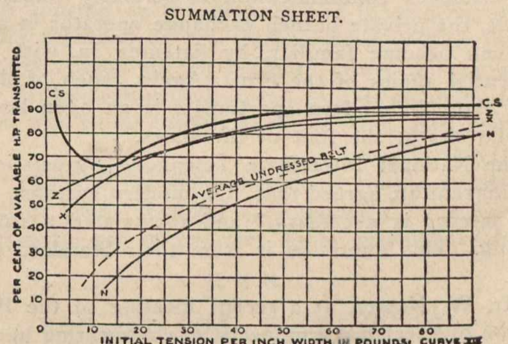
## COMPARATIVE VALUE OF BELT DRESSINGS.

An interesting series of comparative tests has been made on the belt-testing machine of Sibley College, Cornell University, to prove the difference between, and comparative value of, Cling-Surface, neatsfoot oil, and two belt dressings; one in a semi-liquid form, designated here as "Z," and one in a solid form, designated here as "X." The four materials were subjected to a chemical test, to ascertain the presence of resin, free alkali, ammonia, mineral and fatty acids. None of the first three were found in any of the materials. Dressing "Z" contained some free mineral acid. The amount of free fatty acid was as follows:—

Cling-Surface, .027 of 1 per cent.
Neatsfoot oil, .070 of 1 per cent.
Dressing "X", 3.5 per cent.
Dressing "Z", 29.85 per cent.

In making the test four new 4" single-ply belts were used, each being dressed with one of the four dressings. The

SUMMATION SHEET.




Curve 13, showing percentages of power transmitted by the different treated belts at different tensions, by taking 100% as the total amount (see page 28) capable of being transmitted.

engine used had a limit of 40 R.P.M. per minute, the load being applied by means of a pony brake. As will be seen from the chart, the test proved conclusively that it is perfectly feasible to run belts loose, which means increased life for the belt, no slip, no burning of the belt, less wear in journals, less lubrication, less straining of shafting and pulleys, and more available power, few or no stoppages for repairs, and loss in time and product.

The Effect of Preparations Applied to Belts is the title of a complete and comprehensive treatise on this subject, which can be had by writing the Cling-Surface Company, Buffalo, N.Y., U.S.A.

## ELECTRIC LIGHT.

An incandescent lamp of 16-candle power takes .5 ampere at 100 volts potential. It, therefore, requires 3½ to 4 watts per candle. One Board of Trade unit will keep the lamp burning for sixteen hours. One indicated horse-power will run eight lamps. Incandescent lamps are usually run in parallel. The average life is about 1,000 hours.

# THE PROBLEM OF SECRET TELEPHONY

**By Edward P. Thompson.**

If first-class or sealed mail matter were abolished, and if people were obliged to correspond by open letters or postal cards only, all mail matter thus being open to inspection by those through whose hands it passed, it seems evident that both business and social intercourse by correspondence would be seriously crippled. The postal revenue would be reduced also. The public would object to the fact that all their correspondence could be read by post-office employees.

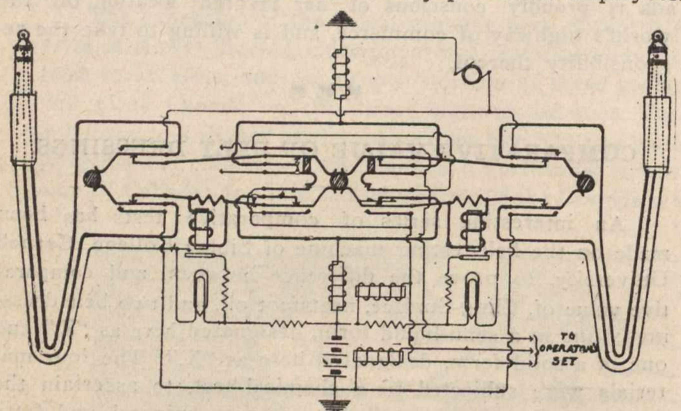


FIG. 1.—DIAGRAM OF CORD CIRCUITS.

As a somewhat parallel case, telephone engineers have always known, but subscribers are only becoming aware, that present telephonic communications are no more private than postal card messages. The objectionable abuses of the operator's power to "listen in," being known, telephone business men, engineers and inventors have taken steps to remedy the deficiency.

Telephone users, in general, experience inconvenience and annoyance resulting from operators listening in. In some instances communication is seriously impaired. For example, the private branch exchange operator in a business office can become familiar, by listening in, with the most confidential affairs of the firm. Again, much of the private life of those in modern apartments is an open book to the girl who sits at the foot of the stairs.

The National Inter-State Telephone Association, at the June convention, agreed that "On modern systems, no listening whatever is necessary," and formulated a rule against listening. This quotation is from their Standard Operating Rules.

Mr. W. Napier, at a recent meeting of the British Institution of Electrical Engineers, in commenting upon similar views of Mr. Herbert Laws Webb in a paper read before the society, approved the latter's remarks by observing that the necessity of listening in on the part of the operator is obviated. To make rules and to show that listening in is not necessary, proves that such listening is objectionable (perhaps as much so as are open letters by mail), but do not prove that the evil is thereby remedied.

Richard M. Beard, chief engineer and vice-president of the International District Telephone Company, of New York, is becoming well known through his success in demonstrating that through the adoption of a few simple expedients, listening in by the operators may be absolutely prevented without detrimental effects in the handling of the traffic. That he has completely solved the problem is established by the sixty-seven claims allowed or granted to him by the Patent Office. One of the broader claims reads as follows: "Listening keys, an operator's circuit normally connected to said keys, and means automatically preventing more than one said listening key being connected to said circuit in listening phase at a time."

Telephone men especially, may be interested in an exposition of the practical construction for carrying out this generic conception, which could be practised in various ways, all of which, however, if done by others, would constitute infringement. The particular manner in which Mr. Beard has constructed plants when applied either to a cord or cordless switchboard, comprises the old elements of an exchange together with the usual listening keys, each having a pair of contacts normally open to the respective subscriber's lines, and an operator's circuit to which said contacts are multiplied, the listening keys having spring contacts preventing said open contacts of any key from being connected to more than one of said subscriber's lines at a time. All the installations in the world, therefore, could be transformed into secret systems, simply by incorporating a few extra contacts in the right places in the listening keys.

The cord circuit in the accompanying diagram, Fig. 1, shows the usual arrangement of lamp supervisory signals and a well-known method of connecting to common battery. It is not claimed that this is the only arrangement or even the best, but one of the many ways of applying this circuit in common battery exchanges. By tracing the circuits, it will be clearly seen that it is impossible for an operator to listen in while two subscribers are in conversation.

Fig. 2 shows a two-way listening and a two-way ringing key mounted on the same escutcheon plate. From this it will be seen that the keys look about like those usually employed in switchboards. The invention, therefore, is not one of complicated apparatus, but a simple arrangement of circuits. It is interesting, furthermore, to note that the estimated extra manufacturing cost of equipping a new one hundred line board is less than ten dollars.

Regarding the former state of the art, perhaps no other invention approaches the solution of the problem so closely as does the old and abandoned common call wire system, in which the operator connects any two subscribers' lines by a pair of cords having no connection with her telephone. The

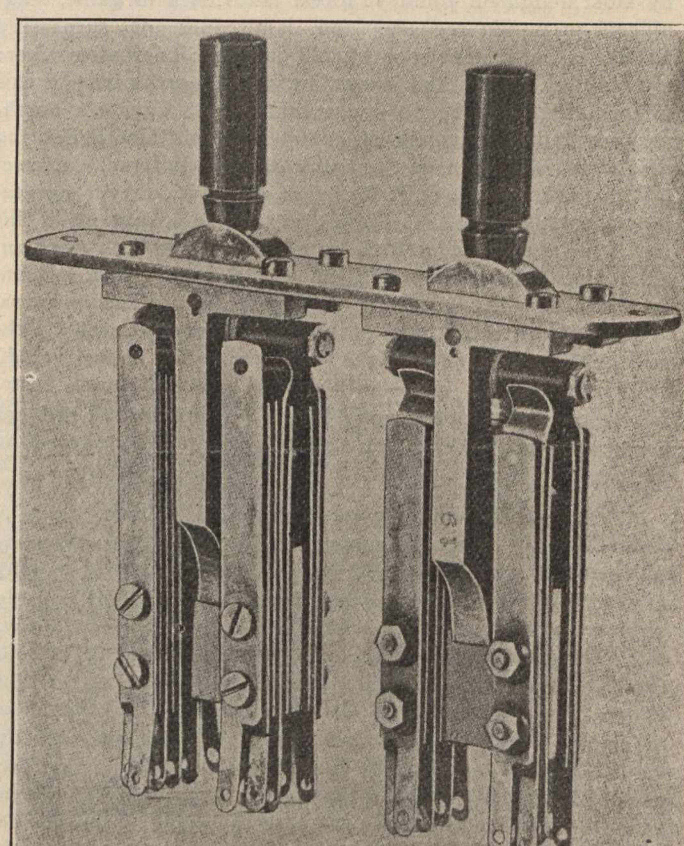


Fig 2.—Two-way Listening and Two-way Ringing Key.

system became obsolete on account of the dire confusion produced by any number of subscribers trying simultaneously to address the operator who listens continuously on the common call wire. It lacked complete secrecy, as the orders of any calling subscriber could be heard by any one or all of the other subscribers. It has no bearing upon modern telephone traffic, because it is a thing of the past. It is dead, except in places like Glasgow, in the municipal plant, and there is moribund.

As in the art of watchmen's clocks (which until recently have defied the cunning of the night watchman in vain), so in the art of the telephone, former inventors have attempted to devise a system which would be perfect, and that would be independent of the employee's sense of honor. The principal attempts in secret telephony will be briefly mentioned.

A patent No. 756,424 of April 5, 1904, is upon an invention entitled "Secrecy System for Telephone Switchboards." However, this system is deficient in failing to provide for one important contingency. Practically and theoretically, the secrecy seems to depend upon the operator being so stupid as not to think of listening by merely connecting the two subscribers with plugs of different pairs, connecting the two plugs together by maintaining her telephone set connected with each pair of cords, and thus listening to the conversation between the subscribers. Operators become extremely intimate with their switchboards, and therefore this expedient would soon occur to their minds.

In patent No. 785,673, of March 21, 1905, an invention is described for the alleged purpose of securing secrecy, but it should properly be classed with the abandoned common call wire system as equally useless; for when the signalling generator is brought into circuit to signal on any one subscriber's line, the signalling current will pass to every subscriber's station where the receiver is on the hook. All or none of the subscribers would be signaled, according to whether the generator is powerful enough to ring all the subscriber's signals in parallel. Independently of this prohibitive feature, the jacks and plugs disclosed in the patent could be manipulated for listening in on the "connections" almost as conveniently as by the ordinary bridging key. Thus is chronicled another effort toward the desired end, but which still falls short of attaining it.

Heretofore, others have alleged a solution of the problem of secret telephony, but the evidence, it seems to me, shows, as in the instance cited, that Mr. Beard is the first and sole inventor of a system that is in itself, operative, simple and practical—as secret as a sealed message—and at the same time differing radically from the abandoned common call wire installation and former attempts generally in being readily applicable to the modern and standard cord or cordless telephone exchange switchboard, and still not involving visionary and undesirable complications, like relays, "attachments," or intricate mechanisms. For these reasons, it was thought by the writer that an article on the subject might be of interest to the readers of the leading electrical periodical. Recently the invention was installed and given a thorough trial in actual service in the exchange at Elizabeth, N.J. The result indicated a successful solution of this important problem. On the whole, the invention appears to be the most marked advance in the telephone art in recent years.—Electrical World and Engineer, Nov. 11, 1905.

## STORAGE BATTERY LOCOMOTIVE FOR INTERWORKS TRANSPORTATION.

Through the courtesy of the Canadian Westinghouse Company, Limited, we are enabled to set before our readers an illustration of one of their storage battery electric locomotives, which we saw running about their fine Hamilton shops recently.

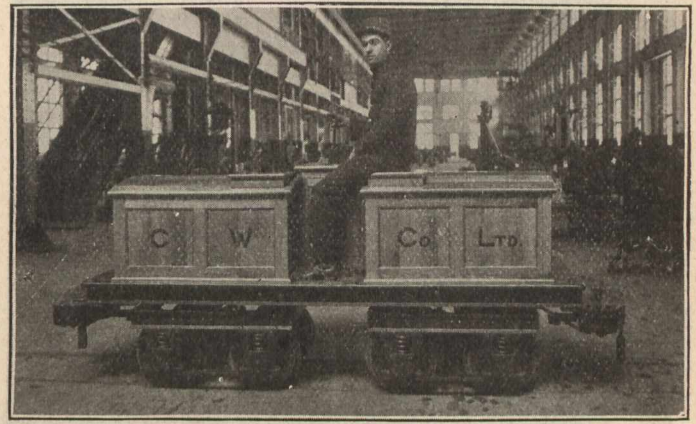
A notable feature in modern, highly organized industrial establishments is the amount of thought and ingenuity expended on the design and arrangement of their interworks transportation systems.

Owing to the increasing size of these establishments, and enormous output of their modern "rapid production machinery," the question of supplying raw materials, and transporting the finished parts from the various points of manufacture to the assembling floors, and to and from warehouses and storerooms, has become one of great importance.

The first important innovation was the electric travelling bridge crane; then came the electric travelling jib crane, capable of passing up and down the shops between the fixed jib cranes on ground floor and heavy travellers overhead. The latest example of progress in shops of magnitude is the supplementation of the crane service by a system of industrial railways, and running thereon, storage battery electric locomotives.

One of the first firms in the Dominion to adopt this method of interworks transportation has been the Canadian Westinghouse Company, Limited, of Hamilton, Ontario. They have in use several locomotives of this description, of their own manufacture, and a few facts in regard to their system may be interesting to our readers.

They have at present in service 2,000 feet of track, 24 inch gauge, constructed of T rails 16½ lbs. weight per yard, spiked to ties in the usual manner. Where this track is inside of the buildings, the top of the rail head is level with the floor, and the space between the rails is covered with the usual flooring material, so as to present as little obstruction as possible to the use of hand trucks, etc.




The locomotive which seemed best suited for their use, is the one shown above. It has a total weight of 6,000 lbs., a draw bar pull of 1,050 lbs., is constructed with swivel or bogie trucks, to enable it to pass around curves of very short radius, and is capable of handling eight to ten loaded shop cars. The storage batteries are mounted in a lead lined hardwood housing on the deck of the locomotive, and the motors are mounted on the trucks, and geared to the axles in a manner similar to the ordinary street railway motors. They are of the type manufactured by this company for motor vehicle use, being entirely enclosed, and dust and water proof.

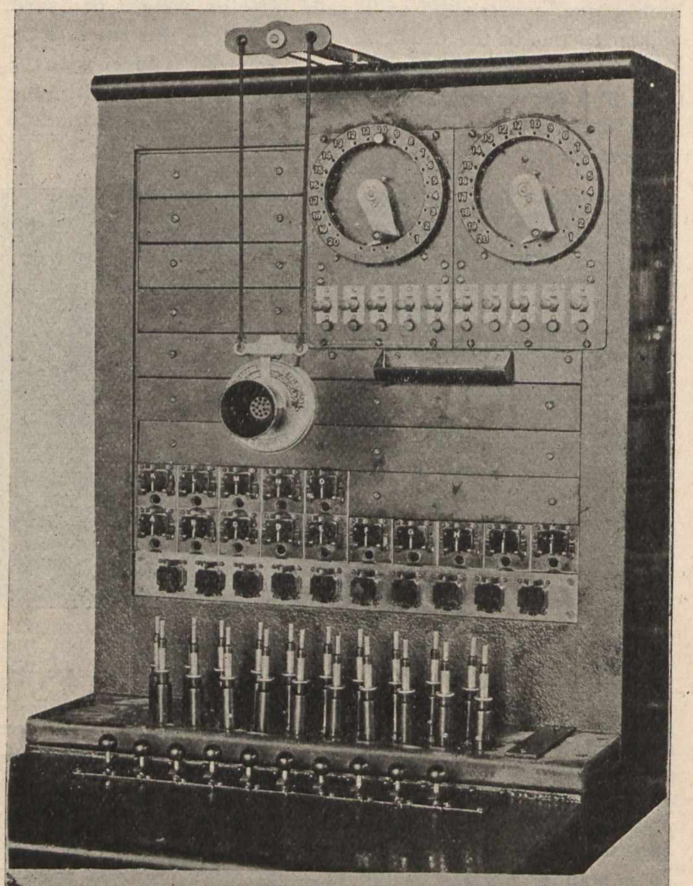
The method of control is extremely simple, consisting of a small drum type controller operated by a short lever, and the whole outfit can be operated by an intelligent laborer.

## IRON AND COAL PRODUCTION.

The world's production of iron ore, coal, pig iron, and steel for 1903 has been engaging the attention of the American Iron and Steel Association, and the tabulated results make interesting reading. The work involved in their compilation must have been enormous on account of the different systems of standard weights. However, a fair comparison has been made, and it is clear that in the total production of iron ore, and coal, and lignite, the United States, Great Britain and Germany, and Luxemburg, are responsible for nearly three-fourths of the whole quantity raised. America leads the way with a percentage of 34.95 per cent. in the case of iron ore, and 36.48 in the case of coal and lignite. The figures of Great Britain and Germany respectively are 13.69 and 26.34, and 21.19 and 18.57. It has been estimated that the world's production of iron ore in 1880 was about 43,359,000 tons, in 1890 about 57,474,000, in 1900 about 90,000,000 tons, and in 1903 about 100,198,000. In 1873 the world's production of coal was put down at about 262,567,000 tons, in 1883 at about 398,012,000 tons, in 1894 about 552,650,000 tons, and in 1903 about 874,620,000 tons. The manufacture of pig iron and steel has proportionately increased, pig iron having gone up from 825,000 tons in 1800, to 46,381,000 tons in 1903, and steel from 3,021,000 tons in 1878 to 35,883,000 in 1903. Here again the United States is by far the largest producing country, her output of pig iron being a little over 39 per cent. of the total, and of steel just somewhat below 41 per cent., Great Britain's share is 19.27 per cent. of the pig iron, and 14.31 per cent. of the steel, and Germany's is 21.75 and 24.53 per cent., respectively. The relative position of the three great producers of coal and iron is sometimes apt to be forgotten by believers in this country's great natural resources.

## SECRET SERVICE SWITCHBOARD.

The switchboard illustrated was designed for the Citizens' Telephone Co., Decatur,, Ind., by the Baird Manufacturing Co., of Chicago. It is equipped to take care of fifteen rural lines, each line having a capacity of nineteen telephones, a total of 285 instruments, each of which enjoys the same privacy as an individual subscriber on an individual full metallic circuit. The calling apparatus is shown in the upper right-hand corner; this operates the lockout mechanism of the various phones, and are connected into the cord circuits of switchboard in such a manner that one calling device will take care of all the calls an operator can handle with five pairs of cords. The instruments on the line are not connected with the calling device until the operator plugs in, the calling device being connected into the cord circuit, and not the line circuit. Decatur to-day has 130 of these instruments in use, and is equipping its exchange to take care of double the present facilities, which proves that the apparatus has substantial merits.



The Baird Secret Service Switchboard.

## HIGH-SPEED, AUTOMATIC, VERTICAL STEAM ENGINE.

The newly-dawned twentieth century is witnessing a great conflict of forces between steam, gas and oil as prime movers. Father Time, with the law of the survival of the fittest in one hand and his keen sickle in the other, is cutting down on every hand cumbersome, complex, uneconomical, obsolete types of reciprocating steam engines. The museum is geeting some; the scrap-heap and foundry cupola are receiving more. Only those plants employing the most skilful designers, equipped with the finest modern machinery, using the best material, and hence, putting on the market prime movers which embody the highest conceptions of the science of engineering and the most perfect product of the mechanic's art are holding their own. In this latter class may be ranked high the manufacturers of the neat, compact, efficient, high-speed vertical steam engine, illustrated in Fig. 1:—

These engines are specially designed for the driving of direct-connected generators, pressure blowers, etc. Being of comparatively large cylinder diameter and short stroke, they develop great power and high rotative speed without excessive piston travel. A system of forced lubrication and the complete enclosure of the moving parts provide for continuous operation for weeks at a time, without attention, and ensure perfect reliability, even in the hands of the unskilled. Within the heavy cast-iron base, to which is bolted the lower part of the frame, a submerged oil-pump, operated by the crank-shaft, draws oil from the reservoir, and forces it through pipes and internal passages in the moving parts to the crank-pin, the wrist-pin, and the main bearings. Twice during each revolution the reversal of stress on these parts, due to the double-acting feature of the engine, so reduces the pressure that the pump has an excellent opportunity to force between the surfaces a fresh film of oil, which is carried around to lubricate the rotating parts when the pressure is greater. The pressure of 10 to 20 pounds per square inch positively maintains this film of oil, preventing actual contact of metal, reducing wear and friction to a minimum, and ensuring a mechanical efficiency of over 90 per cent. Centrifugal oil-guards, located on the shaft just where it passes through the casing, together with the enclosing frame and the water-shed partition, ensure perfect cleanliness, and absolutely prevent the escape of the oil, which is continuously repumped to the bearings.

The watershed partition, a valuable and distinctive feature, prevents water from the piston-rod stuffing-box mixing with the lubricating oil in the case, and at the same time makes impossible the passage of oil from the enclosing frame to the interior of the cylinder. The piston-rod stuffing-box may be readily adjusted without opening the case. This watershed partition forms a part of the enclosing frame which protects the parts from dirt and accident, ensures economy, and eliminates the necessity of frequent attention; but the removable oil-tight plates or covers make the parts as accessible as in the open type of engine.

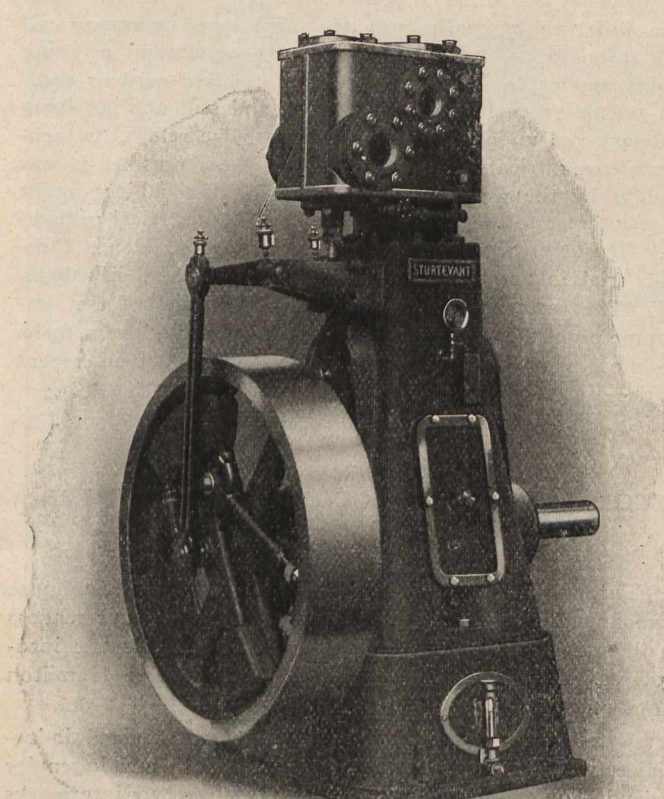



Fig. 1.

The cylinder, with which is cast the valve chamber, is provided with relief valves, which, by opening automatically at any pre-determined pressure, prevent possible damage by water. A planished sheet-iron cylinder casing enclosing a thick layer of asbestos greatly reduces condensation. This lagging need not be disturbed, for the cylinder is tapped for the indicator. The flow of steam to and from the cylinder is controlled by a perfectly-balanced piston valve, possessing the simplicity of the plain slide valve, but requiring only a minimum of power to operate. The snap rings on this valve ensure tightness, while the bushing in which it moves may be easily replaced when worn. A Rites governor, placed within the heavy fly-wheel, gives motion to the valve through the medium of a rocker, and alters the cut-off by changing the valve travel, permitting only 1½ per cent. variation in speed between no load and full load. The hollow cast-iron piston, strengthened by internal ribs, is fastened to the piston rod by a forced taper fit, secured by a nut. To prevent leakage without unduly increasing friction, the cast-iron packing rings are turned to a perfect contact.

Open-hearth steel is the material from which are forged the piston rod, connecting rod, and crank shaft; each from a single piece. The composition boxes of the connecting rod are lined with Sturtevant white metal, hammered in and accurately bored; the cast-iron cross-head is equipped with adjustable shoes and a nickel-steel wrist pin; and the crank pin is of such unusually large size that it cannot heat, since the intensity of pressure is always low and the lubrication ample and positive. The manufacturers are B. F. Sturtevant Company, Hyde Park, Mass., U.S.A.

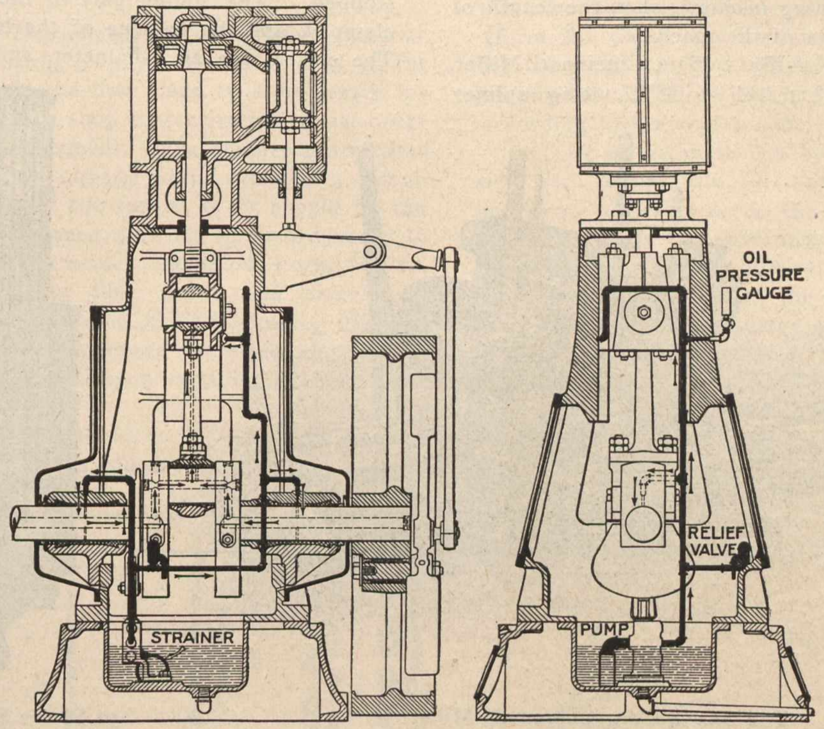


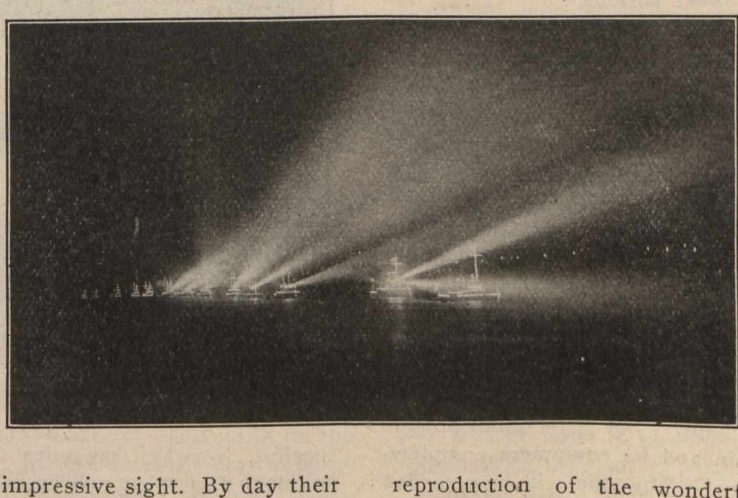

Fig. 2.

Showing System of Forced Lubrication, Watershed Partition and Enclosing Frame.

## A TRIUMPH IN ELECTRICAL DISPLAY.

Electricity played its own brilliant part in the recent ovation tendered by Greater New York to Prince Louis of Battenburg and the officers and men of His Britannic Majesty's Atlantic Squadron. The imposing array of battleships of the British and American navies anchored in the Hudson made a beautiful and impressive sight. By day their graceful lines stood out clearly and sharply defined against the dark background of the Jersey shore. But it was something never to be forgotten by those who saw it when, on the first evening of their anchorage, each ship burst forth in a perfect glory of illumination from stem to stern, and the effect was heightened by the long, bright streamers of their searchlights, which played about in all directions.

Through the courtesy of the New York Edison Company we are enabled to give our readers an actual picture reproduction of the wonderful scene witnessed on the Hudson on the 9th of November last, when the Union Jack and the Stars and Stripes were intertwined in token of mutual good-will and the noble spirit of fraternity.



# MACHINE SHOP NOTES FROM THE STATES

By Charles S. Gingrich, M.E.

XXIII.

A very interesting piece of work is shown in the accompanying illustrations, showing a method for cutting long splines into shafts on a milling machine when the length of the cut is beyond the range of the machine.

The illustration shows a No. 2 Plain Cincinnati Miller, (which has maximum table travel of 28") cutting splines ¼" wide, 11-64" deep, and 44" long, at a single cut in two shafts at one time. It is provided with a special fixture, which consists of a main base secured to the machine, and to this is attached a sliding part, which is provided with jaws for holding the work, and then when the splines have been milled part of the length, the clamps are loosened, and the table of the machine is returned to the end of its travel ready to begin the balance of the cut, and while this is done, the cutters remain in the work exactly as when the machine was stopped. The sliding part of the fixture is then securely clamped, and the balance of the length of the slots is cut. The cutters are 2½" diameter, and ¼" wide, run 112 revolutions per minute, with a feed of .050" per turn, giving a table travel of 5.6" per minute.

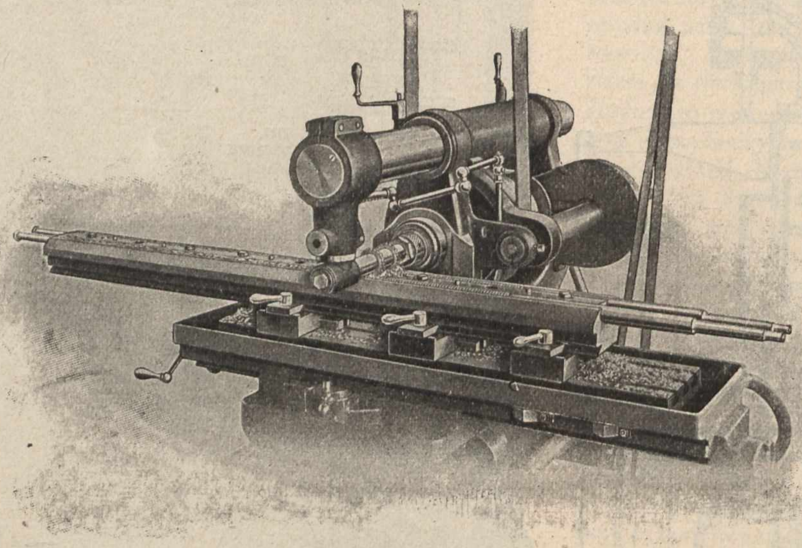


Fig. 1.
The No. 2 Plain Cincinnati Miller.

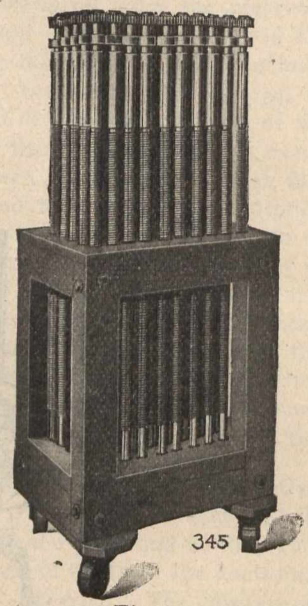



Fig. 2.
50 Pieces Splined in Eight Hours.

Fig. 2 shows a lot of 50 of these pieces, which have been splined on the above machine by this process in eight hours' time. The finished splines are smooth and accurate to gauge.

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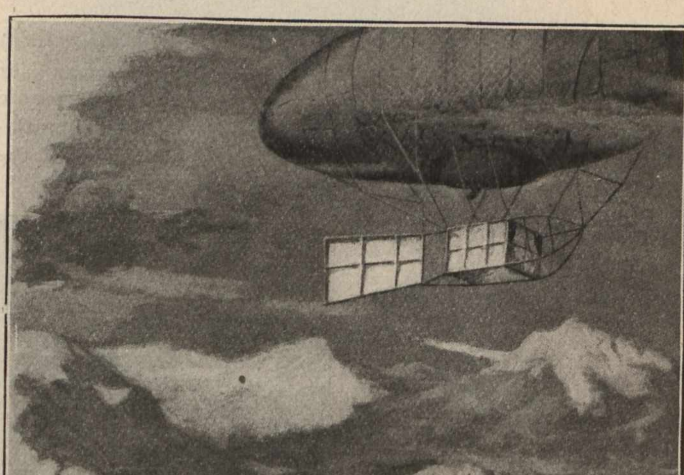
## TO THE NORTH POLE BY AIR-SHIP AND WIRELESS.

Almost simultaneous with the announcement of the *Canadian* scheme of Captain Bernier, to reach the North Pole per the good ship "Arctic," sailing by way of Behring Sea into the Arctic basin, and from a point 72 north and 165 west, drifting to within 150 miles of the coveted centre; finishing the search on foot, aided by aluminium staff, wireless telegraph, etc., comes the startling proclamation of an *American* expedition, to be characterized by all the splendid audacity and contempt for tradition which differentiates the great Western Republic from other nations.

On behalf of the Chicago "Record-Herald," Mr. Walter Wellman, the journalist, will assay this year to reach the North Pole in a Santos-Dumont air-ship, built by Louis Godard in Paris, and ready next April. From an easily reached base of operations in Northern Spitzbergen he will have but 550 geographical miles to go to the pole, and a like distance for the return voyage. The whole 1,200 miles mean but 100 hours of motoring at 12 miles an hour. Santos-Dumont has repeatedly made from 19 to 23 miles an hour with small air-ships equipped with relatively small motors. The air-ship will be the largest practicable one ever built. It will be 196 ft. long and its greatest diameter will be 49 ft. Its surface will measure 23,000 sq. ft., and its volume will be 226,000 cubic ft. Inflated with hydrogen, it will have a total ascensional force of 15,300 pounds. Seven thousand pounds will be the weight of the ship and its equipment complete, leaving 8,000 pounds for cargo. The ship will be provided with three motors, with a combined energy of 70 H.P.. If the winds hinder no more than they help, and there are no delays, the ship can motor from North Spitzbergen to the pole in 45 hours. The airship will have an endurance capacity in buoyancy sufficient to enable it to remain 25 to 30 days in the air. It will carry 5,500 pounds of gasoline and its distance capacity during calm weather will be 1,800 miles more than the distance from Spitzbergen straight across the pole and the whole Arctic ocean to Alaska. Wireless telegraph stations will be established at Spitzbergen and Hammerfest, Norway, 600 miles distant. Further than this, a wireless equipment will be carried in the airship, and it will be the effort to send frequent, if possible, daily despatches to the outside world throughout all the time the expedition is in the Arctic regions, even from the pole itself, if the courageous aeronauts have the good fortune to reach it.—"Electrical World," Jan. 6, 1906.



# SYSTEM IN INDUSTRIAL ESTABLISHMENTS

BY A. J. LAVOIE.



## THE MAKING OF THE PATTERN.

Article VIII.

How is the Cost Department to know what material, labor and machine work, if any, has been used in the making of a pattern? In the first place, it is necessary for the foreman of the pattern shop to receive an official order from the Production Department. (The number and method of issuing this order has already been explained.) Simultaneous with the advent of the formal order should be the delivery of a fully dimensioned drawing, in accordance with which the pattern is to be made. On chart, Form No. 61, the method of distributing blue prints and sketches is clearly indicated. One blue print off each drawing involved is sent to the respective departments interested, and in each case the deliverer must insist upon receiving a receipt for same.

The shop order (original form Nos. 15 and 99), on which is inscribed the pattern and drawing numbers, having been delivered to Department No. 8, and the full complement of blue prints having been placed in the Tool Room, accompanied by Instruction Card Nos. 11 and 12, if any have been made, the next course of procedure will be the preparation of a job card for the pattern maker, as follows:—

(1) All job cards are prepared in the foreman's office by his clerk, who also handles the stores, tool room, and indexing of all patterns; in fact, performs all the clerical duties pertaining to the pattern shop.

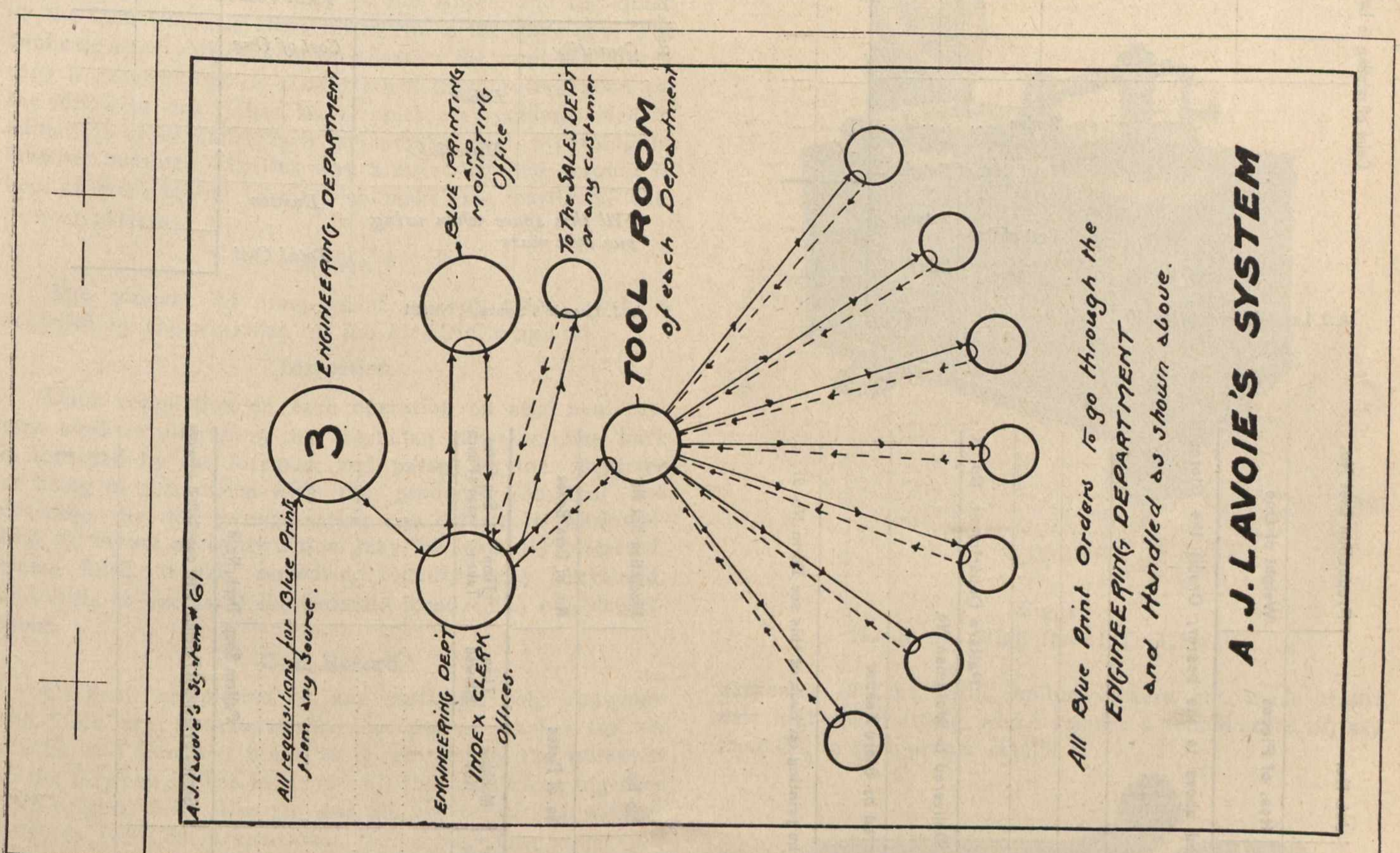
(3) Upon receipt of a shop order on form No. 15 and 99, to make or alter any pattern, the clerk fills in the "job cards," form No. 9 and 20 and Nos. 110 and 20 in one operation, viz., by placing a carbon paper between form Nos. 110 and 20 and form Nos. 9 and 20, then write on the former the drawing number, pattern number, job number, description of article, and, if an estimate has been made, enter also data contained on Instruction Card No. 11 and 12, the Instruction Card number to be written on form No. 20. The clerk then places this data, together with the blue prints before the foreman, who straightway indicates the workman who is to do the work. Thereupon the clerk inscribes the workman's check number on the job card (form No. 9 and 20), and places it in the filing case set up for the purpose. The original card, No. 110* and 20, must be indexed in numerical order under job numbers, and according to drawing numbers.

(3) If no estimate has been prepared, and no Instruction Card issued, the foreman should not only select the workman he wants to do the work, but should instruct his clerk to specify the operations he desires performed first.

Assuming that the job cards have been filled and properly indexed, how does the work apportioned reach the selected workman in a large establishment?

Hard-earned experience has demonstrated that it is sound economy to set apart some one to specially look after the mechanics' supplies, job cards, drawings, material, etc., since it relieves the high-priced foreman of clerical detail and routine, and gives him more time to be around the benches of his men, counselling and advising on short cuts and expeditious methods of construction. A good plan is to relegate this work to an apprentice during his first year. In this way he soon becomes familiar with the names of tools, nature of materials, and purpose of drawings, getting an insight into detail and a comprehensive view of the "pattern" maker's craft, which is bound to evoke interest and enthusiasm for his chosen trade. Hence, when he goes to the bench to handle edged tools and the wood of his employer it will be with a keener perception of his duties and a higher sense of responsibility than if he had spent his first six months or a year running errands, melting glue and sweeping the shop floor, which is the common use made of first-year apprentices in the average pattern shop to-day. No wonder there is an outcry for skilled artizans when the foundations are laid in this way.

When a workman is on the point of completing a job he calls an apprentice and hands him *two* of his checks, of




*Form 110 is precisely similar to form No. 9, except that it is printed on light paper, the number being changed to 110. Printed black on 20 lb. salmon color bond paper.

## COST CARD.

Color of printing to be the same as the other side of the form, wherever it may be used

| Operation No. | Workman's Check No. | Machine No. | HOURS: Day Work | Over-time | Bonus | Rate per Hour | Amount $ | c. |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Instruction Card No. | | | Burden .. | | | | | |
| | | | Total Value of Labor .. | | | | | |

| Quantity | Remarks | Material | Rate | $ | c. |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | Burden .. | | | |
| | | Total Cost of Material .. | | | |
| | | Cost of One — Material .. | | | |
| | | Cost of One — Labor .. | | | |
| | | Total.. | | | |

A. J. Lavoie's System, No. 20

## COST CARD.

Back of Form Nos. 10, 32, 36, 37, 39, 40, 41, 42, 56, etc.

| *Bought from* | |
|---|---|
| *Catalogue No.* | *Figure No.* |
| *Page No.* | *Customs Charges* |
| *Remarks* | |

| *Quantity* | | *Cost of One* | *Amount for All* |
|---|---|---|---|
| | *Material* | | |
| | *Cartage* | | |
| *Fill this space when Buying from Outsiders* | | *Burden* | |
| | | *Total Cost* | |

| *Quantity* | | *Cost of One* | |
|---|---|---|---|
| | *Labor* | | |
| | *Material* | | |
| *Fill this space when using our own make* | | *Burden* | |
| | | *Total Cost* | |

A. J. Lavoie's System, No. 21

| Drawing No. | Pattern No. | Material | Job No. | Production List No. |
|---|---|---|---|---|
| Name of Article | | | Nos. of Pieces | Weight of One |

STORE-KEEPER.—Please deliver the articles described above to the bearer, Credit the Stores Account, and send this card to the Cost Office.
Remarks:

A. J. Lavoie's System, No. 37 — Pattern Department, No. 8

| Date Order was received | Date Article was delivered | Delivered to Workman No. |
|---|---|---|
| Issued by Foreman | | Delivered by Store-Keeper |

Printed black, on 20 lbs. salmon color bond paper. For the printing on back of this see Form No. 21

| Drawing No. | Pattern No. | Material | Job No. | Production List No |
|---|---|---|---|---|
| Name of Article | | | No. of Pieces | No. of Core Boxes |

| Date Received | Operations | Workman's Check No. | Machine No. | Time Allowed | Time Taken | Sub Foreman's Punch |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

A. J. Lavoie's System, No. 9 — Pattern Shop Dept., No. 8

Work must be Inspected before it leaves the machine or the bench. Signed by General Foreman after completion of work

| Passed by | P u n c h H e r e | Inspector |
|---|---|---|

Printed black on 100 lbs. salmon board, good quality which he has several. The apprentice takes them to the clerk in the foreman's office, who looks in his index file at the place allotted to the particular workman's check number, takes out the original job card, No. 9 and 20, and gives it to the apprentice, who in turn hands the clerk one of the workman's checks, which is deposited in the place previously occupied by the job card No. 9 and 20, until the same is returned to the office. The apprentice thereupon looks at the job card, glances at the drawing number indicated, and asks for same, and upon receiving the blue print, hands to the clerk in exchange the second check, which is also retained in the office until the drawing is returned. Job card and blue print are then conveyed by the apprentice to the workman, who, after inspection of the drawing, gives the apprentice a memorandum of the tools he requires, handing to him at the same time as many checks as tools required; and the checks are held in the tool room until the tools are returned. In this way track is kept as to the whereabout of the job cards, drawings and tools.

### Material.

The foreman having made, or received from a workman, an estimate of the lumber required for a particular job, enters his requirements on form No. 37 and 21, in duplicate, despatching the original copy to the stores, and the other to the Cost Office, in Department No. 4, the same day. The duplicate copy will be kept on separate file until the Stores copy is received, which should reach there before noon on the following day. Then both copies are regularly filed in numerical order under their job number; and according to drawing number. In this way a strict detailed account is kept of the material required to make any particular pattern or patterns.

### Labor.

The amount of time spent on any given work is recorded by the workman on job card No. 9 and 20.

### Inspection.

Upon completion of each operation on any new pattern work or alteration, the workman must at once have it approved by the foreman, and passed by the inspector as being in accordance with the produced job card and drawing. By this prompt action any defects in workmanship or errors in construction may be instantly detected, blame fixed, trouble remedied, foundry delay prevented, and costs in excess of the estimate localized to one department.

### Cost Record.

On final completion of any particular job, drawings and tools are exchanged by the pattern maker for his checks, and form No. 9 and 20 is returned by the workman to the foreman's office for approval; then this form, together with original form No. 110 and 20, are forwarded without delay to the Cost Department, No. 4, and filed under job number according to drawing number.

### Storage.

Immediately the pattern is checked and passed it must be transferred to the pattern vault for storage.

### Pattern Shop Records.

The clerk to pattern shop straightway enters the precise location of the pattern in vault on index card No. 62* and 15, in numerical order under pattern numbers, forgetting not to inscribe on said card all necessary information relating to the particular pattern for future reference, and in addition must fill in his pattern order form No. 15 and 99 to correspond with pattern index card No. 62 and 15, returning card No. 15 and 99 to the Production Department Office for cancellation, at the same time returns the blue prints to Engineering Department, so that they may be used by other departments. The Production Department then transfers No. 15 and 99 to index clerk in Department No. 3, who makes his record card No. 15 and 100 to correspond with No. 15 and 99. This done, original form No. 15 and 99 is delivered by Department No. 3 to Cost Office, where complete cost account of making the pattern is prepared from the data furnished on form No. 15 and 99 for labor, and from form No. 37 and 21 for material.

In our next chapter we shall set forth what happens to the pattern after being deposited in the pattern vault.

(Continued.)

*Form No. 62 is precisely similar to form No. 99, with the exception of the words "Pattern Index in Engineering Dept." which should be changed to "Pattern Vault Index," the number being changed to 62.

## ROCKWELL FURNACES: HARDENING, WELDING, ANNEALING.

In modern machine shops, the general introduction of high-speed tool steels has necessitated more expeditious, economical and accurate methods of temperature treatment. The system illustrated in Fig. 1 is admirably adapted for the hardening of taps, drills, milling cutters, etc., made of the new high-speed steels, which require a temperature of, say 2200° F., to give proper results.

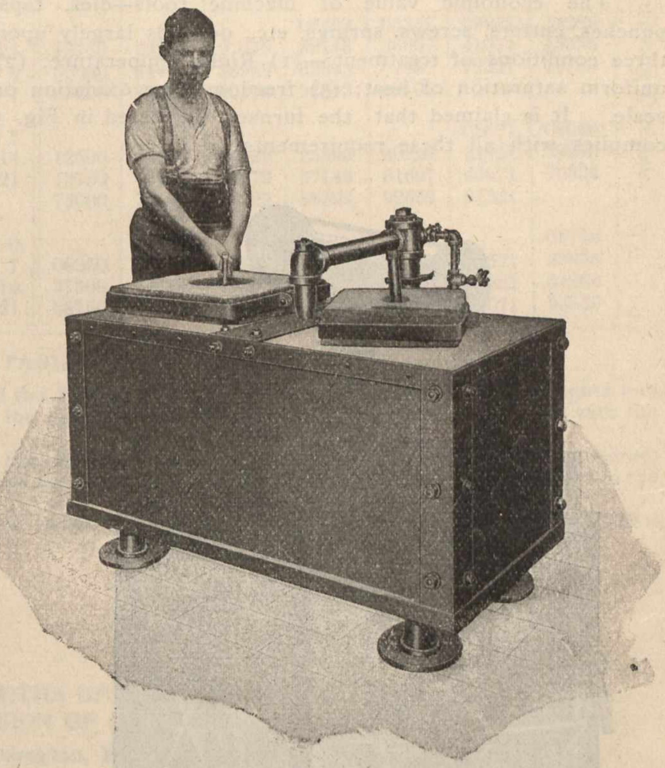


Fig. 1.
Hardening High Speed Tool Steels.

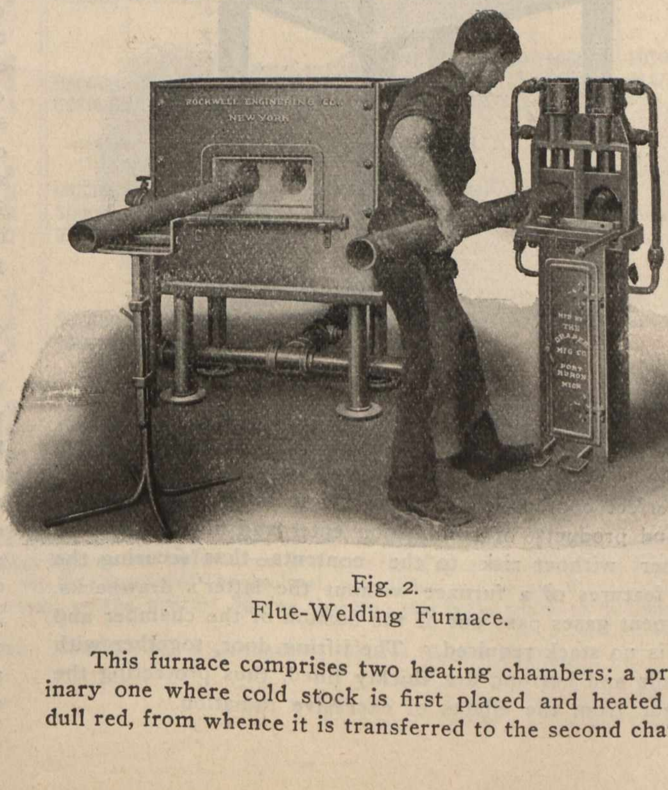



Fig. 2.
Flue-Welding Furnace.

This furnace comprises two heating chambers; a preliminary one where cold stock is first placed and heated to a dull red, from whence it is transferred to the second chamber for bringing to full hardening temperature. In both chambers the stock is protected from direct contact with the furnace gases by graphite crucibles. The stock may be suspended from the top on soft iron wires—the practice advocated and used by the steel manufacturers. The furnace has one burner, and may be fired either with oil or gas; operated by blast in both cases. It requires 15 minutes to raise the heat to hardening temperature, on a consumption of about four gallons of oil per hour.

The neat, compact furnace shown in Fig. 2 is designed to take flues up to 4" diameter, and will heat this size to a welding heat in 1½ minutes. Two burners are used, and the furnace may be fired with either fuel, oil or gas. Under full heat, it consumes seven gallons of oil per hour or about 700 cubic feet of gas—only takes 10 minutes to raise heat to welding temperature—starting cold. A convenient provision is that worn out tiles can be replaced without changing body of furnace.

The economic value of machine tools—dies, taps, punches, cutters, screws, springs, etc., depends largely upon three conditions of treatment:—(1) Right temperature; (2) uniform saturation of heat; (3) freedom from oxidation or scale. It is claimed that the furnace indicated in Fig. 3 complies with all these requirements.

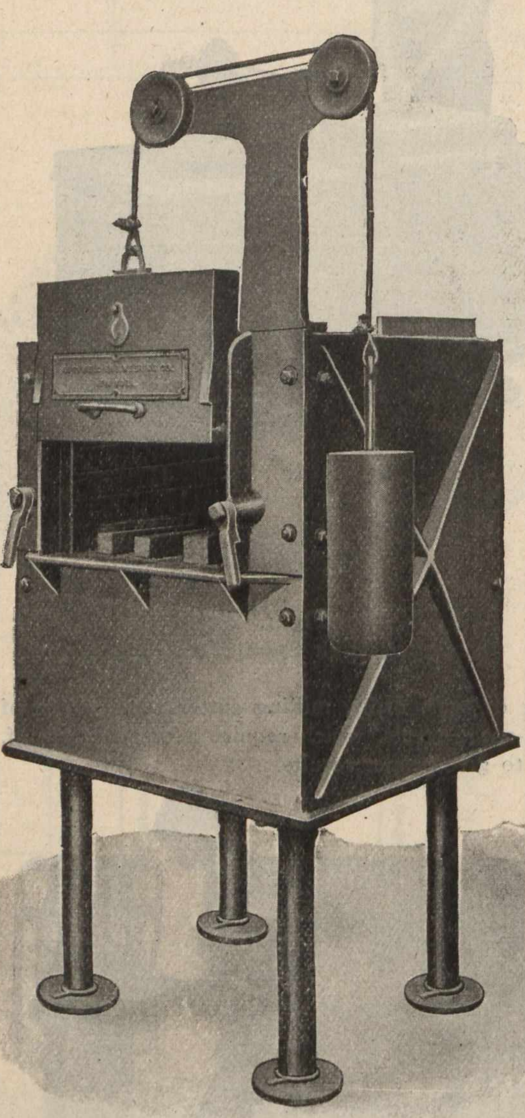


Fig. 3.
Case Hardening and Annealing Furnace.

Perfect combustion is made below the furnace and the heat and products of combustion enter and fill the heating chamber without risk to the contents—thus securing the good features of a furnace without the latter's drawbacks. The spent gases pass out of the bottom of the chamber and there is no stack required. The lifting door, together with the rails and bottom, are thickly lined, thus protecting the operator from the effects of excessive radiation.

## PIPE-THAWING BY ELECTRICITY.

The pipe-thawing outfit of the Durango Light and Power Company in Colorado, Fig. 1, has a switchboard erected in the vehicle above four Westinghouse transformers. At the top of the switchboard is a 150-volt voltmeter and an ammeter of 350 amperes capacity, together with 8,100 ampere single-pole cartridge fuses; below these are four double-pole knife switches of 75 amperes, while

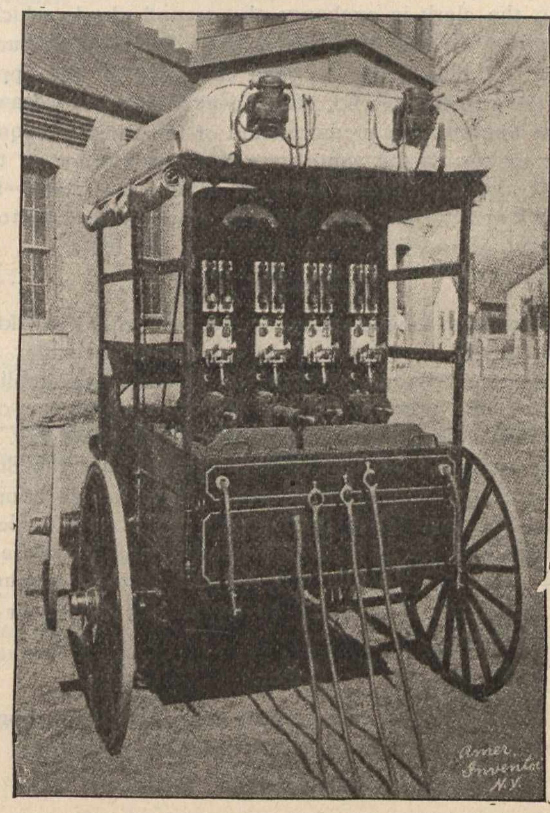



Fig. 1.

in front of the switchboard are installed four choking coils or reactive coils used to regulate the transformer secondary voltage. These coils are 1.5 feet long, and a core slides in a tube 2.5 inches in diameter. Two 30-ampere primary cut-outs are mounted upon the back of the vehicle, together with a 30-ampere, double pole, 500-volt, quick-break knife switches of 75 amperes, while in front of the circuit of 1,100 volts.

For carrying the heavy current, No. 0 and 00 cables are used for connecting to fire hydrants, water faucets or iron piping. On arriving at the place where the pipe is to be thawed the primary wires are connected to the nearest circuit and the secondary cables are connected with the piping or faucets at points including the frozen section. Both the secondary and primary switches are then closed, and the cores of the choking coils are adjusted until the proper amount of current is delivered to heat the iron pipe, which is usually from 50 to 100 feet in length and ¾ of an inch in diameter. About 125 to 150 amperes are used ordinarily for from 1 to 10 minutes, it is stated.

It is said that with this outfit nearly a third of a mile of cast-iron pipe of 4-inch diameter was thawed out in sections with a current of only 250 amperes. A short section was taken at a time, and the entire length was in service within three hours. It is also stated that 700 feet of 1-inch pipe was cleared of ice with 175 amperes in about 20 minutes, one of the secondaries being connected to a fire hydrant near the main, and the other to the water pipe of the farthest of five houses on this line. It is stated that but a very small percentage of the pipes thawed have burst, this never occurring when the pipes have been frozen less than a day. A charge of $5 is made by the electric company for thawing a service pipe of ordinary dimensions, making the cost but a small fraction of a plumber's bill were he required to dig up a service pipe in order to clear it of ice.

# EXTRACTS FROM AN ENGINEER'S NOTE BOOK

## A Contribution to the Decimal System.

### TABLE FOR CONVERTING HUNDREDWEIGHTS, QUARTERS AND POUNDS INTO DECIMALS OF A TON, AND FOR RECONVERSION OF DECIMALS.

Adapted from Major-General Hannyngton, F.I.A.

| HUNDREDWEIGHTS (First pair of Decimals.) | | | | | | POUNDS (Third and following Decimals.) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 1 2 3 4 | 5 6 7 8 9 | 10 11 12 13 14 | 15 16 17 18 19 | *Qrs.* | *Lbs.* | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| | | | | | 0 | 00000 | 04464 | 08929 | 13393 | 17857 | 22321 | 26786 |
| .00.05.10.15.20 | .25.30.35.40.45 | .50.55.60.65.70 | .75.80.85.90.95 | | 7 | 31250 | 35714 | 40179 | 44643 | 49107 | 53571 | 58036 |
| | | | | | 14 | 62500 | 66964 | 71429 | 75893 | 80357 | 84821 | 89286 |
| | | | | | 21 | 93750 | 98214 | | | | | |
| | | | | | 21 | | | 02679 | 07143 | 11607 | 16071 | 20536 |
| .01.06.11.16.21 | .26.31.36.41.46 | .51.56.61.66.71 | .76.81.86.91.96 | 1 | 0 | 25000 | 29464 | 33929 | 38393 | 42857 | 47321 | 51786 |
| | | | | | 7 | 56250 | 60714 | 65179 | 69643 | 74107 | 78571 | 83036 |
| | | | | | 14 | 87500 | 91964 | 96429 | | | | |
| | | | | | 14 | | | | 00893 | 05357 | 09821 | 14286 |
| .02.07.12.17.22 | .27.32.37.42.47 | .52.57.62.67.72 | .77.82.87.92.97 | | 21 | 18750 | 23214 | 27679 | 32143 | 36607 | 41071 | 45536 |
| | | | | 2 | 0 | 50000 | 54464 | 58929 | 63393 | 67857 | 72321 | 76786 |
| | | | | | 7 | 81250 | 85714 | 90179 | 94643 | 99107 | | |
| | | | | | 7 | | | | | | 03571 | 08036 |
| .03.08.13.18.23 | .28.33.38.43.48 | .53.58.63.68.73 | .78.83.88.93.98 | | 14 | 12500 | 16964 | 21429 | 25893 | 30357 | 34821 | 39286 |
| | | | | | 21 | 43750 | 48214 | 52679 | 57143 | 61607 | 66071 | 70536 |
| | | | | 3 | | 75000 | 79464 | 83929 | 88393 | 92857 | 97321 | |
| | | | | | 0 | | | | | | | 01786 |
| .04.09.14.19.24 | .29.34.39.44.49 | .54.59.64.69.74 | .79.84.89.94.99 | | 7 | 06250 | 10714 | 15179 | 19643 | 24107 | 28571 | 33036 |
| | | | | | 14 | 37500 | 41964 | 46429 | 50893 | 55357 | 59821 | 64286 |
| | | | | | 21 | 68750 | 73214 | 77679 | 82143 | 86607 | 91071 | 95536 |

TO USE THE TABLE.

Find the Hundredweights at the top, the Quarters in the margin, and the Pounds at the top. Then under the Hundredweights and in the bracket with the Quarters will be found the first two figures of the decimal; the further figures will be found on line with the Quarters and under the Pounds.

For the reverse operation, find in the first part of the table the two first figures of the decimal, over these will be found the hundredweights; then in the corresponding bracket find the further figures of the decimal, or the nearest figures thereto; this will guide to the quarters in the margin and the pounds at the top.

EXAMPLE: 9 cwts. 3 qrs. 20 lbs. is in decimals .496286; 13 cwts. 2 qrs. 14 lbs. is .68125; .24375 is 4 cwts. 3 qrs. 14 lbs., and .528125 is cwts. 2 qrs. 7 lbs. exactly.

### TABLE FOR CONVERTING SHILLINGS, PENCE AND EIGHTHS OF A PENNY INTO DECIMALS OF A POUND, AND FOR THE RECONVERSION OF DECIMALS.

By Major-General Hannyngton, F.I.A.

| SHILLINGS (First pair of Decimals.) | | | | | EIGHTHS OF A PENNY (Third and Following Decimals.) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 1 2 3 4 | 5 6 7 8 9 | 10 11 12 13 14 | 15 16 17 18 19 | *Pence* | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| | | | | 0 | 000000 | 052083 | 104166 | 156250 | 208333 | 260416 | 312500 | 364583 |
| .00.05.10.15.20 | .25.30.35.40.45 | .50.55.60.65.70 | .75.80.85.90.95 | 1 | 416666 | 468750 | 520833 | 572916 | 625000 | 677083 | 729166 | 781250 |
| | | | | 2 | 833333 | 885416 | 937500 | 989583 | | | | |
| | | | | 2 | | | | | 041666 | 093750 | 145833 | 197916 |
| .01.06.11.16.21 | .26.31.36.41.46 | .51.56.61.66.71 | .76.81.86.91.96 | 3 | 250000 | 302083 | 354166 | 406250 | 458333 | 510416 | 562500 | 614583 |
| | | | | 4 | 666666 | 718750 | 770833 | 822916 | 875000 | 927083 | 979166 | |
| | | | | 4 | | | | | | | | 031250 |
| | | | | 5 | 083333 | 135416 | 187500 | 239583 | 291666 | 343750 | 395833 | 457916 |
| .02.07.12.17.22 | .27.32.37.42.47 | .52.57.62.67.72 | .77.82.87.92.97 | 6 | 500000 | 552083 | 604166 | 656250 | 708333 | 760416 | 812500 | 864583 |
| | | | | 7 | 916666 | 968750 | | | | | | |
| | | | | 7 | | | 020833 | 072916 | 125000 | 177083 | 229166 | 281250 |
| .03.08.13.18.23 | .28.33.38.43.48 | .53.58.63.68.73 | .78.83.88.93.98 | 8 | 333333 | 385416 | 437500 | 489583 | 541666 | 593750 | 645833 | 697916 |
| | | | | 9 | 750000 | 802083 | 854166 | 906250 | 958333 | | | |
| | | | | 9 | | | | | | 010416 | 06250 | 114583 |
| .04.09.14.19.24 | .29.34.39.44.49 | .54.59.64.69.74 | .79.84.89.94.99 | 10 | 166666 | 218750 | 270833 | 322916 | 375000 | 427083 | 479166 | 531250 |
| | | | | 11 | 583333 | 635416 | 687500 | 739583 | 791666 | 843750 | 895833 | 947916 |

TO USE THE TABLE.

Find the Shillings at the top, the Pence in the margin, and the Eighths at the top. Then, under the Shillings and in the bracket with the Pence, will be found the two first figures of the decimal; the further figures will be found on line with the Pence and under the Eighths.

For the reverse operation, find in the first part of the table the two first figures of the decimal, over these will be found the shillings; then in the corresponding bracket find the further figures of the decimal, or the nearest figures thereto; this is the guide to the pence in the margin and the eighths at the top.

EXAMPLE: 9.3¾ is in decimals 465625; and 13s. 2d. is .65833, etc.; .634723=12s. 8½d. nearly; .5375 is 10s. 9d. exactly.

# The Canadian Engineer.

ESTABLISHED 1893.

With which is Incorporated

THE CANADIAN MACHINE SHOP

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TORONTO, CANADA, FEBRUARY, 1906.


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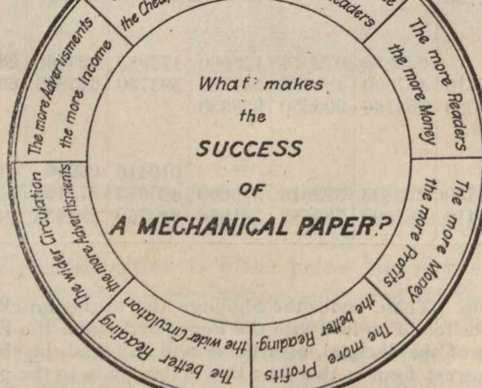
## WHERE DOES IT BEGIN?




By E. W. Chodsko, Haiphong-Tonkin, China.—In "Machinery."

## PROJECTED EFFICIENCY.

In the inaugural address delivered by Mr. F. L. Somerville, before the Engineers' Club, (January 17th), there was a passage worthy of very serious consideration, not only by every engineer, but by every man interested in public affairs and the future welfare of Canada. It was where he denounced the folly of early municipalities and legislatures in granting permanent rights to enterprising corporations to lay down railways in choice spots in newly staked out regions, without any regard whatever to the civic possibilities of the future, and which have since proved to be serious hindrances to commercial development on the one hand, and scenic beauty on the other, of the great cities which have naturally sprung up beside them. Toronto was cited as a typical example; and he might have mentioned Hamilton as another instance of the miserable shortsightedness of those who gave away, without a thought, the birthright of thousands unborn, to stroll for miles in the hot summer days on a well-kept promenade along the margin of the bay, or rest under shady maple trees lining a handsome boulevard, or to linger in a continuous garden park, which ought to fringe the blue waters of the lake. Few great cities in the civilized world, have been so lavishly provided by Nature with opportunity for the making of a city beautiful; but "God made the country, man made the town." Toronto is no mean city as it is; but her marine approach might have been as picturesque and beautiful as Constantinople—which is the admiration of the travelled world. Alas, the intervening railways occupying the bay front have spoiled all this. Then again, see how the revenue resources of the city are suffering, and are likely to suffer, in consequence of this undesirable location—from the civic standpoint. In the order of things, factories and works should be adjacent to railways; having in view convenient freight facilities. But if the sides of the railways along the bay front were lined with smoky factories, noxious fume belching furnaces, and dust-creating foundries, the freshening breezes from the lake would have carried the irritating dust, grimy smoke, and poisonous gases over the city; and to these terrors would be added the noise of forge hammers, rattle of rolling mills, shriek of furnace blast, and constant hum of machinery. It would be Dante's Inferno. Toronto would be a nice place to get out of. The possibility of all this has only been averted by stern municipal ordinance, and a more enlightened public conscience. Had the railways been located at a decent distance behind the city, the nuisance objection would have been minimized, and industrial establishments of magnitude, instead of having to go outside, would have been located within the city limits, and now be contributing to the revenues of the city, thus relieving the burden of taxation. As it is, the people of Toronto are suffering financially, physically, and æsthetically, for the deplorable misjudgment of their ancestors. It is an object-lesson on a large scale for the rest of our developing country. In some sections of the Dominion to-day, the predatory, mediæval creed of Rob Roy:

> The good old rule and simple plan,
> That he shall take who has the power,
> And he shall keep who can,

is being practised with impunity. A glaring instance has just come to our knowledge, where a picturesque township, lovely for situation, has—with apparent recklessness—been disfigured, and doomed for all time to civic mediocrity, by the cutting of a railway right through the centre: a piece of present-day commercialism destined in the future to be a curse instead of a blessing. It is high time, therefore, that every man of light and leading—whether he be engineer, architect, or political economist,—should lift up his voice and cry aloud that this spoliation of fair Canadian lands which have the promise of future greatness, due to their commanding position, and which were won for us by Britain's sons at a priceless cost of blood and treasure, must stop.

[A movement along this line, is in accord with the noble teaching of Henry Drummond, in his "Ascent of Man," and of Benjamin Kidd, in his masterly statement of the case for *Projected Efficiency*, in Vol. I, of his new System of Philosophy.]

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## Editorial Notes.

**A Lesson from U.S.A.** Before us is the annual report of the Engineer-in-Chief of the United States Navy, 1905; and instructive reading it is. This official document states "that so few engineers of the line are taking up engineering *seriously*, that the situation is becoming alarming;" and declares that "were the country suddenly plunged in war, the Navy would find itself in no condition to win battles." According to Admiral Rae, only young "amateurs" are "in charge of the machinery." The report alleges that the deplorable accident on board the U.S.S. "Bennington," most forcibly emphasizes "the need of serious and immediate attention" on the part of the government at Washington. We do not find any satisfaction in this "critical condition" of the United States Navy, and only refer to the matter in order to point a moral. It appears that instead of spending laborious days in acquiring an accurate knowledge of boiler working; mastering the engine indicator; regulating governors; adjusting eccentrics, and enjoying the thrill which the successful setting of a slide valve always brings; the embryo American engineers at Annapolis,* have been more intent on kicking their brains out through their feet, or keeping up their end in a set of quadrilles in the ball-room; hence, after graduation, have boarded the splendid vessels of the White Squadron, possessing only the veneer of engineering science, and utterly devoid of executive ability, but with a distorted perspective of their own importance, which superficial book knowledge and artificial technical training always breeds; ending in tragic disaster, and destruction of the costly property of the nation. To every patriotic young Canadian engineer, who reads this, the moral is, "By others' faults wise people correct their own."

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**A New Idea in Concrete-Steel Construction.** In the discussion on Steel-Concrete at the Toronto Engineers' Club, (January 25th), it was reported that in experiments made at the testing laboratory of the School of Practical Science, steel, after being stretched *beyond* its elastic limit, was found to possess the property of taking unto itself *another elastic limit* beyond which it can be stretched; analogous, we presume, to the phenomenon of the seried overlapping flow limits of ocean tides on the seashore. We understand this theory was accepted by prominent engineers present as a reliable scientific induction. And what is more important, the stretching of structural steel beyond its elastic limit prior to being embedded in concrete was actually recommended as good engineering practice. From what we can glean, the objective of this cold treatment of the steel is to equalize the stresses in the dissimilar materials. But what is the price to be paid for this equilibrium of forces? After the limit stretching, is the resilient structural steel, as such, as perfectly adapted for its purpose? We should hesitate to occupy rooms in a sky-scraper built in accordance with this academic drawn-wire theory. Awaiting with interest, formal statement of the case, we betake ourselves to a calm meditation on J. E. Stead's aphorism, which reads thus: "The result of careful experiment is the voice of Nature speaking truth, the interpretation of it is the work of fallible humanity."

*See Railway and Locomotive Engineering, December, 1905.

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**Canadian Foundrymen's Association: Why Not?** In 1894 the foundrymen of the United States, under the initiative of John A. Penton, organized themselves for the interchange of ideas, and general advancement of the art of founding in metals. The result has been that the founders' craft has been raised from a despised rule-of-thumb business, to a respected, scientifically based trade of recognized industrial importance. In 1905—nine years later—a similar movement was started in England, and is doing much good work in raising the standard of iron and steel founding in Great Britain. Although iron, steel, and brass founding is an important branch of trade in Canada, it has no recognized standing in the country. Hitherto, founding experts like J. T. Best, of Montreal, and others, have had to avail themselves of the privileges of the American Foundrymen's Association. The time is ripe for Canada to have an organization of her own.

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**"Wake Up England."** Here is interesting reading: "The latest returns show that while foreign countries have 372 Consular officials in Canada, the Mother Country's commercial representation is *nil*. Closer scrutiny shows that of this number 189 represent the United States; while Germany, France, Brazil, Belgium, Italy, Portugal, Spain, Norway, and Sweden have each ten or more." (Daily Mail; over-seas edition, January 13th). The spectacle of Joseph Chamberlain (Ex-Colonial Minister in the late Unionist Government, responsible for the disgust evoking figures quoted above), shedding tears over Canada, reminds us of the lines he once recited in the House of Commons:

It is all very well dissembling your love,
But why did you kick me downstairs.

# Book Reviews

**Electric Wiring Diagrams and Switchboards...** By Newton Harrison, E.E., Instructor of Electrical Engineering in the Newark Technical School. New York: Norman W. Henley, Publishing Company, 1906. 105 illustrations. Size 7⅝" x 5¼". 272 pp. (Price $1.50.).

This strongly bound, admirably printed, and copiously illustrated work is a model of its kind. It is evidently written by one who is not only familiar with the technics of electricity, but has gathered in practice invaluable data on the various systems of wiring necessary for alternating current circuits of single, two and three phase, as well as on switchboard design and installation. We can not commend too highly the perspicuous and systematic manner in which he has set forth the fundamentals of this important branch of electrical science. The book bears evidence of sound theoretical knowledge, a mastery of the art of the oral instruction, and that restraint in statement, which actual practice alone can give. By way of exhibiting the scope and aim of the author, we can not do better than quote the opening paragraph in the preface:—

"The contents of this book cover the fundamental facts of wiring, as well as such of the practice as its modest proportions could be well expected to embrace. It is not offered to the reader as a scientific treatise—though its statements will be found able to bear the light of scientific investigation —but as a technical work in which the author has made an effort to present the underlying principles of wiring in language suited to the comprehension of the general reader. Though framed in accordance with the technical requirements of the art of wiring, the subject matter has been presented with the idea and intention of making the reader independent of it as soon as possible. Though a mastery of the principles of rational wiring go hand in hand with its practice, it is frequently found easier to gain the practice than the theory. But it is also true that the best equipped in this particular field of work are those whose power lies within the head and hand, to an extent which makes them independent of text-books or other references. To gain this much-to-be-desired equipment, a knowledge of what is best and most useful must be obtained. What the author considers to be just such knowledge, is presented here in a logical form, as far as its various successive steps are concerned."

This book should be in the hands of every user of electricity, whether the office building or factory.

**Modern Machine Shop Construction, Equipment and Management.** By Oscar E. Perrigo, M.E. New York: The Norman W. Henley Publishing Company, 1906. Size 10½" x 7¾". 343 pp. (Price $5.00.).

**The Science Year Book.** With Astronomical, Physical and Chemical Tables, Summaries of Progress in Science, Directory and Diary for 1906. Edited by Major B. F. S. Baden-Powell. Published by King, Sell & Olding, Limited, 27 Chancery Lane, London, W.C.

A work which should be on the writing desk of every man of science.

**Handbook of Metallurgy.** By Dr. Carl Schnabel. Translated by Prof. Henry Louis. Second edition. Vol. 1. Copper, lead, silver, gold. London: Macmillan & Company, Limited. Size 8¾"x6½". 1123 pp. (Price 25s. net.)

The fact that a second edition of Dr. Schnabel's solid work has been called for within four years, is conclusive evidence that it has met a want in the metallurgical world. "The volume now issued deals with copper, lead, silver, and gold. Incidentally it may be remarked that the work excludes the subject of iron and steel, a fact which might perhaps have been indicated with advantage in the title. This apart, the book is decidedly the most comprehensive of its kind which has appeared in our language. The second volume is promised for next year, and when it appears the metallurgist will have at his command an unrivalled treatise on the subject of the various metals, and the methods by which they are pressed into the service of mankind. So far as the translation of the work is concerned, Prof. Louis seems to have executed his onerous task with a keen sense of responsibility. Throughout he has subordinated literary style to the all-important consideration of accuracy. Here and there he has, with the author's consent, introduced references to new processes or improvements that have been brought out since the original issue of the work. These are principally confined to gold, the metallurgy of which has made such rapid advances in modern times. The style and get-up of the volume are distinctly good; the illustrations are very numerous and well-executed, and the index is copious and valuable."

## CATALOGUES AND CIRCULARS.

**Roofing Rules.**—Merchant & Evans Co., Philadelphia, Pa. This work has been prepared for the benefit of owners of factory and residence buildings, and contains the most complete data regarding roofing materials, and rules for the laying of same, hitherto published, and will enable contractors to make a selection of this special line of builders' supplies, with scientific precision and economy. 8 x 5½, pp.52.

**Fans, Blowers, etc.**—Green Fuel Economizer Co., Matteawan, N.Y. Fans, blowers, and exhausters for heating, ventilating, mechanical draft, and other purposes are described in a booklet of 16 pages. 3½ x 6.

**Planers and Shapers.**—Catalogue No. 5 of the Hamilton Machine Tool Co., Hamilton, O., U.S.A., is of the costly type, setting forth their complete line of planers and shapers. 6 x 9, pp. 80.

**Catalogue Changes.**—The Yale & Towne Manufacturing Co., New York City, have just issued a circular making changes and additions in their No. 18 catalogue. 5¾ x 8¾, pp. 4.

**Cast Iron Pipe and Specials.**—Bulletin No. 33, by the Canada Foundry Co., Limited, Toronto, Ont., describes and illustrates cast-iron pipe and specials, from 3 in. up to 36 in. diameter. 8 x 10½, pp. 8.

**Industrial Railways.**—C. W Hunt Co., West New Brighton, Staten Island, N.Y. Narrow-gauge railways for use in industrial establishments are being more widely used than ever. Fine illustrations and graphic descriptions of this company's special manufactures are given in an expensive catalogue. 6¾ x 9¼, pp. 64.

**Electric Radiators.**—Canadian General Electric Co., Toronto, Ont., The Luminous Radiator, as described in a booklet just issued, is fitted with three incandescent heating lamps, so arranged that they radiate the heat, as well as a cheerful glow. 3½ x 6, 8 pp.

**Automatic Circuit Breakers.**—Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. Bulletin No. 1107 lucidly describes these circuit-breakers, which are shown by half-tone engravings. 7 x 10, 20 pp.

**Calendars.**—The A. R. Williams Machinery Co., Limited, Toronto, Ont., have just sent us a useful office calendar, together with a poster, illustrating and listing the many kinds of wood-working machinery they have in stock.

Allis-Chalmers-Bullock, Limited, Montreal, have issued the first of a series of monthly calendars, 6" x 3½". Each of the series will bear the coat of arms of one of the provinces of Canada. If the subsequent issues are as artistically designed, printed and tinted with the same aesthetic taste as the one before us, they will be a prized decoration in any office.

**Travellers' Compass.** The makers of "Smooth-on" iron cements, elastic packing, anti-scale preparations for boilers, etc., are sending out a handsome nickel-plated mariners' compass, 1 5-8" diameter, to anyone giving business address, and enclosing 4 cents in stamps. Write to Smooth-on Manufacturing Company, Jersey City, N. J., U. S. A.

**Smokeless Furnaces.**—The Canada Carb-Ox Co., Limited, Winnipeg, Man. The Carb-Ox system is a regenerative plan for increasing furnace efficiency. It is fully described in a booklet of 16 pages, 3 x 5¾.

**Buyers' Reference.**—The Buyers' Reference contains the names of all electrical jobbers, dealers, contractors, consulting engineers, fixture companies and repair shops, The Buyers' Reference Co., 123 Liberty St., New York, 8¼ x 9¼, 142 pp.

**Oil Furnaces.**—Rockwell Engineering Co., 26 Cortlandt St., New York, have published bulletins descriptive of their flue-welding, hardening, annealing and hardening furnaces; burning oil or gas fuel. 6¼ x 9¼.

**Hammers.**—The David Maydole Hammer Co., Norwich, Chenango Co., N.Y. The regular line of Maydole hammers now comprises 343 styles. The name "Maydole" represents the highest qualitiy in hammers, and the illustrated catalogue and price list which they publish will be found of value to purchasers. 9 x 9¼. 48 pp.

**Walschaert Valve Gear.**—This is the title of a special catalogue by the American Locomotive Company, New York, devoted to the application of this valve gear to the larger American locomotives. 9x6, 44 pp.

**Electrical Supplies.**—Incandescent supply catalogue, section No. 5, by the Canadian General Electric Company, Toronto, Ont., is a complete list of the electrical fittings which they manufacture for incandescent lighting. 8 x 10½, 94 pp.

**Engine Stop and Speed Limit System.**—A pamphlet re their system of stopping runaway engines, has just been published by the Consolidated Engine-Stop Company, New York, N. Y.

**Supplies.**—Crane Co., Chicago, Ill., U. S. A., have issued advance circulars illustrating and describing the various kinds of valves, pipe dies, brackets, hangers, supports, rolls, anchors, drip pockets, flanged pipe joints, steam and oil separators, sediment and steam traps, which they manufacture. 19 circulars in all. 6¾x10¼.

**Tangential Water Wheels.**—The Abner Doble Co., San Francisco, U.S.A., have issued a handsome pamphlet descriptive of their tangential water wheels, ellipsoidal buckets, high-speed ring-oiling bearings, etc. Within 100 pages the authors of this bulletin No. 7 (1906) have set forth the various applications of the Dobie System of Hydraulic Engineering with a graphic skill, and artistic restraint, altogether commendable. Every engineer engaged in water power development, who sends for a copy, will feel himself almost under obligation, for the invaluable data and formulae, which have been incorporated for the benefit of the reader. Mr. William A. Doble was awarded a gold medal at the Louisiana Purchase Exposition, 1904, "in recognition of his distinguished services in Hydraulic Engineering." Every engineer interested in hydro-electric work should send for this excellent bulletin No. 7, 100 pp., size 6x9. The Canadian licensees are The John McDougall Caledonian Iron Works Co., Limited, Montreal.

**Portable Incandescent Lamp Stands.**—Canadian General Electric Co., Toronto. Ont, "Light where you want it," is the title of a booklet, setting forth the advantages to be derived from the use of portable lamps. 3½ x 6, 24 pp.

**Transformers.**—Westinghouse Electric & Mfg. Co., Pittsburgh, Pa., circular 1126 illustrates, and is descriptive of, type C transformers. 7x10, 8 pp.

**Small Tools and Gauges.**—The John M. Rogers Boat, Gauge and Drill Works, Gloucester City, N.J., describe in catalogue No. 7, their many styles of fixed gauges, together with mandrels, solid and adjustable reamers, etc. 6 x 9, 44 pp.

# CORRESPONDENCE.

## IMPRESSIONS OF THE NEW CUNARD TURBINE R.M.S. "CARMANIA."

**By Charles H. Mitchell, C. E.**

It was the writer's good fortune to be a passenger on the Cunard Turbine Steamship "Carmania" upon her first trip from New York to Liverpool, sailing December 16th. The appearance of this ship on the American side of the Atlantic marked another epoch in the history of ocean steam navigation. It is true that the Allan Company of Canada was the pioneer in trans-Atlantic turbine navigation in its famous ships "Virginian" and "Victorian," but the extreme size of the "Carmania"—being some 2,100 tons—represents the next very long step.

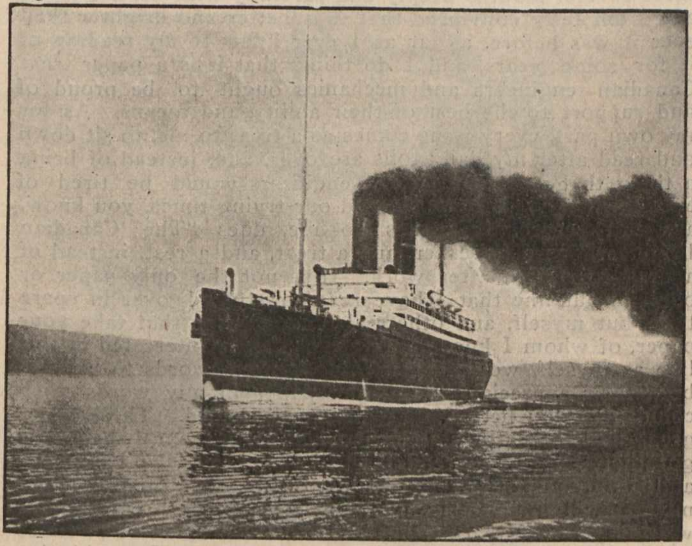


Fig. 1.

The reputation for steadiness and other sea-going qualities made by the elder of these two sister ships of the Cunard line, the "Caronia," is well known, and is now duplicated in the newer ship but in a more marked degree. The lines of these vessels are such as to ensure easy motion in all seas, being very full in the bilge and not too fine in the bows. Neither were built for great speed, for the average voyage of the "Caronia" between New York and Liverpool has been about eight days. It is too early to speak of the ocean speed of the "Carmania," but it is significant that at the trials on the Mersey in November last, she maintained a speed of 19.5 knots per hour over a measured course for six hours, which is more than contracted for, and a knot more than the "Caronia" made under like circumstances on her trials.

It is not intended here to enter into details regarding the accommodations and appointments of the vessel, except to say, that for her full complement of 3,100 passengers and crew, the "Carmania" has, in her nine decks every convenience and appliance which it would appear money can supply and ingenuity devise for comfortable and eminently safe ocean travel. One is struck with this many times on the voyage, in the completeness of the service and in the attentions of the crew; in the novelties of luxury, the features of operation, and in the care exercised in navigation.

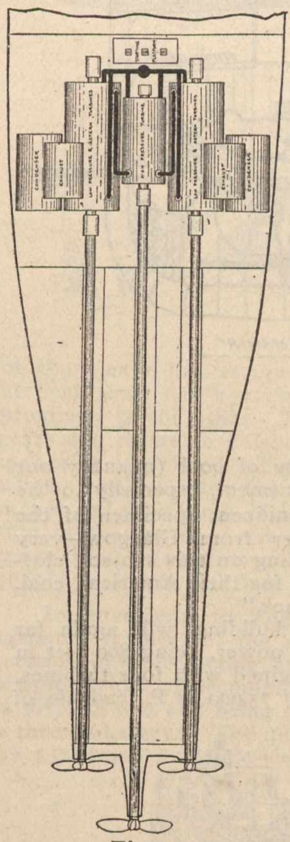


Fig. 2.

But above all, the centre of interest is in the engine room, not only because of its novelties, but because to it is attributable much of the comfort of the voyage, despite the weather. The turbine system is responsible for the lack of the usual vibration on vessels propelled by reciprocating engines. It is true there is a slight tremor, or quivering, particularly on the uppermost deck amidships, which is due in a small part to the engines and screws, but in a large part to the almost unavoidable vibration of the steel superstructure, noticeable when running fast in a rough sea. Entirely absent, however, is that incessant throb and thump of the reciprocating engine. Then, too, the immersion of the three screws to a greater depth than is usual in the former type—due to their smaller diameter and higher speed—eliminates racing and the consequent racking sensation so common in heavy weather.

On entering the engine room, which the writer had the pleasure of examining early on the voyage, the commodious size is at once evident. This room is the same in plan but smaller vertically than that of the sister ship, and yet the upper portion is particularly roomy and airy. This can be readily seen in the accompanying diagram, (Fig. 3) which shows a composite section of the two ships through their engine rooms. Descending stair after stair, we reach the lowest engine room floor, and are instantly struck with the simplicity of the engine units. To the layman there is of course "nothing much to see" as far as mechanical motion is concerned. The high pressure turbine in the centre, and the low pressure on either side; the latter arrangement to admit steam at either end for manoeuvering purposes, hum almost noiselessly in their cases, and the only really prominent sound beyond auxiliary apparatus is the rushing steam in the mains. The high pressure steam is at 190 lbs., and in the low pressure the attendants are not so concerned with the steam pressure as with the vacuum in the condensers, which they require to nurse carefully at about 28.5 inches. The auxiliary machinery is most interesting on account of the varied purposes to which it is put. In the turbine system this feature is particularly noticeable and requires no small attention from the engine crew, especially on a large vessel equipped with so many new appliances as are on the "Carmania." There is necessarily a great deal more piping in a turbine engine room than in that of a reciprocating engine mainly on account of the three power units. Perhaps the most interesting point in the room is the starting platform, where all gauges, signals and controlling apparatus are located. It may be interesting to note that there has been practically no trouble from hot main bearings on either the outward or return trip, and the fact that the main thrust bearings are eliminated by the turbine steam thrust, alone means much in successful and economical operation.

The run of the "Carmania" outward from Liverpool to New York was a remarkable baptism for a new ship, and all accounts of passengers and crew are in praise of her performance in the heaviest weather. It was not to be expected that she should make a speed record under these conditions. The return trip to Liverpool was hardly less trying, as she encountered probably all kinds and combinations of weather in the Atlantic category, from calm to heavy gale, from fog to sunshine, from head sea to flowing sea, and for four days she rolled along in a very heavy beam sea which would have made things most unpleasant on a smaller vessel; the performance of the engines under these conditions was most satisfactory. With the exception of several occasions when the low pressure turbines were considerably slowed down during thick fog and very heavy seas, the engines ran continuously at full speed on both passages, and in no case was either of them entirely stopped. The class of weather and the daily runs on the homeward voyage are given below in the log. The daily runs average lower than had been hoped for, but in combination with very heavy weather, this was

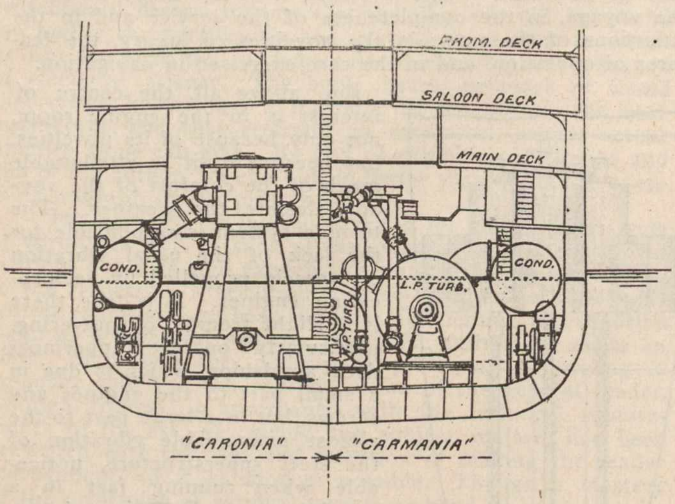



Fig. 3.

undoubtedly due to the poor quality of coal (quantity not given) which caused much disappointment, especially to the chief engineer. This officer—a magnificent specimen of the genial and careful Scotch engineer from Glasgow—very forcibly indicated his warmth of feeling on this subject, closing with, "an' that's whut I can say for their American coal, and I wush to G—— they hud it back."

The two new Cunarders now building will again far surpass the "Carmania" in size and power, being 800 feet in length and 30,000 gross tonnage; engined with four turbines, and screws of a combined power of 75,000 H.P., capable of

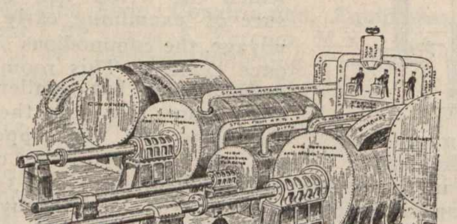


Fig. 4.

making about 30 miles per hour. The designing engineers of these new vessels were aboard the "Carmania" on this voyage, carefully watching the performance of the engines.

**Extracts from Log of "Carmania."**

| Date | Knots | Wind, Weather, Etc. |
|---|---|---|
| Saturday, Dec. 16 | 7 | 11.30 a.m. Sandy Hook lightship. |
| Sunday, Dec. 17 | 351 | Moderate E.N.E. gale with rough head sea. |
| Monday, Dec. 18 | 385 | Fresh S.E. breeze. Rough head sea. |
| Tuesday, Dec. 19 | 412 | Strong W.N.W. breeze. Rough following sea. |
| Wednesday, Dec. 20. | 420 | Fresh N.N.W. breeze. Rough sea. |
| Thursday, Dec. 21 | 408 | Moderate S.E. breeze. High N.W. swell. |
| Friday, Dec 22 | 392 | Light S.W. breeze. High N. W. swell. |
| Saturday, Dec. 23 | 360 | Fresh S.W. breeze. Rough sea. |
| Saturday, Dec. 23 | 72 | 5.10 p.m. Daunt's Rock lightship. |
| Sunday, Jan. 24. | 228 | 8.00 a.m. Liverpool Bar lightship. |

Note: Runs taken to noon of each day.

Length of passage, Sandy Hook to Daunt's Rock, 2,807 knots.

Time of passage, Sandy Hook to Daunt's Rock, 7 days, 0 hours, 40 min.

Time of passage, New York to Liverpool Pier, 7 days, 18 hours.

## BOILER INSPECTION; A CORRECTION.

Montreal, Jan. 19, 1906.

Editor "Canadian Engineer:"

In your issue for this month we notice in the editorial columns a reference to the report of Mr. Longridge, of the British Engine, Boiler, and Electrical Insurance Company, Limited, in which mention is made of Babcock & Wilcox boilers. The statement made is entirely misleading, and, therefore, we feel that we should draw your attention to it. You state the following: "Mr. Longridge insists that the* headers of Babcock & Wilcox boilers should be removed annually for examination. He cites a case in proof of this need." This must be incorrect, as the headers should never be removed for examination. The case cited must have been a very exceptional one, and the water used must be very bad for boiler purposes, and we should say that if this water were used on the ordinary type of horizontal tubular or shell boilers very dangerous results would follow. The statement as it appears in your columns would mislead any person who was not a practical engineer, and we trust, therefore, that you will make the necessary correction. We think that all engineers will agree that every steam boiler should be thoroughly inspected at least once a year.

Apologizing for trespassing on your time, we are,

Yours very truly,

Babcock & Wilcox, Limited.

H. W. Weller, manager for Canada.

Montreal, Jan. 19, 1906.

[Our correspondent is in error when he alleges that our statement is "*entirely* misleading." It is true we inadvertently omitted the words "*doors of the,*" prior to the word "headers;" but the context shows that this is what we meant; for the terms "doors," and "doors and caps," are used in the subsequent elaboration of the facts. We are glad Mr. Weller agrees with the plea for yearly inspection of the doors or caps in the headers. Editor.]

## A FRIENDLY WORD FROM THE EAST.

225 Brussels Street, St. John, N.B.,
Canada, Jan. 20, 1906.

Biggar-Samuel Co.:

Dear Sirs,—I have been planning to write you for some time about your paper, "The Canadian Engineer," since it was combined with your discontinued paper, "The Canadian Machine Shop." Mr. Groves, your esteemed Editor, wished me to give you a few lines on the style of your paper from July issue forward. I have been reading and studying it these several months deeply and carefully with the old issue, and I am fully convinced that it is better and brighter than ever it was before, as far as I ever knew to my reading of it for some years, and I do think that it is a paper that Canadian engineers and mechanics ought to be proud of and support to the best of their ability and means. As for my own part, every issue comes as a treat to me, to sit down and read after my daily toils are over, and, instead of being a thing that you would think engineers would be tired of enough in their daily work, and our trying times, you know, are not scarce, it comes to me, does "The Canadian Engineer," as a refresher, and a treat, and a rest, instead of a drag to read it after work. It is not the only paper or book in our line that I have read or studied over in spare time, but myself, and others also around me that take your paper, of whom I know, they are as deeply interested in this line as myself, would not be able to find words to express both their appreciation of your paper in any words they could give you better than I have described. There is no great show or flattery about it when I ask them if they have got their paper and read it. All they say is, *it's all right,* and so on, and that is a good test of the value of your paper now. I will now close my letter this time. I would have written you before this, but I am quite busy most of times with my work and study; and also I thought I would give it lots of time before expressing my opinion.

Yours respectfully,

Edward Watson,

Engineer Vulcan Foundry, St. John, N.B.

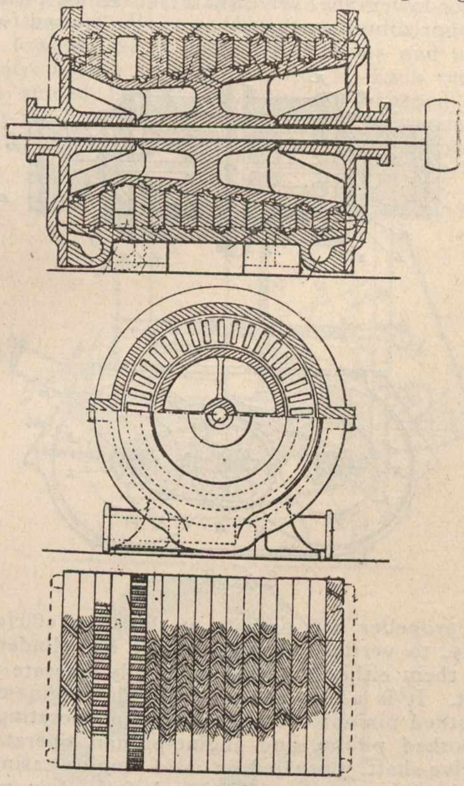
P.S.—Please find enclosed $1.00 for a new subscriber to your paper, C. N. Northorp, 22 Queen Street, St. John, N.B.

# INTERNATIONAL PATENT RECORD

## CANADA.

Specially compiled by **Messrs. Fetherstonhaugh and Dennison,** Patent Attorneys, Toronto, Montreal, and Ottawa.

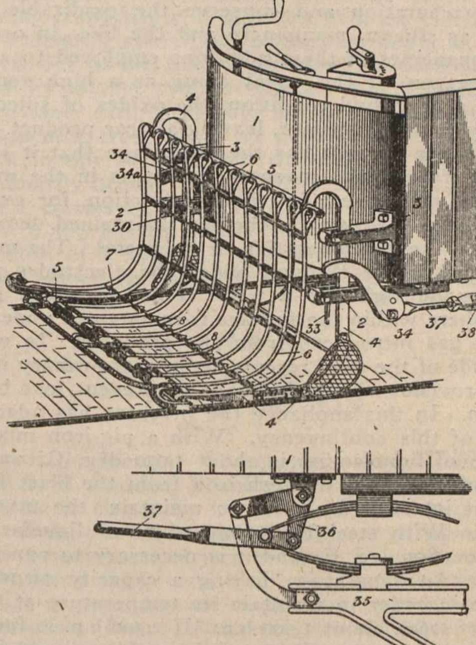
**Turbines.—E. T. Pollard.—94,390.**—The invention consists of an expansile fluid turbine adapted so that it may be reversed, and also be accommodated to equalize steam pressure under expansion. One end of the machine has a set of rings on the cylinder and alternating rings on the



94,390.

casing with V-shaped ports, which are so arranged that the ports in any three consecutive rings are never in communication at one time. The other end of the machine is provided with rings on the cylinder, and rings on the casing, with V-shaped ports reversely arranged to those on the forward end.

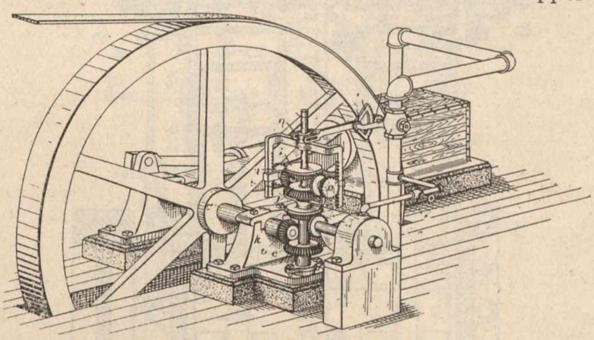
**Car Fenders.—F. W. O'Connor.—94,767 and 94,768.**—A car fender in which the operating mechanism maintains the fender at a constant height above the roadway, and automatically compensates for the varying height of the car body due to swinging



94,767 and 94,768.

or oscillating of the same. This fender has a safety device automatically operated upon coming in contact with any obstruction. and has a receding and downward movement, into which position it is locked and maintained in close contact with the roadway and thus forces its way under an obstacle. The invention consists essentially of a vertical, slidable fender held in guides attached to the car body and operated by a cam, which is connected directly to the trucks of the car, whereby the compensating action is accomplished.

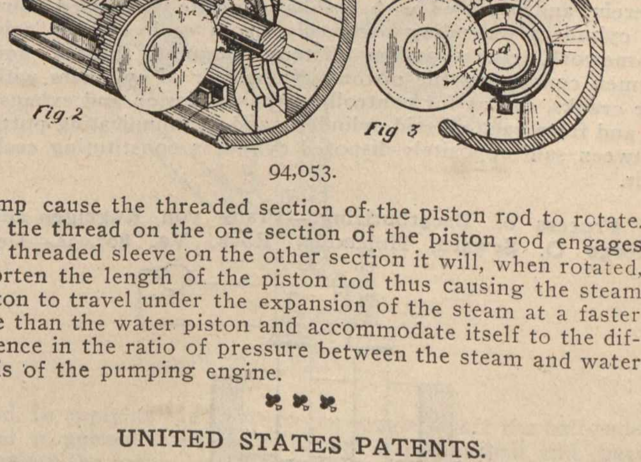
**Improvements in Governors for Engines.—H. E. McLean.—94,161.**—The salient feature is that the use of weights and springs is entirely obviated; the action of the governor being absolutely controlled by direct gearing. The main shaft of the engine is provided with a gear which meshes with a corresponding gear on a vertical shaft, a loose sleeve encircles a portion of the vertical shaft, and has secured to it a gear. The latter gear has a gear meshing therewith, operated by an independent source of power. The upper end



94,161.

of the sleeve has secured thereto a bevel gear and the vertical shaft has a corresponding inverted bevel gear in proximity to the other. The bevel pinions mesh with these gears and rotate in unison with the same on a yoke which is loosely journalled. These bevel pinions engage the rack which revolves with the vertical shaft. The independent motor and main shaft revolve at the same speed. Any variation in the speed of the main shaft will cause the rack to move in an upward or downward direction and throttle the supply of steam and thus govern the engine.

**Improvements in Engines.—E. R. Clarke.—94,053.**—The essential features of the invention are to utilize steam expansion in direct acting hydraulic engines, and to provide a simple means of accomplishing the result. The piston rod is divided, one end being threaded and the other end having a threaded sleeve. The quadrant and train of gears operated by a channel or guide-way formed in the stretcher of the




94,053.

pump cause the threaded section of the piston rod to rotate. As the thread on the one section of the piston rod engages the threaded sleeve on the other section it will, when rotated, shorten the length of the piston rod thus causing the steam piston to travel under the expansion of the steam at a faster rate than the water piston and accommodate itself to the difference in the ratio of pressure between the steam and water ends of the pumping engine.

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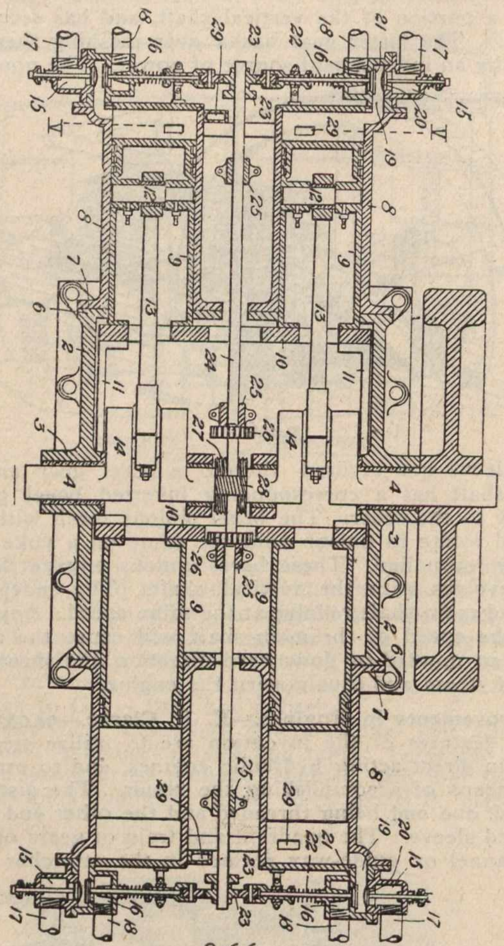
## UNITED STATES PATENTS.

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

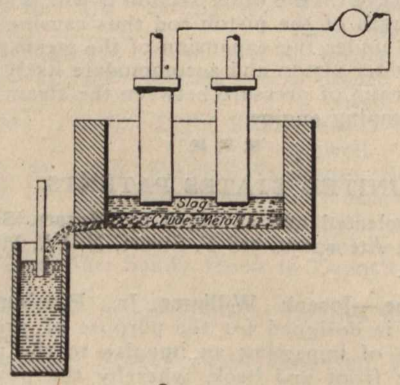
**Gas Engine.—Joseph Williams, Jr., Pittsburgh, Pa.—806,610.**—This is designed for the purpose of providing an engine capable of imparting an impulse to the main shaft at each stroke front and back, whereby the power is imparted to the main shaft through the medium of a plurality of pistons arranged in oppositely-located series, mounted in suitably-arranged cylinders, and connected by an intervening reciprocating frame. In these cylinders are produced cycles of operations through four strokes of the piston and two complete revolutions of the crank-shaft, the operations of admission, compression, explosion, and exhaust being performed successively in each cylinder or its explosive-chamber, receiving an igniting-spark once during two revolutions at the proper moment. The engine is designed to transmit power generated in the explosion-chamber in a constant succession of strokes imparted to the crank-shaft, thereby obviating the usual delay incident to the functions as carried out in engines of single or double cylinder construction, and the transmission of the forces is maintained throughout



806,610.

the connected piston structure by means of an intervening frame, thus securing equal strain on the working parts of the engine and main shaft, while fully utilizing the generated power. The invention also refers to means whereby pairs of the cylinders are connected so as to insure simultaneous explosions therein, and assist in scavenging the chambers. The apparatus consists of a main framework constituting an inclosing case, a main shaft mounted in bearings therein, and provided with cranks, oppositely-disposed pairs of cylinders extending outwardly from each end of said framework, corresponding pistons mounted therein, and pitmen connecting the pistons of one pair of cylinders with the cranks, means for controlling the admission and exhaust to and from each of said cylinders, and communicating ports between said oppositely-disposed cylinders constituting each pair.

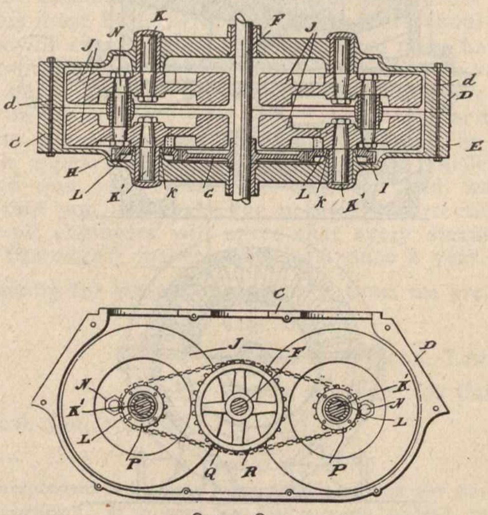
**Process of Decarburizing.—Franz von Kügelgen and George O. Seward, Holcombs Rock, Va. 807,034.**—De-



807,034

carburizing a metalliferous substance is done by fusing it as an electrode in presence of a substance having a high affinity for carbon.

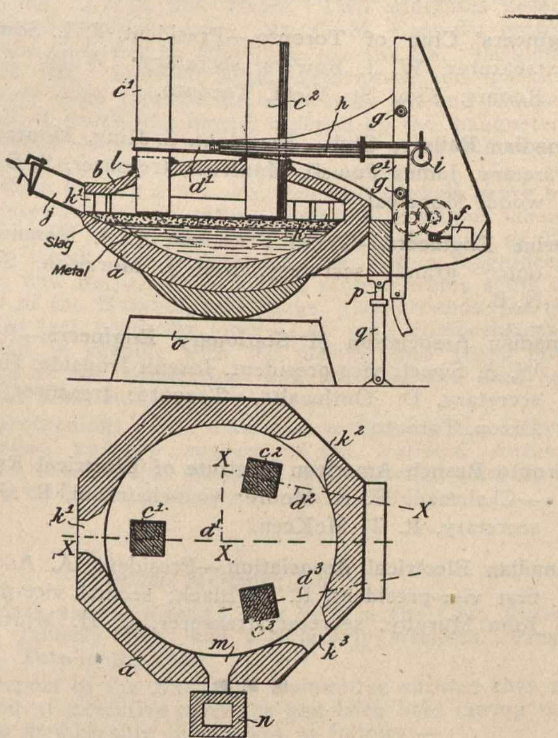
**Transmission-Gear for Gas-Engines.—Anson Groves Ronan, of Toronto, Canada.—807,048.**—Improvements in transmission-gear for gas-engines; the objects of my invention are, first, to dispense with the usual half-time shaft and gearing thereon, making the drive-shaft perform functions of same; secondly, to reduce the weight of engines of this class; thirdly, to relieve the engine axle of all undue strain; fourthly, to lower the drive-shaft as far as possible and keep same horizontal, so that when engine is used for marine



807,048.

work the propeller will operate at the most efficient angle, and, fifthly, to vertically mount a pair of cylinders abreast and have them either together or singly operate the same drive-shaft. It is a combination with the engine-casing; or a first toothed pinion; the engine-pitman operating same; a second toothed pinion, and engine-pitman operating same, of the drive-shaft journaled in said engine-casing, and a toothed wheel keyed to said drive-shaft, and in mesh with said pinions from which it receives energy.

**Steel Mixer.—P. L. T. Heroult, December 12th, 1905.—807,027.**—This invention is a "sign of the times;" for it is a supplementary application of electricity—on a large scale, to the conventional methods of steel manufacture; with a view of ensuring a more perfect product. "The largest charge ever smelted in an electric furnace has been about 4½ tons. It is proposed to make this mixer large enough to carry a charge of 300 or 400 tons; to be fed by five or six Bessemer or Siemens furnaces." The inventor describes a mixer for steel of considerable capacity, to secure uniformity in the product of an entire works, to secure a certain desulphuration and recarburation and conserve the oxidizable additions—such as silicon, manganese and the like—in order to reduce the quantities of these additions employed to a minimum. By reason of the metal being at a high temperature and in a very fluid condition, the oxides of silicon and manganese rise to the surface, leaving a clear product. Heat from the electric current has the advantage that it is non-oxidizing; moreover, the inventor maintains in the mixer a non-oxidizing atmosphere by the introduction, for example, of producer gas. The slag is thereby maintained deoxidized so as to favor the desulpheration of the metal. The mixer is closed. The aperture through which the electrodes pass is preferably made tight by a water-cooled pressure gasket. The atmosphere within the furnace is maintained under pressure by the gas introduced from the producer. In view of the magnitude of the steel receptacle, it is of primary importance that provision should be made to prevent loss by heat by radiation. In this appliance the inventor has adequately taken care of this contingency. With a pig-iron mixer the temperature of liquefaction is about 1,050 deg. C., and it is only necessary to pour in fresh iron from the blast furnace at sufficient intervals in order to maintain the mass in a liquid steel. With steel the temperature of liquefaction is 1,600 deg. to 1,800 deg. C., and it is necessary to apply additional heat. An apparatus, "having a capacity of 100 tons will require in order to maintain its temperature at that of the fusion of steel, about 1,500-h.p. If 2,500-h.p. is furnished to the apparatus, there will remain 1,000-h.p., producing 635 calories per horse-power per hour, which places at the disposal of the bath of steel 635,000 calories per hour. The specific heat of steel being 0.25, said quantity of heat is capable of reheating through 11 deg. for an hour about twenty-five tons of steel, which are supposed to have been furnished to the mixer at a temperature already sufficient, or nearly sufficient for tapping. A 100-ton furnace, capable of reheating through 100 deg. twenty-five tons for an hour, or of reheating through 50 deg. fifty tons for an hour fed by a 2,500-h.p. generator, should preferably have about the following dimensions; surface of the bath, twenty-six square meters; depth, one meter. The electrodes using a single-phase current, may be about 95 centimeters square in cross section by five meters high, so as to assure their lasting six or seven weeks. With a three-phase current using three electrodes, the cross-section should be proportionally reduced. Referring to Fig. 1, a crucible a is closed by a cover b, through which pass three electrodes $c^1c^2c^3$. Each of these electrodes is carried by an arm, such as $d^1$ (or $d^2$ or $d^3$), of which the support $e^1$ is in engagement with, and may be raised or lowered by, a system of pinions and an endless worm, controlled by an electric motor f. Each vertical support $e^1$ is guided by rolls g between U-shaped members fixed upon the head of the crucible with interposed insulating material. Each carbon or electrode is embraced by a




807,027.

collar of metal sheets which is compressed or slackened by means of a screw h, operated by a wheel i through a suitable intermediate system of gearing. The crucible a carries a spout j, through which the metal may be poured out when the furnace is inclined. There are three doors $k^1k^2k^3$, corresponding respectively, in position with the electrodes. The slag is ordinarily poured out of the rear doors $k^2$ and $k^3$, and the metal out of the front door $k^1$. The electrodes are surrounded by cooled pressure-gaskets l. The crucible a is also provided with a passage m in communication with a gas producer n, from which the gases are led into the crucible a, which in operation is entirely closed. The metal and slag ordinarily occupy the positions indicated in Fig. 1. The crucible a carries curved tracks, which rest upon a suitable pedestal o, and has its other point of support on the articulated piston of a hydraulic cylinder q, which is also articulated, and which serves to determine the angle at which the crucible is tipped.

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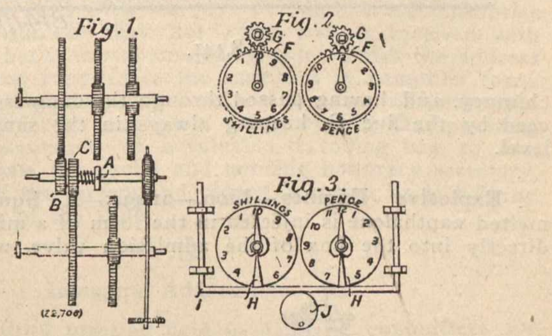
## GREAT BRITAIN.

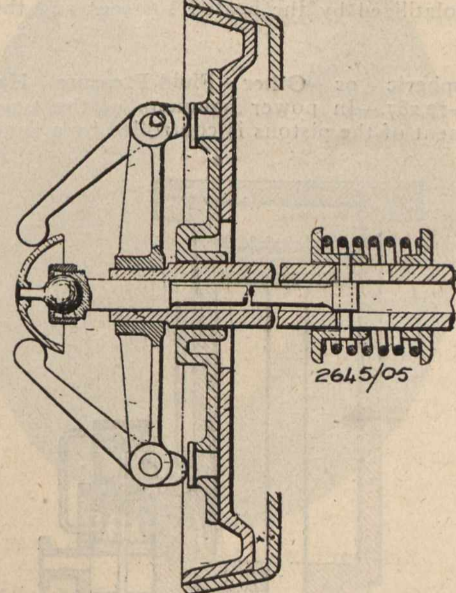
**Electricity Meters.—Chamberlain and Hookman, Limited, and S. H. Holden, Birmingham.—22,706.**—The improvements relate to electricity meters which have two connecting trains or dials, one registering the current consumed, and the other the money value of that current. The invention consists in so arranging the second dial train that the hands may be readily set to zero by one movement and without opening the meter-case. Fig. 1 shows two sets of wheel trains—one for units and one for values, driven off the same spindle A by means of two wheels B and C. The wheel B, which drives the upper set of hands, which indicate units, is soldered upon the spindle A, while the wheel C, which drives the lower set of hands, is fixed tightly, but only held by friction. A square is filed upon one of the spindles of the lower train of wheels, thus enabling the wheels of this train to be turned backwards by means of a key inserted through an opening in the case. The friction of the wheel C upon the spindle A is, however, sufficient to enable the former to drive the train of wheels. If a ratchet and pawl arrangement is used instead of trusting to friction to drive the wheel C, the pawl must be raised when it is desired to set the hands backwards, or obviously they may be also set to zero by moving them forwards a sufficient number of turns. Fig. 2 shows an arrangement for setting the dials to zero. In this case after a certain registration has been made upon the value-dials and the corresponding amount of payment has been made, the dials are rotated so as to bring the zero of each dial up to the hand in whatever position that is. The hands in this counter are driven in the ordinary way by the wheel train, but each circle of the value-dials is separate and is mounted loosely upon a short tube, through which the hand passes. A toothed wheel F is at-




22,706.

tached to the back of the dial, and this may be turned round by means of a key fitting upon the square end of a pinion G which gears with it. Fig. 3 shows an arrangement whereby each hand may be set direct to zero without affecting the gearing. In this case the hands are friction-tight upon the pinions, and each carries or forms part of a heart-shaped cam. By pressing a point H against the edge of such a cam it is brought back to zero, the point may then be removed and the hand is ready to commence registering again. Two such points are shown mounted upon a common moving frame I. When it is desired to set the hands to zero, this frame is moved towards the hands by means of an eccentric J. This device is commonly employed in chronographs for resetting the hands after use.

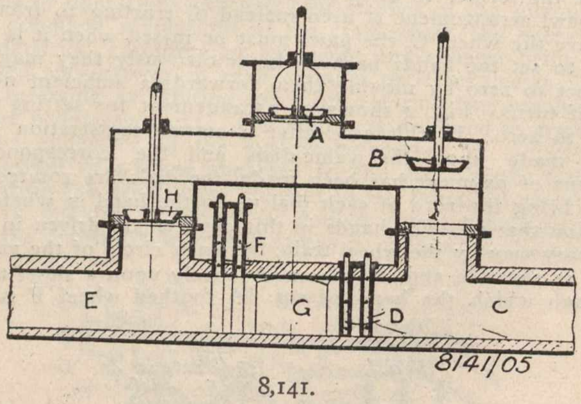
**Clutches, Brakes, or the Like.—Noble.—2,645.**—This clutch is operated by a number of toggle levers, the effort being applied to these levers through a pivoted ball-ended




2,645.

rod. In applying the effort to the toggle levers the ball-ended rod is pushed longitudinally, so that the ball end bears against the toggle levers, which force the male cone into the female cone.

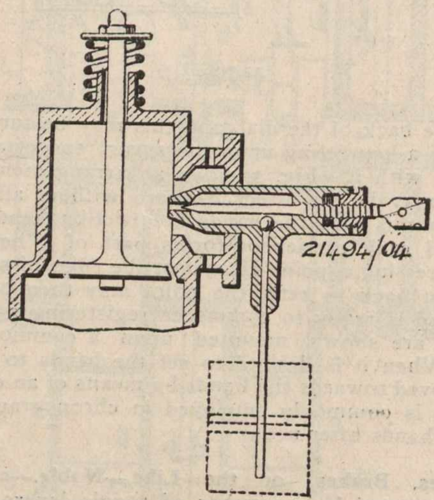
**Gas and Air-Reversing Valves as Applied to Gas-Fired Furnaces.—Gaunt.—8,141.**—The gas from the producer main enters through the regulating valve A and passes alternately through the valves H and B. On opening the valve A the gas passes through the valve B, and, being stopped by the dampers D D, it passes through flue C to the regenerative chamber, and thence to the furnace. The waste gases leaving the furnace are drawn along the flue E by the draught of the




8,141.

chimney, and, having passed through the dampers F F, proceed by the flue G, keeping always in the same plane or level.

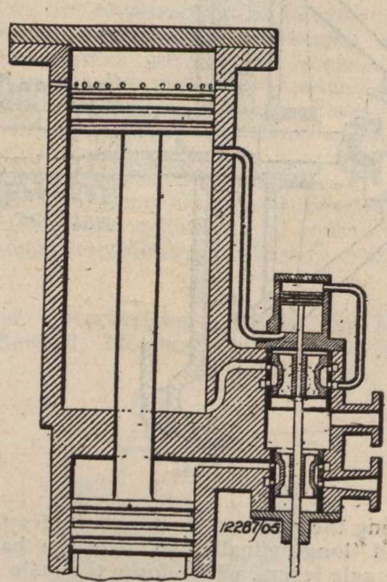
**Explosive Engines.—Lion.—21,494.**—A liquid jet of melted napthalene is injected in the form of a mist or spray directly into the box of the admission valve, where, after




21,494.

having been intimately penetrated by a current of air, this spray is volatilized by the heated surfaces and then fed to the motor.

**Atmospheric or Other Fluid-Pressure Hammers.—Sharples.—12,287.**—In power hammers of the type wherein the movement of the pistons is controlled by a hand lever, it




12,287.

has heretofore been necessary where a number of repeated blows was desired, to move the lever at each stroke. By the present invention such lever may be switched out of action, and the hammer caused to work automatically and continuously.

## ENGINEERING SOCIETIES.

**Canadian Society of Civil Engineers.**—President, Ernest Marceau, Montreal; treasurer, H. Irwin; secretary, C. H. McLeod, rooms 877, Dorchester St., Montreal. Annual meeting will be held in Toronto during the fourth week in January, 1906.

**Canadian Mining Institute.**—President, George R. Smith, Thetford Mines, Quebec; secretary, H. Mortimer Land, Victoria, B. C.; treasurer, J. Stevenson Brown, Montreal.

**Engineers' Society School of Practical Science.**—President, J. P. Charlebois; recording secretary, E. C. Ash; treasurer, B. W. Marrs; corresponding secretary, C. S. Shirris.

**Engineers' Club of Toronto.**—President, F. L. Somerville; treasurer, W. J. Bowers; secretary, Willis Chipman. Rooms: King St. West, Toronto.

**Canadian Railway Club.**—President, S. King, Montreal; secretary, James Powell, Montreal; treasurer, S. S. Underwood, Montreal.

**Marine Engineers.**—Grand President, E. J. Henning, Toronto; grand secretary, Neil J. Morrison, St. John, N. B.

**Canadian Association of Stationary Engineers.**—President, W. A. Sweet; vice-president, Joseph Ironside, Hamilton; secretary, D. Outhwaite, Toronto; treasurer, A. M. Dixon, Toronto.

**Toronto Branch American Institute of Electrical Engineers.**—Chairman, H. A. Moore; vice-chairman, R. G. Black; secretary, R. T. McKeen.

**Canadian Electrical Association.**—President, A. A. Wright; first vice-president, R. G. Black; second vice-president, John Murphy; secretary-treasurer, C. H. Mortimer.

## TURBINES CHEAPER.

The Midland Railway Company of England has recently been in a position to gather what is undoubtedly the most valuable comparative data as yet secured, as to the relative performance of turbine and reciprocating engines when used in commercial service. The company recently built for their Irish and Isle of Man service four steamers which were identical in everything but their motive power. This, in the case of two of them, the "Antrim" and "Donegal," consisted of reciprocating engines, and in the case of the others, the "Londonderry" and the "Manxman," consisted of Parsons turbines. Of the two turbine boats, the "Manxman" was provided with turbines of twenty-five per cent. more power than those on the "Londonderry." By the terms of the contract the vessels were to maintain 20 knots per hour with two double-ended boilers under steam and on the trial the "Antrim," under these conditions, showed 20.06 knots, the "Londonderry" 21.6 knots, and the "Manxman" 22.65 knots per hour. With all the boilers in use, the respective speeds were 21.86, 22.36, and 23.12 knots per hour. During the trials the decrease in water consumption in the case of the "Londonderry" amounted to 8 per cent., and the "Manxman" to 14 per cent. as compared with the two reciprocating engine boats. It follows that there was a corresponding decrease in coal consumption by the turbine boats, the "Manxman" making 20.03 knots on the same amount of fuel that was burned by the "Antrim" when making 19.5 knots. There was a great economy in the amount of lubricating oil consumed, which in each turbine steamer amounted to 5 gallons per single trip. This again resulted in further economy by the reduction of the staff in the engine room from four greasers to two. To these advantages must be added the almost complete absence of vibration. Furthermore, in the whole period of service the turbines have cost practically nothing for upkeep. There is a saving in the weight of the hull in the turbine steamers of about 30 tons, and in the weight of the engines, shafting, and propellers, of 85 tons. These two items together represent a saving of 115 tons, or 6 per cent. of the weight of the steamer when running light.

## THE ENGINEERS' CLUB OF TORONTO.

I.

**Annual Dinner: Jan. 4.**

The sixth annual banquet of the above institution was held in the Club Room, 96 King Street West, on Thursday evening January 4th. Mr. R. F. Tate (president of the club) was toast-master, and was supported by Messrs. Edmund Burke (president Ontario Association of Architects), J. P. Hynds (treasurer Guild of Civic Arts), J. W. Tyrrell (president Ontario Land Surveyors' Association), and other noted visitors. The muster roll indicated some 48 all told; but this number included the cream of the engineering profession in Toronto.

Toasts to "The King," "Our Profession," and "Our Guests," proposed respectively by the president; by J. G. Sing, C. E.; and C. B. Smith, C. E., were responded to in suitable speeches by Messrs. Johnston, Wickens, Gamble, Goad, Hynds, Tyrrell, and others. Two addresses deserving of special mention, were: Mr. C. M. Canniff's graphic story of the Club trip to Hamilton, per the SS. "Turbinia," on July 28, 1905: in which bright description and sparkling reminiscence were interspersed with spicy wit and exquisite humor, all of which was hugely enjoyed by the banqueters; the association of well-known names with funny scenes and ludicrous situations evoking hilarious laughter. This gay literary effort had as a foil Mr. Edmund Burke's grave but deeply interesting speech, setting forth the ambitious scheme of the Toronto architects for beautifying the City of Toronto; in which it is proposed to lay out a magnificent boulevard, new parks, wider streets, reserve scenic spots on the banks of the Humber, and make play grounds for the children; in fact, order the Queen City on a comprehensive, artistic plan, in keeping with its dignity and rising civic importance as the connecting link between the East and West of the Dominion.

The proceedings were enlivened with vocal and instrumental music, and the singing of the National Anthem brought to a successful close the sixth annual banquet in the history of this increasingly popular institution.

II.

**Annual Meeting: Jan. 11.**

The sixth annual meeting was held in the Club Room, Thursday, January 11th, and was largely attended. President R. F. Tate in the chair.

The report of the Executive Committee showed that 25 general and 31 executive meetings had been held during the year. The membership report was as follows:—

| | Resident. | Non-Resident. | Total. |
|---|---|---|---|
| New members elected during the year.... | 22 | 5 | 27 |
| Resignations .......... | 7 | 0 | 7 |
| Deaths ............... | 2 | 0 | 2 |
| Membership lapsed about | 3 | 5 | 8 |
| Increase .............. | 10 | 0 | 10 |

The treasurer's report presented by Mr. Bowers showed total receipts of $689, and expenditures of $474; outstanding accounts, $115; accounts owing, $56; cash balance, $387 (an increase of $200 since last year), and in addition $325 in savings bank.

Mr. VanNostrand reported in humorous vein for the finance committee.

The report of the rooms committee, presented by Mr. Chas. H. Heys, showed that the receipts balanced the expenditure.

Mr. S. Dillon-Mills reported for the library committee, showing an expenditure for the year of about $100.

The report of the committee on civic improvements, read by Mr. Robt. W. King, stated that no response had come to the request of the Club for adequate representation on the Guild of Civic Art, from which lack of courtsey it was inferred that the co-operation of the Club, although invited, was not desired by the Guild.

The following gentlemen were appointed a committee to revise the Constitution of the Club:—Messrs. Tate, Somerville, C. B. Smith, Gamble, Chipman, Bowers and Canniff.

After the appointment of Messrs. Gagne and Clarke as scrutineers the election of officers for the present year then took place, and resulted as follows:—F. L. Somerville, president; C. B. Smith, 1st vice-president; J. G. Sing, 2nd vice-president. Directors—J. S. Fielding, chairman rooms committee; C. N. Canniff, chairman library committee; R. G. Black, chairman paper committee; treasurer, W. J. Bowers, 23 Jordan Street; secretary, W. Chipman, 103 Bay Street. Auditors—A. J. VanNostrand, C. H. Heys.

Mr. Tate, the retiring president, in his valedictory address, reviewed the work of the Club during his year of office. He referred in feeling terms to the death of Mr. Kivas Tully and Major H. A. Gray, past presidents of the Club, and Mr. Arthur Harvey, who, though not a member, had contributed a valuable paper on the metric system.

Canada's great hydro-electric development at Niagara and Decew Falls, Ont.; Kakabeka Falls, in Lake Superior country; Lachine, Chamblay, and Shawinigan Falls, in the Province of Quebec, were interestingly outlined. The railway enterprises of the three great trans-continental systems, C. P. R., G. T. R., and Canadian Northern were sketched with masterly grasp. The immense steel rail industries at Sault Ste. Marie, and Sydney, Cape Breton, were noted, as also was the remarkable constructive engineering going on in the building of ships, bridges, locomotives, etc., together with a panoramic view of the important geological survey work going on in the far northern lands, and the opening out of the Temiskaming and Cobalt mineral and ore regions. So impressed were the assembled members with the historic importance of this wide survey of engineering enterprise and accomplishment that not only was it received with acclamation, but it was unanimously ordered that the address be printed and supplied to the members in pamphlet form.

The meeting terminated with a pleasant incident, typical of the generous sentiment of good-will that prevails, viz., the presentation of a valuable travelling bag to Mr. Willis Chipman, the genial and untiring honorary secretary, as a token of the esteem and regard in which he is held by the members of the Club.

III.

**Inaugural Address: Jan. 18.**

At the third meeting held in January, committees for the year were announced as follows:—

**Rooms**—J. S. Fielding (chairman), J. C. Johnston, S. Gagne, W. P. Merrick, H. C. Champ, A. A. Bowman, W. E. Douglass.

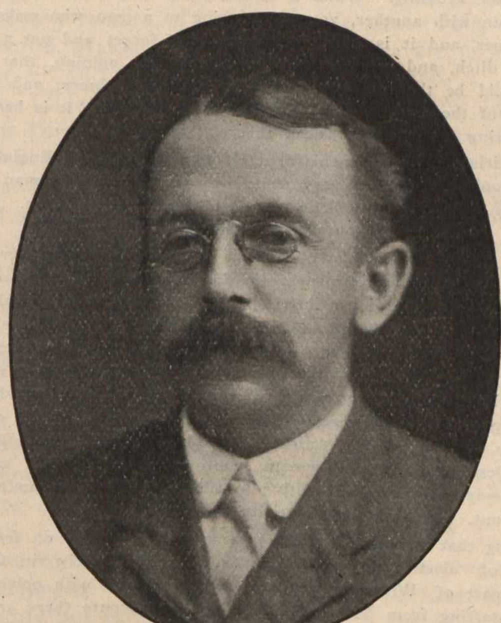
**Library**—C. M. Canniff (chairman), A. C. Larkin, T. B. Speight, J. D. Shields, W. H. Patton, E. B. Merrill, A. B. Barry.

**Papers**—R. G. Black (chairman), E. R. Clarke, J. C. T. Crofts, W. H. Macphail, L. B. Stewart, L. J. Street.

Three new members were elected, viz.:—

E. W. Storer, Supt. Gen. Fire Equipment Co.
C. W. Allen, Asst. Eng. Toronto Water-works Extn.
F. A. Gabey, Can. Gen. Elec. Co.

Then followed the inaugural address of the newly elected President, Mr. F. L. Somerville (resident engineer Grand Trunk Railway), who said in part:—



F. L. Somerville, the new President.

I congratulate the Engineers' Club, and the whole body of Engineers of Canada,—whether they belong to this club or not, on the magnificent prospects during the coming year. Take the branch of Engineering I am most familiar with—Steam Railways. The C.P.R. is extending in all directions in the North-West, and they are digging into what we used to consider *our* own preserves in Ontario, and building lines all over it. The C.N.R. is developing beyond everybody's expectations—except Messrs. Mackenzie & Mann; and the G.T.P. is only just beginning. In view of these developments in Steam Railroads, it certainly will be the fault of any railroad engineer if he cannot get work to do during the coming year. In addition to the new roads and new branches, it is right-up to the old roads to put themselves in better shape to carry the traffic coming. Competition is developing so much that every railroad has to hold its own, and put itself into shape to carry its traffic at the least possible cost. The only way, or one of the many ways is to improve its old roadbed in alignment, and in grades; and enormous sums are being spent to-day in doing that. I know the C.P.R. are doing a good deal in that direction. I know what the G.T.R. is doing, we have nearly succeeded in reducing our grades on the main line for east-bound traffic to 3-10ths of 1 per cent.; as against what it was in the old days, of anywhere from 6-10ths, up to 1 per cent. In addition, both the C.P.R. and G.T.R. are doing double tracking, and they have not nearly finished the work started, therefore, on both these lines there is going to be work for several years to come, as well as on the various other lines.

Leaving Steam Railroads, there is another class of railroads growing very largely: mcre particularly in the eastern part of Canada—Ontario and Quebec, viz.; the enormous suburban electric development. As a maintenance engineer, I think I can give a word of warning to those people who are interested in the building of these electric railroads. A great many built in the last few years appear to have been laid down regardless of all alignment, and without regard to right-of-way. As long as an electric line is to be used for passenger service, and where it runs through the country it is going to be used as a street car, stopping everywhere, the question of alignment or grading is not of very great consequence. But these roads going through the country are anxious for freight business, starting possibly with express, and then developing freight. An electric motor will, as regards gross load, weigh more than a steam motor, hence, and if these roads are to do a freight business, they will have to be put in proper alignment, and at such grades that they can haul decent loads.

Another word of warning; perhaps not for engineers, but for municipalities through which these railroads are being built. Fifty years ago, when steam roads were being built, cities, towns, and townships, and individual owners tumbled over each other to give steam roads all the privileges they could. For instance, Toronto gave steam roads the Bay front. Other towns did likewise; some gave right of way through main streets, and they have been sorry ever since. Now it seems to me, that a good many municipalities, especially in the country, are just making the same mistake that the bigger ones made thirty years ago; and are giving away to these electric roads public rights they have no business to give; and that will be a source of difficulty for all time to come. In this connection there is another matter of interest to engineers; especially to location engineers. It was my duty to go down to Ottawa before the Railroad Commission, and fight applications of other steam roads or electric roads to cross our railroad with grade crossings. Before the Railroad Commission I have always taken strong exception in Ontario; (or in the southern and south-western portion of Ontario at any rate, which is thickly populated, and trains are numerous), that it should be the last resort of a location engineer to ask for a grade crossing another railway; if the nature of the country allows him to come under or over the other road. In the majority of cases, he can make a separate crossing for $30,000. If he puts in a grade crossing he has to put in standard protection work, and a man night and day costs $1,000 a year. Therefore, the separate grade is practically as cheap, and you get rid of all danger from the grade crossing. While it is necessary to prevent interference from one train with another, you are trusting to a man who makes mistakes sometimes, and it is just possible he may forget and put a whole train in the ditch, and cause loss of life. It is my opinion, that grade crossing should be the last resort of the location engineer; and in the greater part of the country like Ontario, I consider that it is bad location engineering when a man does this.

This criticism applies more particularly to Electric Road Engineering; for it is astonishing what a very short time it takes for a man to be picked up off the farm, and made engineer of an electric train. I have known them get there in about two weeks!

Another thing that we have to look forward to in the very near future,—and it is getting very near—is the electrification of steam railroads. This is going to give a large quantity of work to electrical engineers. I am glad to see that the Ontario Government is going to electrify its road up north, and I am sure all railroad engineers will watch their experiments with great interest, not only as to the practicability of running the railroad by electricity, but also from the economical point of view. A good many people I know, do not think it would hardly pay to electrify the ordinary common garden railroad like some of our branch lines in Ontario, unless traffic would warrant continuous running the same as a street railway. We are all waiting to see how the Temiskaming Railway comes out, when run by electricity.

Following that is the great development that is going on from the distribution of electric power in Canada, and particularly in Ontario. The whole part of Western Canada is being covered with power lines, principally starting from Niagara Falls. East of Toronto there are other power lines developing, or being promoted; several starting from Kawartha Lakes, the Trent River, and further east on the Rideau, and on the Ottawa River. This hydro-electric power developed in these places has to be transmitted, and the problem before electrical engineers to-day is the safe transmission of this power. They have largely solved the economical transmission, but the question is *safe* transmission. These power lines are nearly all carried up in the air; wires carrying 60,000 volts. They put on the poles High Voltage, Dangerous, etc. These wires cross public roads, canals and railroads, and the problem that has yet to be solved is the precautions that have to be taken where the wires cross at any place where the public go, as to what precaution should be taken for the safety of the public. We hear every now and then of an accident happening in a most mysterious manner. Last year a man hanging over the bridge at the Queen Street Subway, took hold of a wire and was killed. I read in the paper the other day of a man who evidently wanted some wire to clean out his pipe. He was going to cut off a piece coming down an electric light pole, but was killed. There are so many of these mysterious accidents that it makes those of us who are not electrical engineers afraid of dealing with the article; and certainly the general public, reading these things in the paper, are much more liable to be alarmed than we engineers who have only a smattering of electrical knowledge. *The problem of the future is the safe transmission of power.*

The prospects for municipal engineering are good; towns are growing up, water-works, sewage, and roadways are being put in proper shape, and this should make a lot of work to keep the municipal engineer busy, and I think their prospects are pretty good for the year.

Another line, almost new in Canada, is the shipbuilding industry. Shipbuilding yards to be built in several parts of Canada are going to employ a good many engineers of that class.

Mining is being thrown at us every day. A man has only got to call himself a mining engineer, and people tumble over themselves to get him. Another point; we find that in Canada people are not starting small construction works. Where a new engineering works is started in Canada it is started on a good large basis, and in laying these works out, I find that nowadays they are not laid out haphazard, but there are engineers who make a specialty of laying out works in the most economical manner, and that not only gives work to the engineers, but it is to the advantage of the promoters of these establishments, and it enables them to get their work done so much more economical and more satisfactory in every way. Having reviewed the business prospects for engineers during the coming year, permit me a final word with regard to our club.

While the club has made fair progress during the last few years, it has not made all it ought to. I think, gentlemen, that we are overtroubled with bashfulness, not individually, I won't say that; but as a body we are too bashful. We want to assert ourselves more, as THE ENGINEERS' CLUB OF TORONTO. The Ontario Association of Architects have issued a public scheme, that is an engineering scheme, pure and simple; the planning of a city; the planning of driveways and roadways; not the erection of buildings. It should have been taken up by the engineers, whereas it has been floated by the architects, and they get the whole credit. In the interests of our profession, we should assert ourselves more than in the past.

Next week the Canadian Society of Civil Engineers meet in Toronto, and some members of this society are members of our club, for the members of both club and society belong to the same profession. While we are separate organizations, we are in no way antagonistic, hence when the Civil Engineers meet here next week, it will be a courtesy on the part of our club to welcome this Society, and offer them the privileges of our club.

In the discussion which followed the presidential address, Mr. Tate said that the overtures of the Club with regard to the architects' scheme for civic improvement had been treated with silence. Mr. VanNostrand said the Guild of Civic Art had made an effort to have the Engineers' Club called in, and expressed regret that it had not been. Mr. Somerville, in responding to the vote of thanks, declared that it was not his intention to reflect on the architects, but to reflect on the Club in not more strongly asserting itself at the very beginning of the movement for beautifying the City of Toronto. Upon the motion of Ex-President Tate, it was decided to appoint a special committee on civic improvements.

## CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

### Toronto, No. 1.

The third of the series of popular monthly lectures, in connection with the above society, was held in the Engineer's Hall, Victoria Street, Toronto, on Wednesday evening, January 17th. There was a large attendance and President William McGhie occupied the chair. The subject of the evening's lecture was "How Wrought Iron and Steel is Made," and was delivered by Mr. S. Groves, Editor of "The Canadian Engineer." The address was listened to with rapt attention, delivered, as it was, without notes, and illustrated by diagrams, large colored charts, and blackboard sketches. Every man in the metal trades is interested in the iron and steel development of Canada just now; it is not to be wondered at, therefore, that the stationary engineers listened eagerly to the Editor's oral dscourse on the theory and practice of iron and steel manufacture, of which the following is a

SYLLABUS.

Introductory:—Difference between cast iron, wrought iron, and steel. Wrought iron, preparation in refinery, manual and mechanical puddling processes, theory of puddling. Steel, historical sketch, basic and acid steel making processes. Bottom blowing; Bessemer converter; top blowing; tropenas converter; open hearth: Siemens-Martin regenerative furnace; crucible steel making. General outlook on the iron and steel industries of Canada.

On the motion of Mr. A. M. Wickens, seconded by Mr. Charles Mosley, a hearty vote of thanks was tendered by acclamation to the lecturer.

## "TWO IN ONE" HOISTING DRUM.

The "Two in One" hoisting drum is just what its name indicates; two drums mounted on the same bed plate, and acting as one drum. It is not connected to the engine by gears or sprocket chains, so that the necessity of changing the engine is obviated.

A contractor who has several single drum hoisting engines who wishes to use automatic buckets; or should he

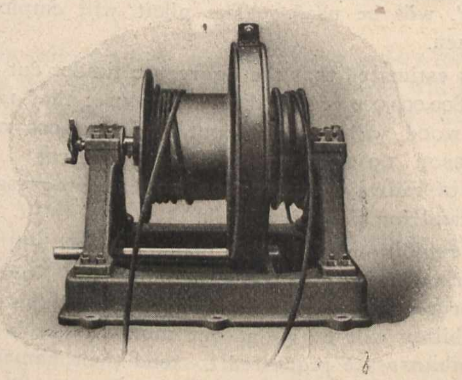


Fig. 1.
End View, Showing Both Drums.

have double drum engines, and in addition to operating the buckets wishes to raise and lower the booms—the all-important question is an additional drum, which in all probability he will order from the engine manufacturer. To connect this drum the engine should be mounted on wooden skids to receive the pedestals which carry the new drum shaft. These pedestals are now bolted to the skids, and the

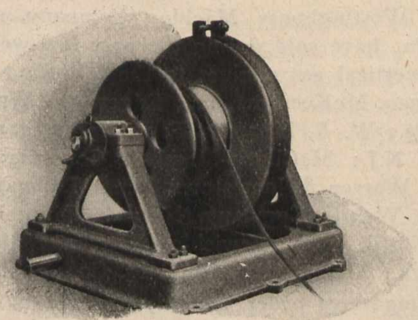


Fig. 2.
Three-quarter View, Showing Large Drum and Friction Attachment.

shaft lined up, so that the gears will mesh properly. These changes are often made in out-of-the-way places, miles away from a machine shop, and should the parts not fit properly, the changes made are often expensive, and very often valuable time is lost.

The "Two in One" hoisting drum does away with this, and is very easily put in operation. It can be used in con-

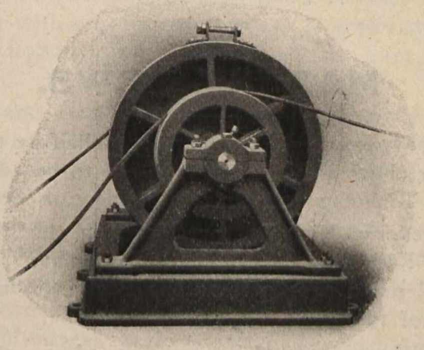


Fig. 3.
Side View, Showing Lead of Lines.

nection with dredges, excavators, travelling derricks, guy and stiff-leg derricks, locomotive cranes, and in fact almost every style of machine capable of operating an automatic bucket.

These hoisting drums are manufactured by The Hayward Company, 97-103 Cedar Street, New York, N.Y.

## BOLT DRIVERS.

An extremely handy lathe attachment has just been brought to our notice by Armstrong Bros.' Tool Company, Chicago, Ill., in the shape of a bolt driver, for turning square,

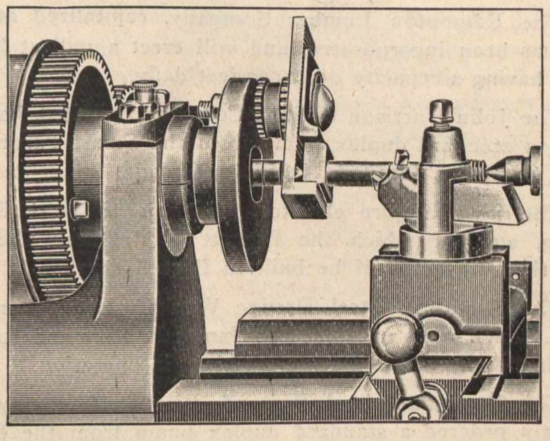


Fig. 1.

flat, or hexagon stock. Fig. 1 shows the driver, which is drop forged from bar steel. It is well designed, and easily adjusted. Fig. 2 shows the driver attached to the lathe. By

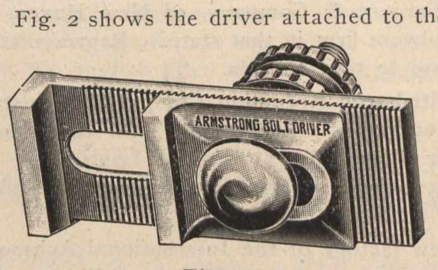



Fig. 2.

means of the extension washer shown between face plate and driver body, the driver can be adapted to use with centres of varying lengths.

## INDUSTRIAL NOTES.

The new factory of the W. R. Woodman Mfg. & Supply Co., Boston, Mass., is completed, and they are now in a position to fill all orders, whether large or small.

The Cling-Surface Company are about to establish a depot in Toronto, and all orders from Ontario and the Western Provinces will be filled from that place.

The Forwell Foundry Company, Berlin, have recently ordered a hand power travelling crane from the Smart-Turner Machine Company, Limited, Hamilton, Canada.

John F. Allen, 370-372 Gerard Avenue, New York City, report that they have just made a shipment of two 72" Allen riveters to Japan, the order for which was received by them through Mitsui & Company, of New York City.

The Robins Conveying Belt Company has recently opened an office in the Frick Building, Pittsburgh, Pa. Mr. G. R. Delamator, their resident engineer, is prepared to receive enquiries from the vicinity of Pittsburgh relating to conveying and hoisting machinery.

That lime can be successfully burned in rotary kilns fired with producer gas has been demonstrated at Natural Bridge, N. Y., where the New York Lime Company has recently put in successful operation a 100'x6' rotary kiln. The gas is of the high quality made by the Morgan Continuous Gas Producer, with automatic feed.

The Singer Mfg. Company, Elizabethport, N. J., are equipping their hand-fired gas producers with automatic feeds, supplied by the Morgan Construction Company. It is expected that the cost of these feeds will be paid for in the savings effected in the fuel and labor bill during the first year of operation, in addition to making the gas supply uniform in quality and quantity.

The Smart-Turner Machine Company, Limited, Hamilton, Ont., have recently received an order from the Sudbury Building Supply Company for one of their automatic receivers.

The machine shops of the Stuart Machinery Company, Winnipeg, were damaged to the extent of $10,000 by fire.

The Green Fuel Economizer Company recently supplied an induced draft-fan and economizer to the Imperial Paper Company, Sturgeon Falls, Ont.

The Edmonton Lumber Company, capitalized at $60,000, has been incorporated, and will erect a mill at Strathcona, having a capacity of 40,000 feet daily.

The John Harrison & Sons Company, Limited, have ordered a standard duplex pump from the Smart-Turner Machine Company, Limited, Hamilton, Canada.

The new Empire elevator, which is to be built this spring, and for which the Barnett & McQueen Company have the contract, will be built in Port Arthur.

The American Steel Dredge Works, Logansport, Indiana, which were organized by James P. Karr and John D. Rauch, now have their complete plant in operation.

The Northumberland Paper & Electric Company have recently ordered a standard duplex pump from the Smart-Turner Machine Company, Limited, Hamilton, Ont.

The latest American firm to announce their intention of establishing a Canadian branch for the manufacture of their goods is Sargent & Company, of New Haven, Conn., the largest hardware firm in that state. Representatives of the company are to tour Canada.

The Pittsburgh Reduction Company are installing four Morgan Continuous Gas Producers for calcining aluminum ore in their rotary kilns at East St. Louis, Ill. These producers are to replace a battery of the old style hand-fed type.

The new factory of the International Acheson Graphite Company on Battery Street, Niagara Falls, is now in operation. The factory contains ten electric furnaces, and will be run to supply the Canadian trade. The electrical equipment cost $35,000.

The Smart-Turner Machine Company, Limited, Hamilton, Canada, have received an order from A. Davis & Sons, Kingston, for one of their duplex power pumps.

The White Sewing Machine Company, of Cleveland, Ohio, is seeking a location for a Canadian branch, in order to overcome the disadvantages of paying duties of 30 per cent. on sales in the Dominion. Its factory will employ about 300 hands.

Plans have been announced for the enlargement of the Carnegie Steel Company on an enormous scale, involving an investment of about $7,000,000. The new mills and furnaces, it is said, will find employment for several thousand additional men.

The Canada Glue Company, Brantford, who are putting in one of the most up-to-date glue factories in America, after careful consideration, have placed their order with the Smart-Turner Machine Company, Limited, Hamilton, for their full equipment of pumps.

The conditions which are rapidly driving large manufacturing interests from the United States to Canada are to be considered within a few days by the Illinois Manufacturers' Association. Reports just gathered show that 132 of the leading concerns of the country have been obliged chiefly on account of tariff restrictions, to establish branch plants in Canada. The resulting loss financially is estimated at upwards of $50,000,000.

A conspicuous departure in the lighting of canals is that of the Welland canal, near St. Catharines, Ont. Over 600 A.C. series arc lamps have been provided by the Canadian Westinghouse Company, and these have been in operation for the past few months, and have given splendid service. This installation as a whole redounds great credit to the Ontario Government, as well as to the consulting Engineer, Mr. R. J. Parker, under whose direction the complete plant was installed.

The American-Abell Engine & Thresher Company will build a large addition to their warehouse at Regina, Sask.

The Jenckes Machine Company have recently ordered an independent jet condenser from the Smart-Turner Machine Company, Limited, Hamilton, Canada.

It is understood that the United States Steel Company are about to build a $10,000,000 steel plant at Sandwich, Ont.

The plant of the International Acheson Graphite Company is now installed in the new building at Niagara Falls. The electrical equipment cost about $30,000. From 200 to 250 H.P. will be used. The plant will employ about a dozen men.

It is estimated that the aggregate timber cut this season will be 800,000,000 feet of board measure; that 125,000 cords of pulp-wood will be taken out, and 2,500,000 railway ties. Last season 1,986,000 railway ties were cut. The great amount of railway construction now in progress has made the demand for ties very brisk.

An exhibition of British manufacturers will be held in Alexandria and Cairo between the months of November, 1906, and February, 1907, and it is proposed that the duration of the exhibition will be about one month in each city. Probable exhibitors are requested to send their names in to the British Manufacturers' Exhibition in Egypt, Alexandria, P. O. Box 423.

John F. Allen, 370-372 Gerard Avenue, New York, report sales of their well-known "Allen" riveters during December as follows: American Car & Foundry Company, three riveters; Scully Steel & Iron Company, three riveters; Berger-Carter Company, two riveters; Mitsui & Company, two riveters; Snare & Trieste, one riveter; Pettibone, Mulliken Company, one riveter; Buffalo Brake Beam Company, one riveter; Schreiber & Sons Company, one riveter.

The Westinghouse Machine Company, of East Pittsburgh, Pa., have sold during the past few weeks 1,247 H.P. of their vertical gas engines to the following customers: A. Zimmerman, McKeesport, Pa.; Edgeworth Water Co., Edgeworth, Pa.; W. R. Morrow, Peru, Kan.; Standard Oil Co., Camden, N.J.; McClintic-Marshall Construction Co., Rankin, Pa.; Warren & Jamestown Street Railway Co., Warren, Pa.; The Wehrle Company, Newark, Ohio; Wm. R. West, New Bedford, Mass.; Sewickley Electric Light Co., Quaker Valley, Pa.; Youngstown Car Mfg. Co., Youngstown, Ohio.

An important order recently secured by the Canadian Westinghouse Company was obtained from the Vancouver Power Company, of Vancouver, B. C. This order included a 1500 H.P., 2200 volt revolving field engine type generator, which will be direct connected to a Pelton water wheel. This is a duplicate of the generators now in operation in the power plant of this company, and will operate in multiple therewith. The order includes switch boards, air blast transformers of 550 K.W. capacity. There is also included in the order a 1000 K.W. 60 cycle rotary converter to operate 550 volts. This converter will furnish power for railway work and will be controlled direct from the switchboard.

## MARINE NEWS.

Three new passenger steamers propelled by twin screws and costing about a million dollars, are to be added to the fleet of the Richelieu and Ontario Navigation Company.

Mr. Frederic Nicholls, president of the Niagara, St. Catharines Railway and Navigation Company, announces that he will put a new boat on the Port Dalhousie line for the season of 1907.

William Cunard, son of Samuel Cunard, one of the founders of the Cunard line, died in London on January 11th. He was 81 years old.

The new Canadian Pacific steamships for the Atlantic line will be fitted up with the new appliances for receiving sound signals through the water. At important points in the St. Lawrence River submarine bells have been placed, which in thick or foggy weather are sounded automatically by pneumatic pressure.

## RAILWAY NOTES.

It is stated that the Southwestern Traction Company's trolley system will be in operation between London and St. Thomas by the first of April.

The Canadian Pacific Railway Company will build terminals at Lethbridge, Alta., including a ten-stall roundhouse, freight shed 500 feet long, and the necessary repair shops.

Canadian railways have already placed orders for 200,000 tons of rails, for delivery in 1906. These rails will be made at the two big Canadian mills, at Sydney, C.B., and Sault Ste. Marie.

The C. P. R. has asked the Railway Commission for approval of a new line, running from a point on their line near Woodstock, through Brantford, to Hamilton, and from Hamilton, through Grimsby, to Niagara Falls.

The Grand Trunk Pacific survey into Edmonton has been completed, and the two possible routes completely delineated, are already before the engineering chiefs of the railway in Montreal for consideration and final choice.

On February 1st, Mr. John J. Beck, of Fort Erie, will assume the position of superintendent of the Union Station, Toronto, the retirement of Mr. Wm. Gormally, the present superintendent, being rendered necessary through ill-health.

The route of the new Canadian Pacific Railway line which will connect Ottawa directly with the Georgian Bay, has been submitted to the Minister of Railways and Canals for approval. The proposed line is known as the Georgian Bay and the Seaboard Railway.

It is said that the three electric railways in and around the city of Brantford, Ont., viz., the Grand Valley Railroad, the Brantford Street Railway and the Thames Valley Railroad, have changed hands. These three roads formerly belonged to practically the same people. The roads have been sold to Toronto capitalists.

C. P .R. engineers are now engaged in making the final surveys for a gigantic "loop" in the main line in order to reduce the objectionable heavy grade at Field. The proposed new loop will be about twenty miles in length and will reduce the steep grade on what is known as the "big hill" to a minimum. The question of doing away with the steep grade at Field has been under consideration by the management of the C.P.R. for some time.

The Niagara, St. Catharines & Toronto Railway Company gives notice of application to Parliament for charter to build lines from Thorold to Welland, Port Colborne, Fort Erie and Niagara Falls; from Niagara Falls to Niagara-on-the-Lake, from St. Catharines to Niagara-on-the-Lake, and from Thorold or Niagara Falls to Brantford, a total length of about one hundred and fifty miles. The N. S. & T. Company also wants to increase its capital, to have the right to amalgamate with any other road, and to make arrangements with power transmission companies for the joint use of right of way.

The Grand Trunk has decided to spend more than a million dollars by placing the following exceptionally large orders for motive power: Ten ten-wheel passenger engines, with the Locomotive and Machine Company, Montreal; ten ten-wheel passenger engines with the Locomotive Company, New York; fifteen Richmond compound consolidated engines, Canada Foundry Company, Toronto; forty Richmond compound consolidated engines, Locomotive and Machine Company, Montreal, making in all 81 locomotives, 20 of which are passenger, and 61 freight engines.

## MINING MATTERS.

The Nova Scotia Steel & Coal Company are preparing to open a new colliery at Sydney Mines, N.S., to be operated almost entirely by electric power.

The Anderson Stone Quarry Company, of Amherstburg, has been reorganized with a capital stock of $1,000,000, and will begin operations in about two months. It is said that $50,000 has been spent in new machinery and that one hundred men will be employed.

The Golden Key Mining Company, Hillside, Ariz., is installing a power plant to operate its mining machinery. Contract has been closed for two of the well-known "Hornsby-Akroyd" oil engines, sixteen horse-power each, built by the De La Vergne Machine Company, of New York.

The headquarters of the Gypsumville Mining Company is to be removed to Logan, on White Mud river, not far from Westbourne, where the product of the mines owned by the company on Lake Manitoba will be manufactured. The C. P. R. will, it is understood, build a spur line from Westbourne to the works.

Last year 227,000 tons of ore were received at the C. P. R. smelter at Trail, B.C. From these ores there were produced 82,000 ounces of gold, 1,360,000 ounces of silver, 13,280,000 pounds of lead, and 4,529,000 pounds of copper. The refined product consisted of 9,200 ounces of gold, 1,088,000 ounces of silver, and 16,393,000 pounds of lead. Considerable improvements and addition are being made to the smelting and refining plant at the present time in order to get it up to the highest pitch of perfection possible.

## LIGHT, HEAT, POWER, ETC.

Cecil B. Smith, of the Ontario Hydro-Electric Power Commission, has left for Hamilton, where he will make some enquiries regarding electric power, its price and cost of production, and matters generally connected with electrical energy. Something of an important nature in the form of a report will be prepared for the coming session of the Legislature.

The City Council of Charlottetown, Prince Edward Island, has passed a resolution denouncing the action of the Charlottetown Light and Power Company in increasing flat rates on commercial and domestic lighting in violation, it is claimed, of an agreement whereby the company is to light the city for five years. The resolution also states that unless the increase is withdrawn the city will install its own electric plant.

The Stark Electric Light, Power and Telephone Company has come forward with an offer to purchase the municipal lighting plant of Paris, Ont., making it the centre of a radius of fifteen miles, in which the company will supply light, power and telephones. The Town Council has set a price of $50,000 upon the plant. The company states that it will sell power at eight cents a kilowatt, while the telephone rates will be one cent a call, with a maximum rate of $15 for residence and $25 for business telephones.

The Pittsburgh Reduction Company, which makes aluminum, has contracted with the Niagara Hydraulic Power Company for the delivery of 27,000 horse-power by May 1. This contract is 2,000 horse-power greater than the recent contract between the New York Central and the Niagara, Lockport and Ontario Power Company, and is greater than the total horse-power of any European development. The extent of the development at the Falls is thus strikingly illustrated.

The Board of Trade and other Amherst citizens have with David Mitchell, manager of the Maritime Coal Company, Maccan, had under consideration for several months a scheme for transmitting from Maccan electric power generated at the mine, for the use of industrial plants at Amherst, at a rate much below the present cut. A right-of-way has been secured—the distance being about nine mills —and an electrical engineer has just entered upon the duty of working out the details for a report which will be submitted to the Board of Trade.

The Georgian Bay Power Company are asking for tenders up to January 26th for the construction of a tunnel in connection with their power development project at Eugenia Falls.

## PERSONAL

Mr. J. W. Davis has recently been appointed manager of the publicity department of the Canadian Rand Drill Co., in which new position we wish him entire success.

Canada's Minister of Marine and Fisheries, Hon. Raymond Prefontaine, died very suddenly in Paris on December 28th. His death was due to angina pectoris.

It is understood that Willis Chipman, C.E., of Toronto, has been engaged by the corporation of Prince Albert, N. W.T., to report on a water power about ten miles from that place.

Mr. C. F. Gildersleeve, formerly general manager of the Richelieu & Ontario Navigation Company, is dangerously ill. Dr. Roddick, Montreal, has been called to the bedside.

Mr. A. Eugene Michel has recently entered the employ of the Geo. H. Gibson Co., advertising engineers, Park Row Building, New York City, having resigned as assistant advertising manager of the Standard Paint Co. Mr. Michel is a graduate of the Rose Polytechnic Institute, and his professional experience includes: two years in the engineering department of the Diamond Chain Works of the Federal Manufacturing Co., charge of the testing department of the Ewart Mfg. Co., and the assistant managership of the department of publicity of the International Steam Pump Co., under Mr. Gibson.

## MUNICIPAL WORKS, ETC.

The Town Council of Aurora, Ont., will install a new system of water-works at an expenditure of $10,000.

The Town Council of Carberry, Man., are considering the installation of an electric light plant, at a probable cost of $15,000.

A by-law will likely be submitted to the ratepayers of Vancouver, B. C., to provide $30,000 for the purpose of establishing a modern crematory.

The ratepayers of Bobcaygeon, Ont., granted a by-law on January 1st to raise $25,000 for the purchase of a water power and establishment of an electric light plant.

The Trenton Electric & Water Company have agreed to extend until February 1 the time allowed the council for a decision in respect to the lighting contract. They have also agreed to make the term three instead of five years.

The City Council of St. John, N. B., have appropriated the sum of $400 for the purpose of securing a report from an engineer on the water power at the Reversible Falls. It is probable that Mr. C. H. Vogel, of Ottawa, will be engaged.

## TELEGRAPH & TELEPHONE

The New Brunswick Telephone Company will build a trunk line between St. John and Fredericton.

The Central Telephone Company, Sackville, N.B., have bought out the Sackville Electric Light & Telephone Company, improvements will be made.

G. M. Kenzie, C. P. R. operator at Kenton, Man., has perfected an automatic device for calling another office which will do the work of a man in this respect. He expects it to greatly facilitate telegraphy.

The City Council of Vancouver, B.C., has required the use, by all telephone and call box companies, of proper protection devices to be connected to their circuits where they enter buildings.

The Canadian Machine Telephone Company have secured a twenty-one years' franchise for a telephone system in the city of Brantford, Ont. The franchise provides that the company must start work by May 1st next, and the system be installed within twelve months. It is understood that as soon as possible the erection of an office building will be commenced.

## NEW INCORPORATIONS.

**Ontario.**—New York and Canadian Milling Co., Toronto, $40,000. G. R. Geary, F. D. Byers, O. F. Taylor, L. Duff, E. Dickey.

The Sudbury Machine Shop and Foundry Co., Sudbury, $40,000; D. H. Haight, J. Lawson, Copper Cliff, Ont.; A. B. Gordon, L. O'Connor, Sudbury, Ont.; O. R. Smith, Victoria Mines, Ont.

The Dwyer Mining Co., Toronto, $100,000. J. B. LeRoy, M. LeRoy, J. R. Humphreys, H. R. Frost, Toronto; D. R. Dwyer, Seattle, Wash.

Vermilion River Iron Ore Co., Toronto, $80,000; C. C. Yerkes, Northville, Mich.; F. Denton, J. W. McDonald, M. A. McKessock, E. A. Francis, Toronto.

The Thorold Natural Gas Co., Toronto, $40,000; C. A. Moss, W. Gilchrist, J. C. Radenhurst, R. Credicott, J. A. Thompson, Toronto.

The Wendigo Progressive Mining and Development Co., New Liskeard, $40,000; J. Cox, S. D. Eplett, A. N. Morgan, New Liskeard; G. W. Slade, J. W. Foreman, Dymond, Ont.; J. McFarlane, Harris, Ont.

Dymond Development Co., Ottawa, $250,000; C. W. F. Gorrell, A. T. Shillington, Ottawa; B. J. Arnold, W. L. Arnold, R. G. Arnold, Chicago, Ill.

The Terrill Cobalt Mining Co., Sault Ste. Marie, $100,000; W. E. Gimby, D. I. Miller, A. G. Terrill, W. B. Moorehouse, A. McIntyre, G. Woolrich, J. A. Shannon, G. W. Shotts, J. A. McPhail, F. Rogers, Sault Ste. Marie; R. H. Schultz, Toronto; H. H. Taylor, R. J. McKeone, W. R. Bacon, Sault Ste. Marie, Mich.

The Siche Gas Co., Toronto, $100,000; F. L. H. Sims, J. H. Chewett, A. I. Chewett, F. Sims, R. G. Hunter, Toronto.

**Dominion.**—The Dominion Brazing Co., Montreal, $100,000; A. Hendery, W. Eckenstein, Montreal; H. L. Dinning, Lachine, Que.; C. Ralph, Longueuil, Que.; C. A. Duclos, Westmount, Que.

Dominion Steel Car Co., Montreal, $500,000; E. F. Surveyer, A. C. Casgrain, C. M. Cotton, J. W. Weldon, S. J. LeHuray, Montreal.

The Turret Bell Co., Toronto, $200,000; G. G. Ruel, R. P. Ormsby, G. F. Macdonnell, F. C. Annesley, Lorne W. Mitchell, Toronto.

Jamaica Light and Power Co., Montreal, $250,000; J. Hutchison, C. J. Fleet, W. G. Brown, Montreal; G. M. Webster, H. Holgate, Westmount, Que.

Canadian Consolidated Mines, Toronto, $5,500,000; H. S. Osler, W. B. Raymond, F. Ford, G. C. Loveys, W. W. Livingston, J. M. Ewing, B. Osler, Toronto.

The Central Heat, Light and Power Co., Montreal $500,000; S. Carsley, W. F. Carsley, S. Carsley, Jr., C. Morton, M. Goldstein, Montreal.

Robert Gardner & Son, Montreal, $140,000; R. Gardner, J. Gardner, W. Gardner, D. Currie, J. B. Rowley, Montreal.

The MacArthur Construction Co. of Canada, Montreal, $6,000,000; A. MacArthur, A. F. MacArthur, Chicago, Ill.; J. R. MacArthur, New York, N.Y.; W. J. Poupore, G. C. Foster, Montreal.

Empire Construction Co., Montreal, $1,000,000; L. C. de Buiseret, E. Fichefet, C. Goffinet, L. Goffin, L. Grenier, G. Marquet, J. D'Oultremont, Armand Rouffart, E. Rouffart, Belgium; J. B. Tudhope, Orillia, Ont.; H. W. Fleury, Aurora, Ont.; P. Galibert, F. Gauthier, Montreal.

Grosvenor Electric Light and Heat Co., Montreal, $125,000; J. W. A. Hickson, H. B. Picken, T. P. Howard, J. R. Hyde, H. M. Marler, Montreal.