PAGES

MISSING

The Canadian Engineer

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The Canadian Engineer.

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

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REPORT ON PEAT.

One of the most interesting reports issued by the Department of Mines for Ontario is that on Peat Fuel, which contains the results of investigations by E. H. Carter, an officer of the department, who has made a special study of the subject. It contains a great deal of information of interest in view of the disastrous strike of last year, among the coal miners. The possibilities of peat manufacture in Canada are limitless, and if properly handled, might place us in an independent position as to fuel supply. Speaking of cost, the report says it costs about $1 per ton to produce peat briquettes in Ontario, and after allowing a reasonable margin for profit, interest on investment, etc., it can be sold at the place of production for $3 a ton. Putting the value of the peat at two-thirds that of coal, at $3 a ton, its cost would be equivalent to anthracite coal at $4.50, and at $4 per ton to anthracite at $6 per ton. Such figures at once brings peat fuel into the economic arena, the report adds, as it may be doubted whether with the effective control now exercised by the trusts over production and sale of anthracite, we are likely to see it again drop to a lower level than $6 per ton.

AN IMMENSE INDUSTRIAL DEVELOPMENT.

An immense industrial project is in contemplation on the Canadian side, at Niagara Falls. A. J. Wright, of Buffalo, acting through various agents for a syndicate of London and New York capitalists, who have $10,000,000 to invest in the scheme, has purchased or secured options on about 3,000 acres of the cream of the land, between Slater's Point at Drummondville, which will be converted into factory sites, and already an immense steel plant is said to be arranged for. Large docks will be constructed along the channel, and as vessels can come down the river from Lake Erie, they will be enabled to load and discharge at the works. The land was secured at a low price. On the United States side, similar property for factory sites is held at about $5,000 an acre, while the Canadian property averages about $100. The names of the members of the syndicate have not been divulged, but it is said to be composed of very influential men. This project will furnish a market for the power now being developed at Niagara Falls, and considering the manufacturing centre which has grown up on the United States side within the last few years, we may look forward to a like, or even greater, development on the Canadian side.

THE GRAND TRUNK PACIFIC.

The Grand Trunk Pacific Railway charter now before Parliament has developed considerable opposition, largely from the Maritime Provinces, the members from that section being apprehensive, that as the eastern terminus named in the application is Quebec, the company intend to make Portland, where they already have terminal facilities, their winter port. Assurances are, however, given that such is not the intention. At present, the Intercolonial is available to reach Halifax, St. John, Sydney and other Maritime Province ports, and Mr. Wainwright is stated to have written a letter promising to build from Quebec to Moncton. The promoters of the Trans-Canada Railway also oppose the charter, which was to be expected, as that road covers in part, the same territory, and they claim to have been first in the field. The promoters of the Grand Trunk propose to build from Quebec to Winnipeg first, and to extend the line west as fast as possible. On May 7th, Mr. Hays announced that they had nine survey parties in the field between Winnipeg and North Bay. The rate of construction would depend on the facilities for obtaining labor and material, and he spoke of the line being built complete in from one to five years.

With reference to an eastern outlet, while the Intercolonial would be employed for a time under agreement, Mr. Hays states that it would not be able to accommodate the

traffic. He says that from 1,000 to 1,500 cars, loaded with grain, have stood for weeks in the Montreal yards, unable to go forward. But whatever happens, nothing will satisfy the people of Canada but an eastern terminus in Canada, and that it shall be a road for the accommodation of the people of the country, that is, that traffic originating in Canada shall be given the preference. The public aid to be given will probably take the form of a guarantee of interest on the bonds.

The best solution of the problem of transcontinental transportation is complete Government ownership of all roads hereafter built, but as the Canadian public is not educated up to this point, the next best solution is a generous arrangement with the Grand Trunk, whereby we shall have an all-Canadian route from ocean to ocean, that will secure to the country the service which the Canadian Pacific Railway alone cannot give for the growing west, and that will develop wide stretches of territory, which must otherwise lie fallow or, if colonized, be cramped for railway facilities. Such a cross-continent line is not a prospective need, it is an immediate necessity, and the Grand Trunk alone can supply this need almost off-hand.

In saying this, we should not throw cold water on the Trans-Canada scheme. If built far enough apart from the other trunk lines, it will create business for itself in the colonization it will bring with it, but this will, of course, take time to develop. It will follow the Grand Trunk Pacific line as the Grand Trunk Pacific follows the Canadian Pacific. But the pressing need of the moment is a second avenue from the Pacific Ocean to the Atlantic, and the Grand Trunk plans provide this in such a way as to develop vast reaches of new territory, incidentally as the scheme is carried out.

It is said that photographs have been made in an absolutely dark room, by rays from the human body. The possibilities from this discovery are enormous. It is suggested that physico-radiographs of the rays from individuals may serve to show the physical condition of the subject. The cause of hypnotism may be revealed. Perhaps thought photographs may ultimately be made.

The Bell Telephone case came again before the Grand Jury, at the criminal assizes at Toronto, last month, and resulted in no bill. The ground for this finding, which is contrary to that at the March sessions, was that the agreement between the Bell Co, and the C.P.R., which was charged as being a violation of section 520 of the criminal code, was made in Montreal, and the case must be tried where the offence was committed.

There is reason to fear that the recent accident on the Intercolonial Railway, near Windsor, by which four train-men lost their lives, was the result of drunkenness on the part of some of the crew. Copeland, the engineer of the passenger train which disobeyed orders and ran past the semaphore, has been in the employ of the road for thirty years, and had not a bad mark against him. He had been on duty only three or four hours before the collision. His explanation was that he must have lost his senses, but there is reason to suspect that he was asleep on his engine. If the cause is as stated, too stern an example cannot be made, for railway hands entrusted with human life should be sober, above all things.

While much has been said about the great Assouan dam, recently completed in Egypt, that ancient land boasts of many engineering works of enormous magnitude, all of which are over 4,000 years old. It is not likely that we shall again see a building with 7,000,000 tons of stone in it, as has the pyramid of Gizeh, and it will be long before we have an irrigation reservoir of greater capacity than Lake Moeris, which, accepting the figures of Major Brown, R. E., held 11,800,000,000 cubic metres (tons) of water, between high and low water marks. What the Labyrinth was like we do not really know, but Herodotus classed it as a greater wonder than the pyramids, although lesser than Lake Moeris. Then there is a tradition that at one time the Nile flowed at the foot of the Libyan hills, and that it was diverted by artificial means to its present bed. If that be true, the work must have far exceeded in magnitude the Assouan dam. But after all, there was not so much science in ancient engineering. The engineers of those old days excelled in the manipulation of heavy weights, which was accomplished by the slow and laborious work of great armies of slaves. Among the chief examples of such work are the columns of the Temple of Karnak. To cut a block of stone in a distant quarry, to work it to a cylinder 12 feet in diameter, float it down the Nile, land it, and place it on the top of a column of similar stones, making a total height of 60 feet, was no small enterprise. A still more difficult undertaking was the great obelisk now standing beside the Church of St. John Lateran, in Rome, with a height of a 108 feet, and a weight of 450 tons. But the crowning example of Egyptian engineering was the colossal statue of Rameses II., at Thebes. Before it was broken it was a single block of red granite 60 feet in height, computed to weigh 887 tons. But even with simple instruments, such as ropes, wedges, levers and pulleys, such as the Egyptians used, great weights can be handled without much difficulty, provided time is no object.

LIGHT, POWER, PHONE AND TELEGRAPH ON ONE CIRCUIT.

Another stage in the history of electrical development has been reached, in the invention by Alexander McMartin Stark, late superintendent of the Bell Telephone Company, in Toronto, of a new system of distribution, which will enable electric light, power, telegraph and telephone service to be supplied on the same circuit.

It is well known that modern telephone practice has made a great advance by centralizing the electric energy needed by subscribers for talking and ringing. By bringing about this centralization many desirable results are attained. The idle capital represented by the subscribers' local batteries and the calling generators is done away with. The labor of visiting or inspecting the subscribers' apparatus is greatly reduced; that necessary to repair and renew batteries, together with the expense of material for such renewal, being rendered nil. The subscribers' instruments are made neater and more compact. The electrical efficiency of the plant is greatly increased by having a few large units in operation practically all of the time, instead of a great number of small units in operation but a small portion of the time. All these advantages were achieved by the introduction of the common battery or central energy system, whereby the whole of the current necessary to operate a large telephone system is generated at the central office. The nature of the circuits employed, coupled with the fact that current employed for this purpose is of too low a voltage to enable it to be used for any other purpose than telephoning, has, however, hitherto limited these systems to telephone working only.

Mr. Stark has long been impressed with the idea that it would be a source of great economy if a central energy system could be devised, which would enable a current of sufficient voltage to be delivered at the telephone subscriber's

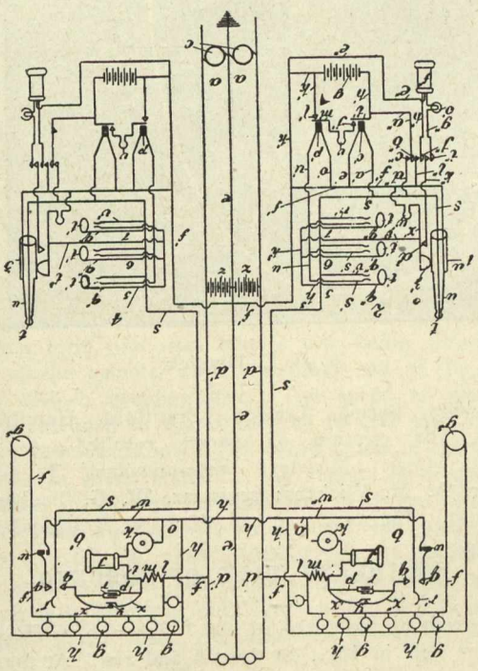
station to provide him with light and power also. As a result of continued experiments, he has succeeded in perfecting a system by which it is possible to use an ordinary electric light direct current of 110 volts, for the operation of telephone instruments, without possible danger thereto; hence, owing to this new development, every telephone subscriber is also supplied with a current which will light any number of lamps that he may require, in addition to driving motors, operating telegraph instruments, electric bells, fire and burglar alarms, etc.

As will be seen from the diagram of the circuits, the inventor proposes to adopt what is known as the three-wire system of generation and distribution. The current necessary for all services is distributed from the generator at the central station, where the telephone switchboard is also located, over the same main power circuit, from which service wires are taken to the subscriber's premises, in accordance with the present method adopted by electric light companies. In addition to this, one wire is carried from the central station to each subscriber's telephone, thereby effecting a saving of the second wire necessary with existing telephone systems.

The advantages claimed by the inventor for this system are as follows:

Economy and Simplicity of Construction.

One generating plant and central station instead of two. One wire of No. 22 B. & S. copper for each telephone circuit, instead of two wires of No. 19 B. & S. gauge. This would enable three times as many subscribers to be served as can be accommodated to-day by a cable of equal diameter over



five times the distance. As the same conduits would carry the mains for all services the number of underground ducts would be reduced to a minimum, and the amount of trenching would be lessened. The system of distributing could be so laid out as to avoid congestion, and the present chaotic web of underground and overhead electric light and telephone wires could be replaced by one well ordered and clearly defined system of conduits carrying the mains for every kind of electric service. These new conditions cannot fail to be a source of economy not yet reached in electric light and telephone construction.

Economy of Operation.

It is obvious that with the exception of the cost of the operation of the telephone switchboard, the combined systems could be maintained for the same expenditure as is now incurred by either one of the companies now supplying electric light or telephones. In other words, one managing and maintenance staff would be required, instead of two, as at present.

It may also be stated that the use of a direct current of 110 volts reduces all danger of personal injury from shock to the minimum. In fact, we believe no case has yet been recorded where death has resulted from receiving a shock from a current of this description and voltage; whereas the number of fatalities due to shocks received from alternating currents of high frequency is legion.

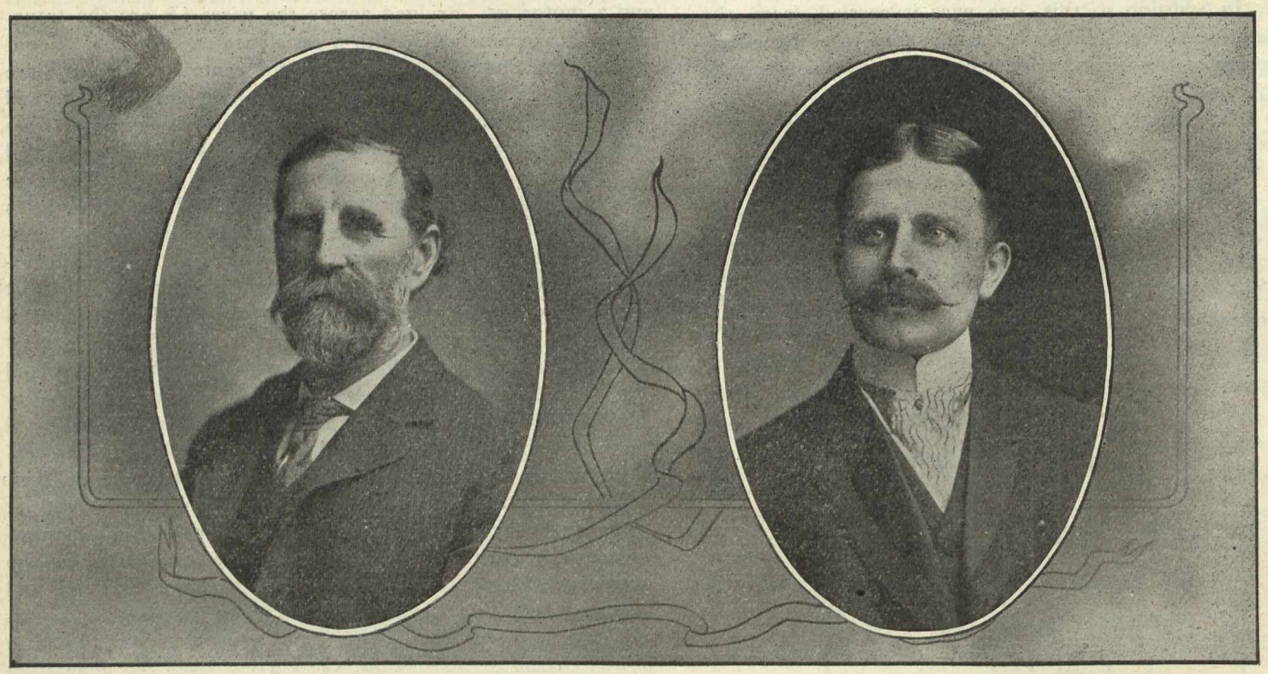
With regard to the general efficiency and economy of the three-wire system for electric lighting, the fact that the largest and most economical electric lighting plants in Great Britain, both company and municipal, including London, Liverpool and Glasgow, employ this system, is a sufficient demonstration of its merits.

The accompanying diagram and explanation will show the method of operation: A represents the central station and b b' the subscribers' stations. Connecting them is a three-wire circuit of two main wires d-d' and a return e. From the main wire d to station b is a wire f with a return h to the wire e. Connected in parallel with these two are the lamps g and a motor g5. Bridged across the wires f-h are the transmitter k and receiver j, with a resistance m. Hook r' is connected to a line wire s leading to the central office and there connected to the tip t of subscriber's individual plug u, and also to the signal relay c'. When the hook is down it rests on contact q' and cuts in the subscriber's signal w, connected on the other side to the main return wire e. The line wire s is connected to one spring v' in each of the multiple jacks of the line at central, of which the other springs s' are connected to the common return u', and thence through the relay p' by wires o' and f' to the common return e. The test rings t' are all connected together and to the plug seat switch x'. At the subscriber's station wires x and x" form a telegraph circuit, with any desired telegraph instrument y bridged by a condenser r, the purpose of which is to prevent the interrupted current of a telegraph instrument being transferred to the receiver of a telephone instrument. When the switch-hook r' is up it rests on a contact q, and the circuit from the central station is then from tip t of plug u, line wire s, hook r', contact point u, wire p, wire i, receiver j, and transmitter k to return wire o, and main wire e, and also from p over the telegraph circuit. Telegraph messages are sent and received over the telephone circuit when the hook is in this position. A storage battery z is bridged across the main power circuit to smooth out the current over the generators a-a. In calling central, the receiver is removed from the hook r' which engages the contact q and closes the line circuit to relay c', which attracts its armature i' and lights the lamp v, by current from battery g', the armature m' being normally back. When a plug is inserted in the jack, the tip t engages spring s' and closes the circuit of relay p', extinguishing the lamp v. It also engages the line spring v' and establishes a circuit to the signalling device w, which continues to operate until the receiver is removed from the hook. A clearing-out lamp w' is provided whose circuit is closed at the plug seat switch of the calling line when the plug is taken up for use. This lamp remains lighted until the subscribers have hung up, its extinction signalling for clearing out. The operator's telephone f2 is cut in by a listening key of the ordinary type whose contacts are shown at i2, j2, b2, and c2.

THE CANADIAN CASUALTY AND BOILER INSURANCE COMPANY.

The above company was recently organized with an authorized capital of $1,000,000, and a paid-up capital of $500,000 to carry on the business of boiler inspection and insurance sprinkler inspection and other classes of insurance and oversight appealing to owners of steam plants and manufacturing plants. The success which has already been attained by the company since it started business encourages the promoters to feel that they are filling an actual want. The business of boiler insurance had only been represented by one company in Canada, before the Canadian Casualty and Boiler Insurance Company entered the field, and the new law which was passed last year making it compulsory for companies to have their boilers inspected and insured, has no doubt

widened the field of operations for the new company. Yet the success achieved by the Canadian Casualty and Boiler Inspection Company is due to the energy and experience of the management and staff. A. G. C. Dinnick, the managing director, is a gentleman of large business experience and ability. To his great activity is due the formation of the company and the selection of the staff. Himself a man of great capacity for work, he understands to pick and choose men whose expert knowledge and ability is designed to place the company in the front rank before long. This ability of Mr. Dinnick to choose competent men for important posts is indicated by his selection of A. M. Wickens as chief of the engineers' department of the company. Mr. Wickens, whose experience covers almost all branches of engineering, recently resigned the position of chief engineer of Public Works of the Ontario Government, in order to accept his present appointment with the Canadian Casualty and Boiler Insurance Company. Bringing, as he does, expert practical knowledge to bear upon his deliberations, as chief of the engineer's department of the Canadian Casualty and Boiler Insurance Company, those who entrust the care of their steam plants to the company may be well assured of efficient and reliable service. Not only is the company in a position to give expert inspection of boilers, but it can also give advice on the erection and installation of any kind of steam or electric plant, on account of the thoroughness with which its engineering department has been formed. The policies of the company are reported to be especially favorable to insurers. Several new and liberal features have been introduced, while old-fashioned, irritating conditions are removed as far as possible. All these factors have combined to give the Canadian Casualty and Boiler Insurance Company a good start in business.



A. M. Wickens. A. G. C. Dinnick.

CANADIAN ELECTRICAL ASSOCIATION.

Arrangements for the annual meeting of the Canadian Electrical Association are well advanced. The convention will open at the King Edward Hotel, Toronto, at 11 a.m., on the 10th June, by an address of welcome from the mayor; to be followed by the president's address, reports of the sec.-treas., and of committees. A paper on long distance transmission will be read by Paul Lincoln, of Pittsburg, Pa. The second day will be taken up with the reading and discussion of papers, among which will be; "Industrial Electric Drive and its Relation to New Shop Methods," by R. T. Lozier, Cincinnati; "Submarine Power Cables," by A. R. Henry, Quebec; "Single Phase Alternating Motors," by W. A. Layman, St. Louis; and a paper by T. C. Frenyear, of Buffalo, on a subject not yet announced.

Friday, June 12th, will be devoted to unfinished business and the election of officers. The Canadian General Electric Co. will entertain the members to a tally-ho drive around the city, on the afternoon of the first day, and a visit to the new works of the Canada Foundry Co. will be made on Thursday afternoon, in special cars, by courtesy of the company. The annual dinner will take place at the King Edward on Thursday evening.

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

The eleventh annual meeting of the Ontario Association of Stationary Engineers was held on the 25th ult. About seventy members were present, from Kingston, Ottawa, Bowmanville, Sarnia, London, Brantford, Hamilton, and Orillia. The election of officers resulted as follows: President, Chas. Moseley; Vice-president, J. G. Bain; treasurer, A. M. Wickens; registrar, W. G. Blackgrove, all of Toronto. The next meeting will be at Brantford.

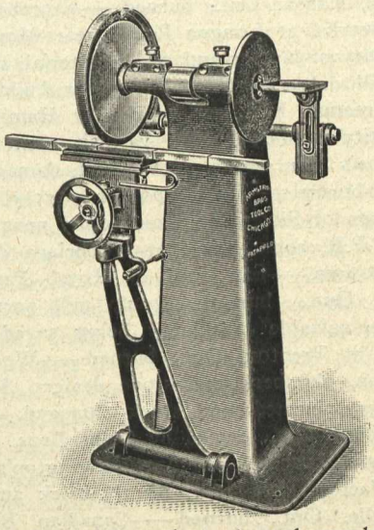
ENGINEERS' CLUB OF TORONTO.

Two regular meetings of the Engineers' Club, of Toronto, were held in May, on the 5th and 21st. At the former, a paper was to have been read, on Petroleum Industry in Canada, by W. J. K. Vanston; and at the latter a discussion was announced, on Street Pavements, led by C. W. Dill, but neither were given, on account of the absence of these gentlemen. On the 30th, a large number of the members visited Niagara Falls, on invitation of C. B. Smith, C.E., to inspect the development works going on there. The meetings have been suspended for the summer.

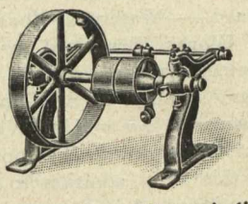
THE ARMSTRONG CUTTING-OFF MACHINE.

The Armstrong Bros. Tool Co., Austin avenue, and Lincoln street, Chicago, are placing on the market a new machine designed for cutting off self-hardening steel, rapidly, accurately, and with economy. It is described by the makers as follows: In the manufacture of our tool holders it is necessary for us to cut off large quantities of self-hardening steel into cutter lengths. Our experience has taught us that this class of steel gives best satisfaction when cut off cold. The ordinary shop practice has been to cut the steel off hot or to break it off on the anvil. The objection to the latter method is that the break is liable to be very irregular, result-

ing not only in a serious loss of steel, but also in vastly increased grinding with attendant waste of time and emery wheels. After experimenting with various methods of doing this work we have developed the machine illustrated, which in a slightly different form, has been in use in our works for about two years, giving perfect satisfaction, and with practically no expense for maintenance. The cutting is



done by a disc of special grade tool steel, revolving at high speed. Any attempt to cut soft steel, or ordinary cast steel with a disc results in a rough dragging cut, with flaring lips which bind the disc to such an extent as to reduce its speed to a point where it is ineffective, if it does not actually bend or break the disc. Owing to the peculiar nature of self-hardening steel however, it is not affected in this manner by the cutting disc, which makes in it even when forced hard, a clean, clear cut incision. The periphery of the disc is coated with self-hardening steel particles, and these particles do the actual cutting. Having had numerous enquiries from machine shops in every part of the world regarding our method of cutting off self-hardening steel, we have decided to place the machine on the market. We believe its convenience and economy will make it a paying investment for any machine shop, especially those which are using our tool holders. It will be observed that the machine is of combination form, the steel cutting disc being mounted on one end of the spindle, while the other end of the spindle carries a 12-inch grinding disc. The speed at which the machine is intended to run is such as to give the very best results for both operations. The construction of the machine is first-class in every respect. The spindle is of tool steel ground true. Bearings are cast iron and are dust-proof, with convenient and positive adjustment for wear and to take up a lost motion. The swinging table is provided with a length gauge, and is conveniently adjustable for steel of different sizes or depth of cut. The cutting disc is provided with a neat guard which can easily be swung back out of

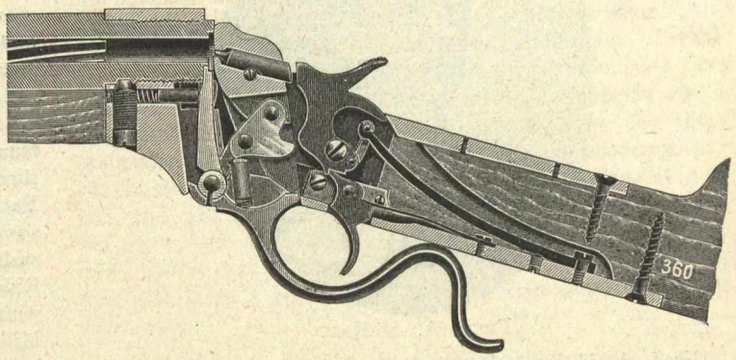


the way when changing disc. The grinding disc is made of boiler plate, and is provided with an adjustable table, so located that the operator will not interfere with cutting off long bars of steel. Each machine is equipped with counter shaft, one cutting disc, one grinding disc, one breaking block, one press for emery discs, one dozen emery cloth discs, assorted; one pound lubricating grease and one can special cement for attaching emery cloth to grinding disc.

It has been discovered in Germany that aluminum is valuable for sharpening cutlery. The metal apparently has the structure of a fine stone, and gives an edge keener than any whetstone.

NEW BREECH BLOCK ACTION.

The accompanying cut shows an improvement in fire arms made by the J. Stevens Arms & Tool Co., of Chicopee Falls, Mass. They have been working for some two years on a new drop-forged, sliding breech-block action to supplant the old style action that has been used on their Ideal rifles for many years, and have perfected what they believe to be the best, simplest and most durable action yet brought out, and is so passed on by their H. M. Pope, the well-known



rifle expert. Its strength permits using the modern heavy charges, and its ease of manipulation is a conspicuous feature. The popular lever action is retained, but greatly improved, with sliding breech-block. The dropping of the lever leaves a free inspection of the barrel from the breach, permitting loading quickly: Bringing back the lever raises and carries forward the strong breech-block with a rocking motion, which prevents any possibility of buckling the shell, thus properly seating the cartridge in the chamber, and finally, securely locking the action ready to be discharged.

RAILWAYS FOR INDUSTRIAL PLANTS.

We illustrate a section of light steel rails, which is especially adapted for use where it has to be cemented into the floor, as in boiler-rooms, etc., where it must not extend above the floor.

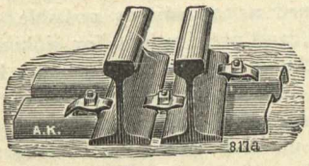


Fig. 1.

In some cases, however, the use of double rail track, as shown in Fig. 2, is desirable in stone or cement floors, where the passage of ordinary road vehicles, barrows, etc., cannot be obstructed, as for instance in factories, factory yards, wharves, etc. This system has been extensively adopted in breweries, factories, paper mills, and in fact in large plants

Fig. 2.

of all kinds. Instead of single rails, as in cases of regular light railways, two ordinary tee rails are placed close together on each end of the track, mounted on steel ties, as shown above. The track is sunk in the floor or ground so that the tops of the rails are flush with the ground level, and the space between the two sets of rails is levelled up with concrete, wooden blocks, bricks etc. The wheels run on the outer rails, the wheel flanges travelling in the slots between the outer and inner rails. For all industrial purposes, as well as for providing factories, warehouses, yards, boiler rooms, mills, etc., with complete track layouts, these tracks are furnished in sections of the required length with the necessary curves bent as required, switches, turntables, etc.,

to complete the system. These rails are placed on the market by Arthur Koppel, 66—68 Broad St., New York, the extensive manufacturer of industrial railway equipment, whose catalogue will be sent to interested firms.

FRED. A. MCKAY.

Fred. A. McKay, the winner of the prize offered by the publishers of the Canadian Engineer for the best essay by a student member of the Canadian Society of Civil Engineers, was born in Montreal, and entered McGill University from the high school, in 1899. He took the mechanical engineering course, and graduated this year, receiving the degree of B.Sc. He is now taking the electrical course. The essay, which appears in this issue, also took the college prize.

ROCK-SLIDE AT FRANK.

(Continued from page 166.)

Writing on the 25th May, our correspondent adds: Regarding Frank, there is nothing much to add. Reconstruction work is progressing, and the C.P.R. ran their first train through on the new track laid across the rocks, yesterday, so that the regular service will now be resumed, and we expect to return on Tuesday morning. At the mine, which is to be reopened as quickly as possible, the main tunnel is being cleared, and preparations for sinking a shaft are in hand. Up to this time all the workings have been above ground, in the interior of the mountain; the formations, strata and arrangements being similar to those prevailing in the Chestnut mines in Montana. Owing to the difficulties of approaching the old working, however, due to the disaster, a shaft is to be sunk some distance away, and underground workings will commence, while the approach to main tunnel will be reconstructed. The town has been declared open for habitation, and people are now flocking back, and the stores reopening, so that in a short time everything will be in full swing. Last week Sir. Thos. Shaughnessy was in Frank, with some geological expert from Montreal, who declared unhesitatingly that the land-slide was preceded and caused by an explosion of coal gas, and the gas generated by lime combined. This was my own opinion, and is the only hypothesis tenable to account for the huge rocks as large as dwelling-houses, which are to be found at the fringe of the rock-covered area, from 2 to 2½ miles distant from the mountain base, it being inconceivable that a land-slide could force the rocks across the valley, and up the opposite slope some 60 or 70 feet high.

The summit of the mountain is split in many places, and frequent rock-falls occur, although nothing in the way of serious slides is anticipated. The lower end of the town is now under water, as the river-bed was filled up with debris and rocks, and the water has had to seek new levels and new exits. The miners' houses in that portion of the town are to be moved to a fresh site, and the town practically reconstructed.

A poor watchmaker named Fritz has sold a mechanical time fuse for projectiles to the Krupp Company for $56,000, and a royalty of one mark (25 cents), for each device used.

FIRES.

The following fires have occurred in industrial works during the past month: Kootenay River Lumber Co.'s mill at Nelson, B.C., burned.——Matilda Mills, near Iroquois, Ont., belonging to M. T. Beach, burned.——Adams Bros. horse-collar factory, Toronto, burned.——Laing & Ritchie's planing mill, Essex, Ont., burned.——Storehouse of new locomotive works, at Longue Point, near Montreal, burned, with a quantity of lumber and other material, the destruction of which will delay work on the other buildings about a month.——Freeman Fertilizer Works, at Hamilton, damaged and a quantity of axle grease, varnish, etc., burned.——M. Beatty & Son's iron works, at Welland, damaged, and a lot of patterns burned——Shaft-house, compressor plant and other buildings of Silver Mountain Mine, near Port Arthur, burned.——C.P.R. round-house at Hochelaga damaged, with three locomotives.——Saw mill of Royal Paper Mills, at East Angus, Que., burned, a pulp mill partly destroyed, some of the valuable machinery being saved.——Reddick's sash factory at Trenton, Ont., burned.——Workshop of A. Riddle & Son, plumbers, and stove dealers, St. Catharines, with machinery, burned, and stock damaged.——Manchester Mills, at Auburn, Ont., owned by Cullis Bros., and operated by Geo. Towns, burned.——George Edgington's sawmill and cheese box factory, and John Kaar's brick and tile works, at Brownsville, Ont., burned.——Canadian Brewing Co.'s premises, Montreal, damaged, principally by water.——Keith & Fitzsimmons brass works, Toronto, damaged.——Warehouse and elevator at Seaport Mills, burned.——Factory of United Mineral Wool & Asbestos Co., at St. Henri, damaged. For drying the wool great heat is required, and it is blown into a room with a ventilator covered with a wire screen. The wool accumulated on the screen, and prevented the air from passing through, and the heat set fire to the pulleys and wood-work around the ventilator, doing considerable damage.——J. Matchett's evaporating factory, Waterford, Ont., burned.——Locomotive shops of Grand Trunk works, at Pt. St. Charles, damaged to extent of $2,500.——C.P.R. station, Ogilvie elevator, engine-house of Northern elevator, a number of cars loaded with lumber, and other buildings at Minnedosa, Man., burned.——Great fire at Ottawa, covering part of same territory burned three years ago, involving a loss of about $400,000, half of which was lumber belonging to J. R. Booth.——The Ottawa Electric Lighting Company lost about $3,000 in plant. The Electric Railway Company lost $3,500, of which $2,500 was on the Somerset bridge. Dominion Elevator Co.'s elevator at Nesbitt, Man., burned, with 13,000 bushels of wheat.——Fire at St. Hyacinthe, Que.; Cote's shoe factory, Dusseau & Lamoreau's implement works, Bedard's implement works, Hamel & Co.'s machine shop, Morin's sash and door factory, Cote Bros. flour mills, Allair's grist mill, Hudson & Allard's machine shop, burned.——Foundry of the Northern Iron Works Company, on Point Douglas, Winnipeg, burned, plant almost new, loss $15,000.——Gordon & Keith's furniture factory, Halifax, burned.——Waterous Works, St. Paul, Minn., in which Waterous Works, Brantford, are interested, used for the manufacture of gasoline engines, burned.——Robt. Mitchell & Co.'s brass foundry, at St. Cunegonde, Montreal, burned.——J. P. Newman's saw mill at Wiarton, burned.——About 100,000 feet of lumber in J. R. Booth's piling ground at Ottawa, burned; this is in addition to what was burned in the great fire mentioned above.

A new steam barge is being built by Lee Bros., at Wallaceburg, to be ready this month. She is being fitted with the engines taken from the burnt steamer Parry Sound, of Collingwood.

—As already mentioned, the Canada Foundry Co. has acquired the Northey pump manufacturing plant, and has removed it to the company's large new works, in progress in north-west Toronto. Mr. Northey will retain connection with the works under the new regime, and the services of Mr. Pell will also be retained for a specified time.

SOME THEORIES UPON RAILWAY LOCATION.*

By J. G. G. Kerry, A. M. Can. Soc. C.E.

(Concluded from last issue.)

In railway economics but little advantage is shown to result from reduction of curvature. There is, however, no doubt that it is received with general approval by all employees connected with the operating department, and that it will become even more popular as train speeds and weights of rolling stock increase. Train resistance is materially increased by curvature, and compensation by grade reduction must therefore be made on all ruling grades, and preferably on all heavy grades. On account of the known increase of this resistance with bad condition of track and rolling stock the compensation should be liberal, and should be carried out to the ends of the transition curves. The effect of curvature in increasing starting resistances is not known, but very strong objection to stalling on a curve exists among train hands. The maximum degree of curve to be used should, like the ruling grade, be determined by the local topography, the demand for easy curvature being mainly from high speed traffic, a variety which occupies far more space in the public and the railway mind than its financial importance seems to warrant. In Eastern Canada there seems but little need of curvature sharper than 4 degrees. . . .

With the recent increase of rolling stock weights has come an enormous increase in the proportion of cripple cars having defective draft gear. The design of couplings and drawbars is being very carefully studied by the Master Car Builders' Association, but it is also necesary that the possibility of subjecting these connections to sudden shock should be avoided as far as possible. Any condition which permits or compels the cars to crowd together, particularly when the engine is braked or running without steam, makes it certain that the connecting gear will be subject to some shock when the engine is subsequently given steam. By acting with judgment, the driver can make the shock very light, and a break in two can be considered as more directly due to his handling than to any arrangement of the grade line. The possibility of the cars crowding together should, however, be prevented when this can be done, and the grade line must be arranged so that the forces acting on the several cars in the train are nearly equal. Vertical curves are introduced for this purpose, and should be made with as small a rate of change of grade as topography and economy will permit. There is no theoretical reasoning from which a proper rate of change can be calculated, and there will always be a tendency for the cars to crowd whenever the grade falls more quickly at the rear end of the train than at the head if the engine is not under steam.

When the limits of grade and curvature have been fixed, railway location becomes little more than the solution by survey of a series of problems, in each of which the operating economy of lowered summits, reduced curvature, and shortened distance has to be balanced against the cost, as shown by the surveys and estimates, of making these improvements. The proper figures to use in calculating operating economy are very difficult to determine, and the values given by Wellington are still generally accepted in practice in spite of the great advancement that has been made in operating methods during the last ten years. The train mileage, upon which all economic calculations are based, is itself so uncertain a quantity that there is no special advantage in having very close values determined by the saving resulting from unit improvements in grade and curvature and distance. The statistics published annually by the Department of Railways and Canals give details of the train movement on the various Canadian roads, and furnish valuable figures for the prediction of train mileage on new roads. The character, resources and population can be determined by inspection and by consulting various official publications; and the history of a road through a similar district is a fair indication of the future of the one that is to be built. It is to be regretted that the gradual absorption of the minor lines into the great systems will prevent the publication of the results of their operation, the earning power and train movement of the main line and all its branches being reported as a whole by the great systems. The striking feature of the minor Eastern Canadian lines is the very slight tendency to increase shown by their traffic returns, a feature which calls for decided caution in traffic estimates.

In the future the skill of the engineer will be less hampered by financial necessity than it has been in the past. That minor lines are in themselves unremunerative is generally recognized, and the construction of the class of lines that formerly depended upon the future and upon local assistance for financial resources has become almost an impossibility. The backing of one of the great systems, or very liberal public subsidy is essential to the successful carrying out of these minor enterprises, and the current of public opinion is certainly setting against subsidies, except for the opening up of new districts. In establishing their own branches, the great systems will feel no imperative necessity for an economy that can be measured by units no greater than thousands of dollars, and will be willing that the roadbed, in common with the track and the rolling stock, shall become a subject of more liberal expenditure. Grading does not to-day constitute nearly so large a proportion of railway cost as it did twenty years ago.

As a general principle, the writer would consider it good practice to assume that a proposed line will eventually carry a heavy traffic and to make the location accordingly. By the use of cheap structures, and by the introduction of temporary grades and curvature, the cost of construction can be greatly reduced, and the line left in excellent shape for improvement when the traffic shall have developed. The old Great Western branch into Brantford is an example of such a location, having an excellent alignment and heavy grades, which can be easily reduced to a maximum of 15 feet to the mile. There is no evidence that the location was made with a view to future improvement, but the profile certainly suggests it. On the other hand, the Buffalo and Goderich line, through the same city, is an example of long tangent location secured by an utter disregard of any grades not exceeding 1.00 per 100, and often in situations where their improvement is impracticable. It should be generally recognized that the executive department of a railway will sanction a scheme for improving an existing line in preference to one that involves a new location, the legal and land difficulties that are involved in the latter case being almost entirely avoided in the former. The calculations of the economies resulting from detail improvements cannot be made with sufficient accuracy to justify an engineer in accepting their indications except in the most general way; and where the resulting gain shows but a small margin over the cost, the improvement may safely be left to the future.

Operating details, whose importance has not yet been measured by the science of economics, should also be considered during location. Of these the need of ample yard room is the most important. In the present great rush of traffic, it has proved much more difficult to keep the yards clear than to keep the lines open, and there is probably no railway today that is not carrying out great yard extensions. It is difficult to foresee during location where the demand for yard space will be made, and perhaps the most satisfactory provision for the future that the locating engineer can make is the selection of ample areas of level ground in the vicinity of all important centres, and preferably where a level grade and a straight alignment can be obtained. There are few yards to-day on the older lines which are not surrounded by settled districts that have grown up since the establishment of the yard, and the cost of extending these yards is made almost prohibitive by land values. . . .

The location of signals, stations and stopping points can be fairly well foreseen, and the line should be arranged to give as clear a view of these points from both sides as possible. A little handcar experience will convince any engineer of the desirability of a straight and open track near stations, no matter how good the signal arrangements may be. Snow

* Extracts from a paper read before the Canadian Society of Civil Engineers.

removal will be a perennial source of expense to Canadian roads, and its accumulation should be prevented by location if possible. It is customary to elevate the grade two or more feet above fields and flats, in order that the rail may be always windswept. In cuts ample width should be provided, and the rail raised well above the bottom of the cut wherever the wind directions are such that serious drifts will be formed. In bush location the change of snow movement that will be caused by clearing should not be overlooked.

That satisfactory track is largely a question of thorough drainage has long been acknowledged, but the fact that the necessity for drainage is a matter of natural soil has not been as clearly recognized by the railway engineer as by the common road builder. Cases occur where an inexpensive shift of the line would throw it upon a dry and open sub-soil, and alter the drainage conditions completely.

Every effort should be made to avoid road and railway crossings, swing bridges and lines along public streets, not only because of construction cost, but to secure freedom of traffic movement. The power to locate such crossings of other lines of transportation has to be obtained from the Railway Committee of the Privy Council. This is rather unfortunate, as that body has a decidedly political complexion, and a railway, no matter how carefully built, may have its line ruined by a level crossing forced upon it by Government authority. It is difficult to suggest an improvement upon our present method, unless it be by the creation of a non-political commission; and for the present it would seem that the road which has consistently avoided the building of level crossings itself is in the strongest position to fight any applications for permission to cross its lines.

The necessity of securing a good foundation for the roadbed is a point that should not be overlooked, as that detail affects both construction and operation. Every soft spot should be thoroughly tested before the location is finally laid down, and if any great depth of weak material is discovered, the line should be changed so as to avoid it. Bad foundation is not only a construction danger, but will be found to be the cause of a wave motion, when under traffic, that materially increases the tractive effort required, and renders it extremely difficult to maintain the track in good condition.

It would appear superfluous to remark on the necessity of always considering construction during location, were it not that many locations are made which require material alteration before the line can be built. It may be said that no engineer who has not had previous experience in location, construction and operation is capable of making a first-class location. There is unfortunately no line of work in which the best workmanship is more likely to escape general observation, an appreciation of which fact is perhaps the reason that so many capable railway engineers have taken up other branches of their profession. . . .

Lastly, it is to be remembered that all Canadian railways must be built under the provisions of the Railway Act, and of such Provincial Acts as may be in force. The engineer should therefore know the requirements of the act, for although railway managements may take most vigorous action to influence Government opinion upon great questions, they are perfectly prepared to accept all lega' requirements as to matters of detail.

WONDERFUL ENGINEERING.

An unparalleled engineering feat, says Collier's Weekly, has recently been achieved in Australia of immense value to the gold fields. The Coolgardie water scheme is to Australia what the famous Assouan dam is to Egypt. The remarkable feat of pumping 6,000,000 gallons of water a day for a distance of 350 miles, from the Helena river to Kalgoorlie, has been accomplished by English engineers by means of a great dam, called the Mundaring weir, ninety feet high, constructed across the Helena river twenty miles from Perth. The reserve capacity is about 5,000,000,000 gallons. There are a number of auxiliary reservoirs and pumping stations along the thirty-inch steel water main which runs along the railway line to the gold fields, the richest square mile of earth on the globe, near Kalgoorlie. The only foreign enterprise of equal importance is the Simplon tunnel, which will make Switzerland and Italy next-door neighbors. In a short time Pullman trains will pass through the Simplon Alps in a few minutes, 7,000 feet under the snow-covered diligence road which Napoleon Bonaparte built 100 years ago, and which takes about ten hours to traverse in favorable weather. This tremendous rat hole, which passes under Lake Avino, will cost the Jura-Simplon Railway over $15,000,000.

LEAKAGE OF KEROSENE OIL.

While it is undoubtedly true that kerosene oil is of a very penetrating nature and that it will leak through a very narrow crack, it is also the case that water is nearly, if not quite, as penetrating. One reason that leakage of water through a narrow crack is not so apparent as that of kerosene oil is that it evaporates and leaves little or no trace of the leak. Again, if there is any sediment or suspended mineral matter carried by the water, the evaporation soon leaves a deposit that effectually seals the crack and prevents further leakage. In the case of kerosene oil the leakage does not evaporate, or does so very slowly, and spreads over the outside of the vessel, making its presence very apparent, whereas the total leakage may be quite small. With the oil there is no tendency for a leak to seal itself, but on the contrary kerosene oil is of a highly solvent nature, and tends to remove all deposits clogging the crack.—Machinery.

SUIT RE TESLA'S PATENTS.

An important decision was lately given by the United States Circuit Court of Massachusetts, in the case of the Westinghouse Electric and Mfg. Co., against the Stanley Instrument Co. for alleged infringement of certain patents of Nikola Tesla. A similar suit was brought against the Catskill Illuminating and Power Co., and resulted in the Circuit Court of Appeals giving judgment, as in the first mentioned case, in favor of the defendants. The point involved was as to the priority of invention.

The claims of the first patent, which came up for consideration, cover a certain method, and of the second certain means of operating electrical motors by means of alternating currents from a single original source. This system is known as the "split phase" system.

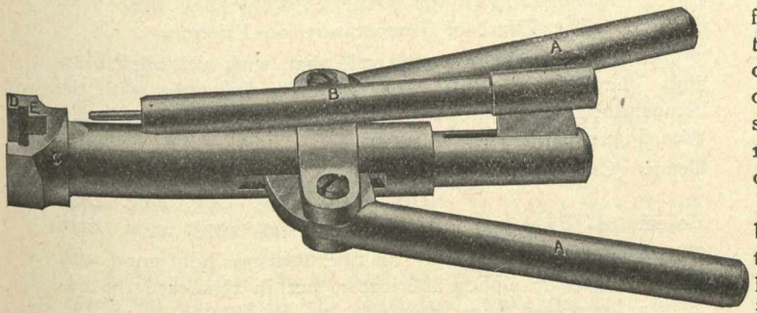
Nikola Tesla was the inventor of what is known as the polyphase system of transmission of power and had covered by his earlier patents said system when operated by means of currents of varying phase from independent lines or circuits. By the methods and means therein described Tesla dispensed with one of the line circuits and was able to run the motor by means of alternating currents from a single original source. This was accomplished by means which so retarded the phases of the current in all circuits or so varied the relative resistance of the motor circuits as to maintain the necessary difference of phase in the circuits. Such utilization of a single original source by thus splitting a single current into two currents was an improvement of great practical value. But on April 22, 1888, there had been published at Milan, in an Italian Journal, a report of a lecture by Professor Galileo Ferraris in which the systems covered by the patents in suit was fully described. This printed publication is such a disclosure of the subject matter of the patents that if prior thereto it would constitute an anticipation.

After reviewing the evidence the court found that the claims of Tesla had been anticipated and that there was therefore no infringement of his patents.

The outlay on the improvement of St. Andrew's Rapids, Red River, will be $469,000, with $47,000 more for the land and engineering expenses. Delay has been caused by high water the first season, and also by proposed changes in the contract by which stone will be substituted for concrete, as being better adapted to the climate.

STEVENS-POPE CAPPER.

The Stevens-Pope gun decapper and recapper, just placed on the market, is stated to be the most practical contrivance on the market for this purpose. It is here illustrated and is described as follows:



The body C is hollow and contains a plunger for seating primers and a spring for returning parts to initial position. To the rear end of this body are fulcrummed levers—A A—which engage said plunger. To the rear end of this plunger is hinged the expeller B. The forward part of the body has a slot D for receiving head of shell for capping, and a slot E into which primer is dropped, coming to exact position to enter primer pocket. In operating it the tool is held in the palm of hand with levers A A wide open; the thumb is pressed on the rear end of expelling plug B, lifting same so the shell is slid on to it freely, the head of shell passing over shoulder C. On removing thumb, the shell drops down so the head of shell falls behind shoulder C, which prevents shell shifting position when levers A A are closed expelling old primer. The shell is then withdrawn and reversed with one motion, and head of shell dropped into slot D, a primer is then dropped into pocket E and levers again closed, seating the primer.

This tool is very light, powerful and does not soil the hands as others do. It is made for standard calibres.

The new double-barrel shot gun, which the J. Stevens Arms and Tool Co. has put on the market is now made in various weights from seven pounds to eight and one-half pounds. This company, whose headquarters are at Chicopee Falls, Mass., has had to again remove its New York offices to get accommodation for its increased business. The present offices at 98 Chambers street having four times the space their late offices (No. 80 in the same street), had. This is in keeping with the growth of the factory at Chicopee Falls, which has increased from 44 men, seven years ago, to 1,100 men to-day, but even with the addition of a third factory and this increased force, they have not been able to fill all orders promptly.

The vicinity of Kamloops is the scene of an irrigation experiment carried on by English capital. A plot of 6,000 acres between the North and Main Thompson rivers has been laid out for fruit ranches. A ditch 18 miles long will convey water for irrigation from Jameson Creek. The land thus watered will be disposed of in small holdings, averaging from 30 to 50 acres. A portion of the area has been irrigated in the past, and settlers are moving in.

The following aids to navigation have been provided: New lighthouse at Kincardine to replace one burned last year; steam fog siren in connection with town waterworks machinery at Kincardine; light house at Varennes, Que.; lighthouses at Otter Head and Slate Island, and range lights at Point aux Pins, Lake Superior; Low Point, Flint Island and Scatarie Island lights, Cape Breton, improved; range lights at Pt. Edward, C.B.; whistling buoy at Gavin Island, near Gabarus; protective piers at Grand Narrows bridge, Bras d'Or lakes; acetylene gas for Stonehouse Point light, near Cornwall. It is understood that the old wooden light houses at Fort William, Lake Superior, will be replaced by two steel towers.

FRICTION ON LUBRICATED SURFACES.

By F. A. McKay, S. Can. Soc. C.E.

It is a well-known fact that when two bodies have their surfaces rubbed together, no matter how smooth those surfaces may be, there is a force which tends to prevent them from moving. This force is called friction, and is caused by the particles of one body intermingling with those of the other. When a force is applied which would cause motion of the bodies in planes parallel to each other, these particles strike against one another, are broken off, and are either rubbed into the surface of the other body, or are thrown down in the form of dust.

If, however, we introduce a substance such as an oil between the two bodies we separate them, and, therefore, there is no striking of the particles together, but rather the layers of oil slide over each other, motion will be less impeded, and consequently we say that friction is reduced.

The Relation of the Normal Pressure to Friction.

Probably of all the influences which govern the amount of friction there is none which has more effect than pressure.

At ordinary pressures the co-efficient of friction varies approximately inversely as the load per square inch.

At low pressures the co-efficient of friction becomes greater, but this is not so much on account of the diminution of pressure as it is on account of the viscosity of the oil.

At very high pressures the co-efficient of friction again takes a rise, but this is also from another cause. It is because the oil is squeezed out from between the bearings and the surfaces come in contact, causing a very large increase of friction.

A number of papers, read before the Institution of Mechanical Engineers of England, have thrown considerable light on this subject.

The first paper was read by Mr. Beauchamp Tower, P.I.M.E., 1883, p. 632, and it gives the result of some of his experiments made on the machine, of which the following is a description. (See Figure 1.).

The journal (F) is four inches in diameter and six inches long. Upon (F) rests a bronze bearing (A), which nearly but not quite half surrounds (F). On (A) is a cap (B), which in turn is bolted to another piece (C), which carries a knife edge (E). On this knife edge swings a bracket (D), which carries the weights (W).

The distance from the centre of the journal to the knife edge is five inches.

When the journal rotates it tends to turn (A) with it, and will throw the knife edge off the centre line.

Let r = The radius of the journal.
s = The distance of the knife edge from the perpendicular centre line.
w = The weights.
Then s x w = The moment of friction.
The friction at the surface of the journal.

$$= \frac{\text{moment of friction}}{r} = \frac{s \times w}{r}$$

Hence the co-efficient of friction.

$$= \frac{\text{friction at surface of journal}}{w} = \frac{s \times}{r \times} = \frac{s}{r}$$

Hence the co-efficient of friction is the relation of s to r and is independent of w.

The long arm (L) is attached, which has a fixed relation in length to the distance between the centre of the journal and the knife edge. The deflection can, therefore, be read off on the revolving roll or scale.

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*The Canadian Engineer Prize offered to student members of the Canadian Society Civil Engineers for the year 1902.

The following table shows the co-efficient of friction at different pressures and velocities which Mr. Tower obtained. He used a bath of olive oil, and kept his apparatus at ninety degrees Fah.

When these results are plotted in the form of curves (see Figure 2), the relation existing between pressure, velocity and friction is very clearly seen. They show that with pressures of 100 to 500 lbs. per square inch, as the load increases the co-efficient of friction decreases.

Co-efficient of Friction at Speeds Below.

Nominal Load Per sq. inch.	100 r/m	150 r/m	200 r/m	250 r/m	300 r/m	350 r/m	400 r/m	450 r/m
520		.0008	.0016	.0012	.0013	.0014	.0015	.0017
468		.0011	.0013	.0014	.0015	.0017	.0018	.0020
415		.0012	.0014	0015	.0017	.0019	.0021	.0024
363		.0013	.0016	.0017	.0019	0020	0022	.0025
310		.0015	.0017	.0019	.0021	.0022	.0024	.0027
259	.0014	.0017	.0020	.0023	.0025	.0026	.0029	.0031
205	.0018	.0021	.0025	.0028	.0032	.0033	.0036	.0040
153	.0023	.0030	.0035	0040	.0044	.0047	.0050	.0057
100	.0036	.0045	.0055	.0063	.0069	.0077	.0082	.0089

The following table and curves, also by Mr. Tower, show the rise of the co-efficient under heavy loads (see Figure 3):—

Load lbs. / sq. in	150 r/m. Co-eff. of limit.
625	.00130
520	.00123
415	.00123
310	.00142
205	.00205
100	.00415

The limit of the possible amount of load per square inch permitting free lubrication is reached when the oil is squeezed out and the surfaces begin to rub. With constant pressure and comparatively slow motion this point is believed to be not much above 500 lbs. to the square inch.

If, however, the load is intermittent, such as at the crank pin of an engine, the load can be greater, because, while there is less pressure, the lubricant gets a chance to flow between the surfaces, and consequently to keep a film of oil always there.

The Effect of Velocity on Friction.

Friction may be said to be divided into two kinds—First, Static Friction, or Friction of Rest. Second, Dynamic Friction, or Friction of Motion.

It is generally, in fact always, found that the co-efficient of friction in the former case is much greater than in the latter case.

In the proc. of the Mechanical Engineers of England for 1883, we find some interesting accounts of experiments in connection with this subject.

Professor Fleeming Jenkin has shown, by experimenting at very low velocities, that in certain cases where there is considerable difference between the co-efficient of static friction and that of dynamic friction, the co-efficient decreases gradually as the velocity increases between speeds of 0.012 and 0.6 feet a minute; and his experiments indicate a probability of a continuous rather than a sudden change in the value of the co-efficient between the conditions of rest and motion.

Where there was little or no difference between the conditions of rest and motion, no difference was found at the velocities between which he experimented.

His experiments were made with a very small steel spindle of 0.1 inch diameter, resting in rectangular V notches, the pressure being constant and due to the weight of a disc carried by a spindle and revolving with it.

In the same paper are to be found the experiments of Professor A. S. Kimball, made on spindles running at moderate speeds. He took a wrought iron shaft of 1 inch diameter acting under a pressure of about 67 lbs. per square inch. The shaft rested in cast-iron bearings well oiled. By increasing the velocity from 6 feet to 110 feet per minute, the co-efficient of friction fell to 0.3 of its original value.

Professor R. H. Thurston also carried out some experiments, but he included not only velocity but also pressure and temperature. His conclusions are, however, that the co-efficient of friction at first decreases, but after a certain point increases with the velocity; the point of change varying with the pressure and temperature.

The Effect of Temperature on Friction.

It is a generally accepted rule that, with well-oiled bearings, the friction varies approximately inversely with the temperature. The following results of Mr. Tower show this (see Figure 4). P.I.M.E., 1883:—

Temp. (Cent.)	43.4 Deg.	37.8 Deg.	32.2 Deg.	26.7 Deg.	21.1 Deg.	15.6 Deg.
Co-eff. of Frict.	.0044	.0051	.0060	.0073	.0092	.0119

This was with an oil bath. The rule does not hold good with an oiled pad or siphon lubricator, but in this case the co-efficient increases more rapidly.

Mr. W. Stroudley, a member of the Inst. of C.E., has experimented with oil pads, and gives as his results the following (see also Fig. 5):—

Temp. Cg.	40.56 Deg.	43.34 Deg.	46.1 Deg.	48.9 Deg.	51.7 Deg.	54.4 Deg.	57.2 Deg.	60 Deg.	62.8 Deg.
Co-eff. of Frict.	.0220	.0180	.1060	.0140	.0125	.0115	.6110	.0106	.0102

Material of the Surfaces in Contact.

In dealing with the subject of friction and lubrication, it is essential to know of just what material the surfaces are made, for all substances have not the same co-efficient of friction.

It can be taken as a general rule that there is less friction between surfaces of different material than between those of like material. If it is of the nature of wood, i.e., has a grain, there will be less friction if the grain is placed at right angles.

However, after tests to find the co-efficient of friction between two metals, it has been found that under similar condition this co-efficient is very similar for all metals. It is not because metals such as babbitt have a lower co-efficient that they are used, and that such great things are claimed for them in the way of running cool. They may run cooler than ordinary bearings, but this is because they are able to take the shape of the journal more easily after any injury to shape or surface.

Lubricants and Methods of Testing them.

Among the factors which govern the suitability of a lubricant is its fluidity and freedom from gumming, its flash and burning points, whether it contains an acid or not, and the co-efficient of friction which it will give.

In a paper by Mr. Woodbury, about which more shall be said later in connection with the co-efficient of lubricating oils, is given a method of testing the fluidity of oil. A pipett was placed within a glass water-jacket, where the temperature was kept constant by circulation from a reservoir kept at the desired temperature. The capacity of the bulb was 28 c.c., and the orifice measured three and one-half inches long and .039 inches diameter. The oil was drawn into the bulb of the pipett, and afterwards the whole was brought to the desired temperature. The time required for its discharge was accurately noted. The oil was forced out of the tube by means of the water pressure, which amounted to a head of about five inches.

Again, an oil must not dry quickly, so as to form a thick gummy substance in parts which ought to be well lubricated.

The method used in the mechanical laboratory of the Stevens Institute of Technology for testing these two qualities of an oil is to take a long slab of glass, say, four inches by six feet, and start a drop of oil at the top, and see how far it will run down after several days.

For instance, suppose we have six kinds of oil to test, we would start them simultaneously at the top. At the end of the first day we would find that some had outdistanced the others down the plane. At the end of the second day we would find that some of the slower ones had pulled up on the first ones, if not passed them. At about the end of the fourth or fifth day the real qualities of the

oil begin to show. While at the end of the ninth or tenth day there would be no doubt left as to which is the most fluid, and which is the gummiest of the oils.

The figures here given are the results of tests made by this method, only flowing on an iron slab instead of a glass one. (See Thurston's "Friction and Lubrication.")

Description of Oil.	1st Day	2nd Day	3rd Day	4th Day	5th Day	6th Day	7th Day	8th Day	9th Day
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Best Sperm Oil....	2 8½	4 2	4 5¾	4 6	4 6	4 6	4 6¾	stat.	....
Com. " "	1 7	3 9	4 6¾	4 11	5 1½	5 4	5 6¾	5 7⅞	5 8
Galipoli "	0 10¼	1 2¼	1 6	1 6½	1 7⅞	1 8¾	1 9	1 9¼	1 9½
Lard "	0 10¼	0 10½	0 10¾	0 11⅜	stat.	....	....	....	....
Rape "	1 2½	1 6¼	1 7	1 7⅛	1 7¼	1 7¼	1 7¼	1 7⅜	stat.
Linseed "	1 5½	1 6	1 6¾	1 6¼	1 6¼	1 6¼	1 6¼	stat.	....

From these it can be seen that of the six oils, common sperm oil was by far the most fluid, while the best sperm oil, though very fluid for some time, eventually turned gummy and stopped running. On the other hand, Galipoli oil, though it did not flow as easily, yet it did not turn gummy as fast.

There are many other methods and modifications of the above for determining the fluidity of an oil, both physical and chemical, but one other very common and simple method may be mentioned.

It is to dip a piece of blotting-paper into the oil, and note the form of the drops which fall from it. If they fall in distinct symmetrical drops it is an indication of fluidity; if, however, they show a tendency to spread, it indicates viscosity. By keeping the oil on the paper for some days the rate of gumming can be obtained.

The flash and burning points are of great significance, for when bearings begin to run at all hot, the oil which is around them must not immediately commence to burn. A good lubricating oil will stand 400° Fah. before beginning to flash, while a good cylinder oil will go as high as 500°-600° Fah.

The next point mentioned, namely, the acidity of an oil, requires careful attention. No oil must contain an acid, for, it is needless to say, if it does, the machines upon which it is used will not be long before they show signs of being eaten by it.

A very simple test is to place a strip of clean bright copper in a small flask and surround it with the oil to be tested. Heat the oil gently, and allow it to stand for a while. If there is any acid present, it will show itself by the green color which it will give to the liquid. The reason for this is that the acid acts on the copper, and forms a compound with it.

And, finally, we come to the co-efficient of friction which an oil gives. It is not such an easy matter to test for this quality.

Mr. C. J. H. Woodbury has done considerable work in connection with this subject, for the Mill Mutual Insurance Company, of New England (see A.S.M.E., 1880-84), and the results of his work are given by himself in a paper read before the American Society of Mechanical Engineers.

The apparatus used by Mr. Woodbury (Figure 7) consisted of a hard, tool-steel, annular disc supported by an iron frame. Upon this disc rested one of hard bronze, in the form of a cylindrical box. The discs were kept at an even temperature by means of water fed into the top one. A diaphragm extended down into the water to keep it in circulation. A copper tube also extended into the water, and in it was placed the bulb of a thermometer, which gave the temperature of the discs. A glass tube ran to the centre of the discs to supply the oil.

The two discs were ground with the greatest accuracy. It is an interesting side point just to notice how they were done. Both rubbing surfaces were made to coincide with the standard surface plates in the physical laboratory in the Institute of Technology, and their contact with each other was considered perfect. When all was finished, the bronze disc was treated with bichloride of platinum; there was left a thin film of platinum upon the surface. When the two surfaces were rubbed together, the platinum was rubbed off the bronze disc in all parts.

The upper end of the lower shaft was rounded and fitted into a corresponding socket in the upper disc. The axes of the two discs were not in the same line, but were in parallel ones about an eighth of an inch apart. This gave a discoid motion when the discs rotated. The upper disc was pressed down by means of weights placed on the upper spindle which rested upon it.

An arm projected from the spindle, and engaged with projections on the disc. Upon this arm, which was in the arc of a circle, a thin wire was wrapped, which went to a dynamometer. The discs were surrounded by wool and flannel to prevent radiation of heat.

In experimenting, the greatest care was taken to have the two discs perfectly clean before starting. The oil used in the previous experiment had to be entirely removed, or it affected the results, for it formed a thin layer between the metal and the new oil. To do this benzine was used.

The accompanying curves (Figures 8 and 9), give some of the results which Mr. Woodbury obtained.

Besides being able to compare the results obtained with similar results made on other oils, they go to point out that, as the temperature increases, the co-efficient of friction decreases; also that, as the pressure increases, the co-efficient decreases, provided that the temperature remains constant.

A very practical method of testing a lubricant is by means of the Thurston Oil Testing Machine. There is one of these machines in the Mechanical Laboratory of McGill College. It is of the car-axle type (Figures 10a and 10b), and consists essentially of a journal corresponding in size to that of a car axle. This is partly surrounded by two brass bearings which support a pendulum. When the axle is turned it tends to rotate this pendulum. This angle of twist is read by means of a scale and pointer. The oil is fed in at the side, and the temperature of the bearing is taken by means of a thermometer, reaching down into the upper brass.

The lower brass can be applied or not, and can have its pressure regulated by a spring situated inside the lower part of the pendulum.

One great advantage of a machine of this kind is that the oil can be tested under conditions similar to those to which it is to be subjected afterwards.

Solid Lubricants.

There is another class of lubricants which differ somewhat from the above, namely, solid lubricants.

Among the principal lubricants of this class may be mentioned graphite, which, in a powdered form, is used where the oils have failed (i.e., where they have broken down under high pressure). It is sometimes mixed with certain oils, and used for both heavy and light pressures.

Soapstone is another solid lubricant, and is used generally in the form of powder mixed with oil or fat. Mixed with soap, it is used between wood and wood, or wood and iron. Among other solid lubricants used may be mentioned soap, lard, plumbago and tallow. The following table gives an idea of the relative value of lubricants to reduce friction (from Kent):—

Lubricant	Wood upon Wood	Wood upon Metal	Metal upon Metal
Dry Soap	.40	.32	.27
Lard	.82	.85	.70
Lard and Plumbago		.67	.96
Olive Oil		1.00	1.00
Tallow	1.00	.93	.80
Water	.22	.24	.18

Distribution of the Oil over the Bearing.

In making all these tests with journals, running in bearings, one of the most difficult things which has to be overcome is how to get the lubricant distributed evenly over the whole surface, and, in experimental work, to establish a standard which can be easily copied.

It has been found that the most perfect method to oil a bearing is to immerse the journal in oil. By this method the journal always has all the oil it can take. Besides it can always be kept at the same temperature by means of

gas jets under the bath. Experiments show that it makes no difference whether the oil is up to the centre of the bearing or just touching it.

Another method is to insert oil pads, but this is less perfect, as was shown by some of the previous diagrams. (Fig. 4-5.).

The most common way, however, is to drill a hole through the upper part of the bearing and cap, and to insert an oil cup. The oil is then distributed by means of grooves cut in the brasses.

In the second report on Friction Experiments, read before the Mechanical Engineers of England (1883), Mr. Joseph Tomlinson and Mr. Tower endeavored to find out the best place to put the grooves. His idea was to find out the parts of a bearing where there was the greatest pressure, and place the distributing grooves wherever they would be most required.

To do this, he took a bearing and drilled longitudinal holes through it. Then, by drilling small holes to the bearing surface, one at a time, and plugging up the last one, and by connecting the holes to a Bourdon pressure gauge, he found that the greatest pressure was on the off-side of the centre line (see Figure 11). Another thing he found was that it made no difference, as far as the pressure of the oil in the bearing was concerned, whether the journal was making twenty revolutions or 150 revolutions per minute.

Again, we turn to the result of Mr. Woodbury to find a comparison between the different methods of lubricating. In the table given below, the advantage of an oil bath will be easily seen. The experiment was made with rape oil on a machine running at 150 revolutions a minute, and under circumstances as nearly similar as possible:—

	Load in lbs./59"	Co-eff. of Friction.	Comparation Friction.
Oil Bath	263	.00139	1
Pad under Journal ..	272	.00900	6.48
Syphon Lubricator ..	252	.00980	7.06

In closing, it is worthy of note that the experiments which have been carried out in connection with lubricating oils have been along very practical lines, and that while a great deal of work has been done in investigating the causes of friction, and its relation to pressure, surface velocity and temperature in a more or less theoretical way, yet, unlike some other researches, these investigations have led to many very practical and useful improvements being made in the form and style of bearings and rubbing surfaces (namely, babbitt bearings, roller bearings and so forth), but the discussion of these improvements would embrace a subject somewhat outside the scope of "Friction on Lubricated Surfaces."

IS TELEPHONE COMPETITION IN CANADA DESIRABLE?

By F. Dagger, Telephone Engineer, Toronto.

It is an undisputed fact that the number of telephones in use in the Dominion of Canada is very small, if we take the best telephoned countries in the world as the standard of perfection. According to the latest statistics, Norway, Sweden, and Denmark have one telephone to every fourteen inhabitants, while the United States have one to every twenty inhabitants. Judged by these two standards, Canada should have, according to the first, 393,000 telephones, or to the second, 275,000, instead of the 63,192 recorded in the 1902 edition of the Statistical Year Book.

Statistics for 1901 place the proportion of telephones in the different provinces, as follows:

Ontario, one telephone to 89 inhabitants.
Quebec, one telephone to 102 inhabitants.
Nova Scotia, one telephone to 122 inhabitants.
New Brunswick, one telephone to 129 inhabitants.
British Columbia, one telephone to 63 inhabitants.
Prince Edward Island and Manitoba not recorded.

It is significant that British Columbia, where the systems are operated by local companies, free from the influence of the Bell Telephone Company, has the best record, notwithstanding the fact that in commerce, manufacturing industries and financial resources, it is far behind the Eastern provinces.

Dealing with the territory served by the Bell Telephone Company of Canada, viz., the provinces of Ontario, Quebec, and Manitoba, a glance over the field will show that the sparsity of telephones is due, first, to the excessive rates charged in the cities and towns, and secondly, to the neglect to provide service except on prohibitive terms in the villages and rural districts.

An analysis of the "Bell" report for the year ending December 31st, 1901, gives the following results:

No. of telephones	42,858
No. of exchanges	343
No. of agencies	514
Estimated number of telephones in 24 cities and towns	32,000
Estimated number of telephones in remaining 319 exchanges and 514 agencies	10,858

If we deduct one telephone for each of the 514 agencies, there remain 10,344 telephones, or an average of less than 33 telephones for each of the 319 exchanges in the smaller towns and villages:

Population of "Bell" territory	4,035,416
Population of twenty-four cities and towns	900,000
Population of territory containing 10,344 phones..	3,135,416

or one phone to 303 inhabitants.

It will thus be seen that the small towns, villages, and rural districts have hitherto been almost entirely left out of consideration by those to whom the duty of supplying telephonic facilities has been delegated, and this is emphasized by the fact that in some districts the people themselves have endeavored to provide their own service.

There is no doubt that the over-capitalization of the Bell Telephone Company of Canada is one of the chief causes of the high rates charged to telephone subscribers in the Dominion. It is on record that the American Telephone and Telegraph Co. hold stock at par, value $1,928,900, out of the Canadian Bell capital of $5,000,000 allotted, it is generally understood, to the former company for the use of patent rights, long since expired. To pay 8 per cent. on this $1,928,900, the sum of $154,312 has to be provided out of the rentals paid by the Canadian telephone users, or, in other words, an average tax of $3.60 per telephone has to be furnished over and above what is necessary to pay an 8 per cent. dividend upon the actual capital outlay upon the plant.

Another reason for the excessive charges is the fact that the telephone has passed through several stages of development since the date of the original patents, and at each stage the apparatus in use became obsolete, rendering it necessary in the larger exchanges for the company to partially reconstruct their system and instal improved plant. There being no adequate depreciation fund in existence to cover the cost of this reconstruction, and the company preferring that the subscribers should bear the burden, rather than the stockholders should have smaller dividends, the expenditure upon this work has been charged to capital account, thereby increasing the amount upon which dividends had to be earned, with the result that to-day the plant of the local systems could be duplicated for about one-third of the total capitalization and bond issues.

These facts prove beyond doubt that not only is there a present demand for a greatly increased supply of telephonic facilities, but that any independent company could give a modern telephone service at much lower rates, and earn satisfactory profits, because their capital outlay would be very much less than the amount upon which present telephone users have to pay dividends. This, however, is not all. We have now reached a stage in the history of the telephone when the manual or "hello girl" system is about to give place to automatically machine operated exchanges, which will enable each subscriber to be his own operator, controlling his line while in use, ensuring him perfect secrecy, and render-

ing his conversations free from interruption. Already these systems are being installed on a large scale in Chicago, and Grand Rapids, Mich.; Columbus, Ohio; Dayton, Ohio; Portland, Maine, and other cities in the United States. In Canada, also, the Canadian Machine Telephone Co. is installing a system in Ottawa and is preparing to enter the telephone field aggressively.

Further than this, a new system has recently been patented, which provides for the supply of electric light, power, telephone and telegraph facilities on the same circuit, thereby effecting a great reduction in the cost of construction and maintenance. This system is in actual operation, and so far as it has been tested is an undoubted success. If the same results can be obtained on a large system as have already been effected, and there is no reason to doubt it, this latest development will prove not only a source of great economy to electric light and telephone users; but it should be a most profitable investment for those who are fortunate enough to control it.

It is not possible in the limited space of this article to describe in detail these new developments of the telephonic art, nor would it be desirable to enter into a discussion of their respective merits. Suffice it to say that they are here, and it is for the public to note the fact and see to it that no binding contracts are made with existing companies, which would prevent them from participating in the benefits of these inventions for years to come.

The Bell Telephone Company's supporters will, no doubt, reply that, in the first place, the telephone is a natural monopoly, and therefore competition must fail, and in the second, that these new developments are mere experiments. In reply to the first statement, the result of the independent telephone movement in the United States has increased the number of telephones in use from 600,000, in 1894, to over 4,000,000 at the close of 1902; while the fact that there have been fewer failures in telephone companies than in national banks in the same period is sufficient proof of the financial success of competition.

In regard to the second statement, it may be said that experts in telephony, as competent as any the Bell Telephone Company have in their service, have pronounced these new systems to be of great practical commercial value.

The main question with the public, however, is whether competition in telephones tends to the advantage of the general community, and the best proof of this is to be found in the history of the independent telephone movement in the United States.

In 1894, before the advent of competition in telephones, the Bell Telephone Company of America had less than 238,000 subscribers' stations, with a total output of 582,000 telephones, the result of nearly twenty years' undisputed possession of the field. On December 31st, 1901, seven years later, the figures were:

Bell telephones	1,020,647	stations.
Independent telephones	1,250,000	"
Total	2,270,647	"

The following are the figures for the States of Ohio, Michigan, and Indiana:

Ohio.—Bell phones, 1894, 17,724; 1901, 79,500; Independent phones, 1894, nil; 1901, 106,344; Farmers' phones, 13,438.

Michigan.—Bell phones, 1894, 15,025; 1901, 48,930; Independent phones, 1894, nil; 1901, 33,731; Farmers' phones, 5,753. Michigan Bell Telephone Co. in receiver's hands through cutting rates in their effort to kill competition.

Indiana.—Bell phones, 1894, 6,000; 1901, 35,000; Independent phones, 1894, nil; 1901, 65,300; Farmers' phones, 16,353.

The records of the other States show a similar increase since 1894, but space prevents the publication of the figures in detail. The following statement by a well known authority in the independent field will, however, convey some idea of the marvellous development:

"There are at the present time in operation in the United States over 5,000 Independent telephone exchanges. A further proof of the immense growth of the Independent telephone work can be found in the fact that the combined output of the Independent manufacturers during the year 1902, according to the report of sales, shows an average daily output during the entire year of 1,500 telephones, or practically 550,000 telephones for the year. These are figures whch can be substantiated. If this is what was accomplished last year, it is not difficult to appreciate that the sales of preceding years would easily make up the difference required to give us an estimated total number of two and a half million telephones now in service."

"It seems almost beyond belief to the uninitiated, but a careful and conservative review of the financial affairs of the Independent telephone industry, covering a period of the last eight years, will show a most favorable condition. As heretofore stated, the percentage of failures among our national banks has been greater than in Independent telephone investments. And when one stops to consider that around the banks of this country is thrown a protective law, which should at least reduce to a minimum any question of failure, the claim of our common enemy, that we are a lot of dreamers, and that our work could not live, is idle; and considering the $300,000,000 or more now invested in the Independent cause, we have from a financial standpoint the best of the argument. Verily the people have suffered long for a telephone service which might have been furnished by the Bell Company years ago."

Dual telephone systems in the United States are not looked upon with disfavor, the effect of competition upon the rates being ample compensation for the inconvenience of two exchanges in one town. The table published herewith furnishes ample proof of the truth of this statement:

Sixty-seven Cities and Towns in the United States Where Telephone Competition has not Increased the Cost to Subscribers who are Compelled to Use both Systems.

Place	"Bell" Rates now busin's Phone	Independent Rates now Busi. Ph'ne	Res'd. Ph'ne	Total pres't co't of 3 P'es	"Bell" rates bef'e comp'n Busi. Ph'ne	Res'd. Ph'ne	Total cost of 2 phones before comp'n.	Annual Saving.
	$	$	$	$	$	$	$	
Ottumwa, Ia.	mostly free	24	12	36-up	75	48	123	87-on most
Iowa City, Ia.	21	30	18	69	48	24	72	3
Oskaloosa, Ia.	24	30	18	72	48	36	84	12
Fairfield, Ia.	12	18	12	42	36	30	66	24
Tipton, Ia.	18	24	12	54	36	18	54	Same cost
Hawkeye, Ia.	15	15	12	42	36	24	60	18
Greenburg, Ia.	30	24	15	69	42	30	72	3
Waterloo, Ia.	30	30	18	78	50	36	86	8
Decorah, Ia.	12	14	9	35	36	24	60	25
Cheboygan, Mich.	?	24	12	36-up	30	18	48	12-on most
Benton Harbor	12	25	16	53	48	36	84	31
Adrian, Mich.	?	24	12	36-up	48	36	84	48-on most
Saginaw, " / Bay City, " / Flint, "	24	20-30	12-18	56-72	42-48	30-36	72-84	16-12
Caro, "	24	20	12	56	48	24	72	16
Holland, "	12	18	12	42	48	36	84	42
Lansing, "	20	24	12	56	48	36	84	28
Iron Mountain	12	24-36	18-24	54-72	48	36	84	30-12
Chillicothe, O.	42	24	18	84	48	36	84	Same cost
Cleveland, O.	84	48	36	168	120	84	204	36
Ashtabula, O.	6-up	24	18	48-up	48	36	84	36-on most
Mt. Vernon, O.	15	30	18	63	48	36	84	21
Fostoria, O.	18-36	24	12-18	54-78	48	36	84	30-6
Wel ington, O.	24	24	12	60	36-48	24-36	60-84	0-24
Zanesville, O.	12-42	33	18	63-93	60	36	96	33-3
Shelby, Ohio	18	24	12	54	36	18	54	Same cost
Barberton, O. / Akron, O. / Cuyahoga Falls.	18-42	32-36	20-24	70-104	72-90	27-48	99-138	29-36
Tippin, O.	24	24	12	60	48	36	84	24
Mifflingburg	21	24	18	63	48	30	78	15
Washington, O.	24	24	15	63	48	36	84	21
Ravenna, O.	18	18	12	48	48	36	84	36
Lima, O.	24	30	18	72	48	36	84	12
Sandusky, O.	48	30	18	96	72	48	120	24
Kenton, O.	24	24	12	60	48	36	84	24
Lancaster	24	24	12	60	48	24	72	12
Cambridge	21	24	18	63	50	36	86	23
Urbana, O.	24	24	12	60	60	36	96	36
Cambridge, Pa.	12	18	12	42	24	18	42	Same cost
York, Pa	15	30	18	63	60	48	108	45
Johnstown, Pa.	6-36	30	24	60-90	60	48	108	48-18
Chambersburg, Pa.	12	24	18	54	48	24	72	18
Fall River, Mass.	90	36	24	150	125	48-up	173-up	23-up
New Bedford, Mass.	48	36	24	108	96	48	144	36
St. Paul, Minn. / Minneapolis, Minn	24-72	48	30	102-150	120	66	186	84-36
Winona, Minn.	12	30	18	60	48	36	84	24
Duluth, Minn.	0-54	30	20	50-104	54	54	108	58-4
Beloit, Wis.	36	24	12	72	60	24	84	12
Owensburg, Ky.	42	30	18	90	60	36	96	6
Louisville, Ky.	?	48	24-30	72-78up	96	60	156	84-down'ds
Lynchburg, Va.	30	28	18	76	64	64	128	52
Fayette, Ind.	12	30	18	60	60	36	96	36
Bluffton, Ind.	24	30	24	78	48	36	84	6
Connersville	18	24	15	57	42	30	72	15
Wabash	18-36	24	18	60-78	42	36	78	18 Same cost
Columbus, Ind.	24	24	12	60	48	30	78	18
Logansport	24	25	15	64	48	36	84	20
Lebanon, Ind	24	21	15	60	48	36	84	20
Michigan City	12	27	15	54	48	36	84	30
Tonawanda, N.Y.	30	36	16	82	60	40	100	18
Auburn, N.Y.	30-54	30	24	84-108	72	60	132	48-24
Joplin, Mo.	24	24	18	66	72	54	126	60
Trinidad, Col.	36	36	18	90	80	60	140	50
Grand Rapids, Mich	30	30	20	80	50-48	40	90-88	10-12

This statement is made up from a total of 71 completed returns received from the independent companies in the towns named.

In 45 towns, two business telephones can be had for the same amount, or less, than was formerly charged by the "Bell" for one. In two towns the increased cost is only $1, and in one town, $3, and in eight towns, $6; one town $10, in three towns (including Cleveland), $12, and in one town $18.

There has further been a very marked improvement in the service given, since the advent of competition, due to the fact that the increased demand for telephones has widened the field for inventors in the various branches of this art, to an extent which would not have been possible during the continuance of the monopoly. It is also obvious that the Independent telephone companies have provided employment for many thousands of people, who would otherwise have been forced into the ranks of other trades and professions, some of which are already overcrowded.

Taking all these facts into consideration, it is not to be wondered at that companies are now seeking to enter the field in Canada, in competition with the Bell Telephone Company, and it may here be stated that only by the encouragement of competition on a sound and legitimate basis, can Canadians hope to end the existing unsatisfactory state of the telephone service in the Dominion.

As a matter of business, between the people and the companies, let those of the latter, who will provide the best service at the lowest cost, be given every facility by the Government and the municipalities to fulfil the requirements of the public. The benefits which have resulted from competition in all parts of the world are such that Canadians cannot afford to allow the telephone service to remain any longer in the undisputed control of a monopoly, which has proved itself to be either unwilling or unable to satisfy the reasonable requirements of the people.

GLASGOW AND WEST OF SCOTLAND TECHNICAL COLLEGE.

It is, we believe, a fact not generally known, in this country at any rate, that Glasgow possesses the oldest technical school in the British Islands, for its incorporation as "Anderson's College" dates back to 1796, when it was founded under the will of John Anderson, professor of natural philosophy in Glasgow University, the close friend of Jas. Watt, who was a mathematical instrument maker under his direction. It was Anderson who first began in the University classes for employers and workmen. He aimed to direct his instruction "to the improvement of human nature and the progress of useful and elegant arts;" and his classes, from which has really sprung the modern and splendid technical college, were to be open to all ranks and to both sexes. It is evident, therefore, that Anderson was a broad-minded, as he must be admitted to have been a far-seeing man.

The fact that the corner-stone of a new and extensive building for the purposes of the college was opened with appropriate ceremonial, by King Edward VII. on the 14th May, gives especially interest to some notes upon this important seat of learning. Many distinguished men have been upon the staff of Anderson's and the Mechanics' Institution; Dr. Birkbeck, Dr. Andrew Ure, the author of the Dictionary of Arts and Manufactures; Thomas Graham, F.R.S., Professor Herschel, Professor G. Carey Foster. And among the students were some who became as famous as their teachers. For example, Dr. David Livingstone, Lord Playfair, Dr. James Young, the founder of the Scottish oil industry; Dr. Sheridan Muspratt; and among the members of the Mechanics' Institute were: Lord Kelvin, his brother, Professor James Thomson, and Sir James Watson.

The great extent of the institution will be apparent when we say that between 5,000 and 6,000 students passed through it last session. There were day students, 596; evening students, 4,394; pupils of Allan Glen's School, 661, making a total of 5,651. This is believed to be the largest number of students attending any technical college in Great Britain. The day students include many from England and from India and the colonies, while the evening students are drawn from practically all the important manufacturing works within twenty-five miles of Glasgow. The staff of the college consists of ten professors, ten other heads of departments, thirty-eight assistant lecturers and demonstrators, and twenty trade instructors. Adding the thirty instructors in Allan Glen's School (affiliated), this makes a total of 130. There are evening and day classes, and the departments of instruction are: Mathematics and Physics; Chemistry; Metallurgy; Civil, Mechanical, Electrical, Chemical, or Mining Engineering; Naval Architecture; Architecture.

From an illustrated pamphlet, issued by the governors of the college, we gather that the new buildings, to be placed on George street, and Montrose street, four stories and a basement in height, will be of red Dumfrieshire stone and light pressed brick, 346 feet in length, the style of architecture a free treatment of Italian classic. The buildings will, we are told, be the largest of their kind in Great Britain, covering nearly two acres, and their cost, exclusive of equipment, is placed at £210,000 sterling. A proof of the confident energy of the thirty governors of this college, the chairman of which body is Wm. Robertson Copland, C.E., and the public spirit of the Glasgow people is found in the circumstance that a committee of the governors raised, in two years, £186,000 for the erection of the new buildings, and that contracts have already been given for the erection of three-fourths of the whole pile. The corporation of Glasgow gave £10,000 to the fund; Andrew Carnegie, of the United States of America and elsewhere, gave £25,000; there are two other subscriptions of £25,000; two of £10,000 each—one of them from an anonymous donor—several of £5,000, £4,000, £2,000, and £1,000 each; many of £500; no less than seventy of £100 each. There must be many hundreds of subscribers altogether, but it is impossible to enumerate them because many are credited in aggregate to the different guilds which compose the "Trades' House" of Glasgow—for example, the Hammermen, the Weavers, the Skinners, the Dyers; then there is the Scottish Association of Master Bakers, the Building Trades' Exchange, etc., etc.

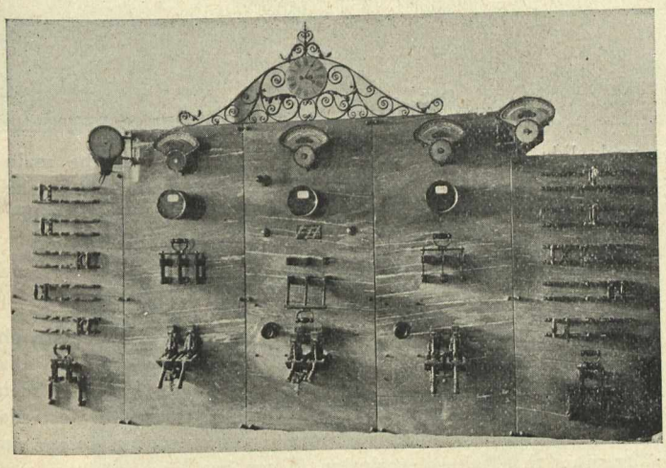
Glasgow has great cause for pride in the age and usefulness of her Technical College. It has done and is still doing a grand work in science and technology. There is no room to doubt, not only that all the money required to complete the splendid new buildings, but the money to equip them, will be forthcoming when required. For, is not the motto of the corporation "Let Glasgow Flourish." It is not conceivable that this splendid city of nearly a million people (mostly Scotch), will allow so worthy a hall of learning to want for anything in equipment or endowment that wealth and the modern spirit of research can supply.

MONTREAL BOARD OF TRADE SWITCHBOARD.

The following is a description of the switchboard manufactured by the Hill Electric Switch Company, Limited, Montreal, for the Board of Trade Building, Montreal, now completed and in position. This board was designed and constructed entirely by the above company, the consulting engineer giving them a free hand to produce an artistic, as well as a thorough mechanical and electrical job, the result being a board that has pleased both the consulting engineer of the Board of Trade, R. P. Southard, and the resident engineer, A. York.

The board is designed to handle the output of three multi-polar C. G. E. generators of 500 amp. 110 volts, machines to run separately or in multiple. Provision is also made for current from the local lighting company, and all distributing switches are double throw, thus enabling current to be used from either sources at the same time, while a special single throw switch is connected to the D. C. bus bars, only, which controls a motor for freight elevator. As will be seen, there are three generator panels of solid blue Vermont marble, 3 feet wide, 7 feet long and 2 inches thick, each fitted with I. T. E. circuit breakers, three pole 600 amp.

switches of the well-known Hill type B, above which are recording watt meters of the well-known Scheeffer switchboard type, supplied by the Packard Electric Company, above these again are illuminated dial, type K Keystone ammeters. Each panel is fitted with a rheostat for field control, while the centre panel has a ground detector switch and lamp as well as a voltmeter switch which enables readings to be taken from any of the three generators as well as the A. C. bus bars.



Hill Switchboard.

Two swinging brackets are fitted to these panels, one holding a Keystone type K voltmeter, the other a Bristol recording voltmeter. The centre poll of the switches is fitted to an equalizer bar, the three switches being connected to the inner bus bars, which are carried down to the inner terminals of the double throw switches on the two distributing panels, on either side of the generator panels. These double throw switches are also of the Hill type B pattern, fitted with D. W. enclosed fuses. Alternating current is taken in on an 800 amp. switch at bottom of distributing panel No. 1, carried up heavy bus bars and across the board down the outside of No. 2, so that when switches are thrown out they connect with outside supply and when thrown in they connect with the generator supply. A large wrought-iron grille, with clock, crowns the whole, making a pleasing effect and showing the board off to good advantage.

MAKING WOOD FIREPROOF.

Jos. L. Ferrell seems to have succeeded in discovering a means for making wood fireproof, which is described in Science.

The compound used is sulphate of aluminum, and it seems to answer all the requirements. It is not only a fireproofing reagent but has the added advantage that, when strongly heated it leaves an infusible residue which is non-conducting and which serves to protect the cellular structure of the wood. It prevents the spread of the glow as well as the flame. It is far more efficient than an alum solution. Ammonium phosphate or sulphate makes wood fire-resistant by liberating the ammonia gas. This serves to check the flames on the surface of the wood. The fiercer the flame that plays upon the wood that is prepared in this way, the more rapid will be the liberation of the gas which protects the wood. When the gas is entirely liberated from the outer layer, the fibre becomes carbonized. But with the sulphate of aluminum, as soon as the outer layer is affected by the flame, a deposit of aluminum is formed, whose non-conducting qualities make it a barrier against the flame and glow, and protect the interior portion. An experiment to show the comparative value of sulphate or phosphate of ammonia and sulphate of aluminum was made as follows: A piece of wood was saturated with a solution of sulphate of aluminum of definite strength to a depth of not more than three-eighths of an inch. The point of a strong gas flame was made to play upon the surface of the wood, and continued in the same place. The result was that a boring effect took place while an abundant deposition of aluminum was observable. A one-inch piece of white pine, treated as above, resisted the boring effect of the flame for over three hours before penetration took place. A similar piece of wood was entirely saturated with sulphate of ammonia, ten times as much being used as was used of the sulphate of aluminum. The flame was applied as in the other experiment and a complete penetration was made in seventy minutes. The same average results were obtained in many tests and seem to indicate that of two very effective fireproofing reagents, the sulphate of aluminum is by far the most effective.

METALLURGY AT MCGILL UNIVERSITY.

The mining and metallurgical departments at McGill University, Montreal, have been separated to meet the demand for men with a thorough practical knowledge of the chemical part of metallurgical work. In its first two years the course will differ from the chemistry course only in the addition of mechanical drawing and shop-work. In the third and fourth years the chief difference between it and the chemistry course will be the elimination of organic chemistry, and the addition of metallurgy, ore dressing and the simpler branches of mechanical engineering. It is hoped as the course becomes fully established to add several attractive subjects, especially electro-metallurgy. The new department of metallurgy is under the direction of Prof. Stansfield.

GEOLOGICAL SURVEY OF CANADA.

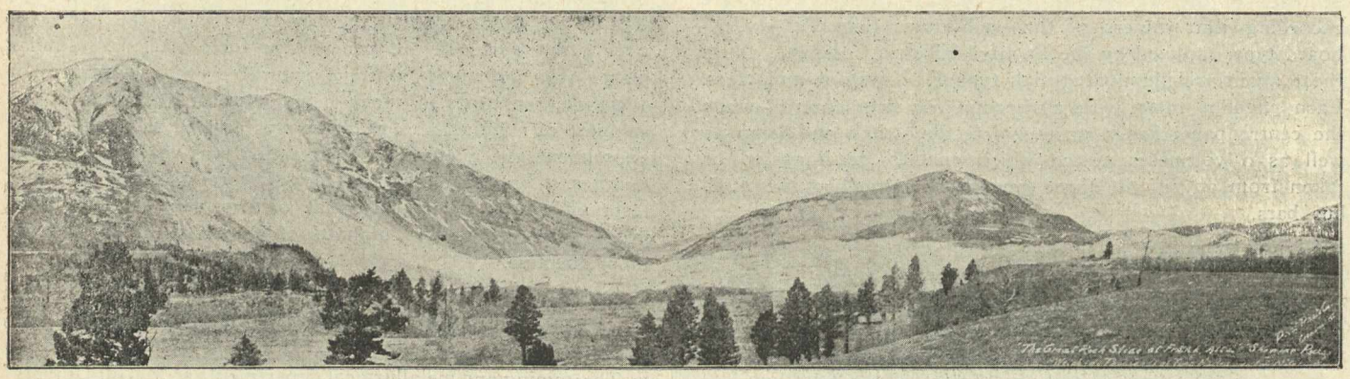
In the work of the Geological Survey of Canada this season fewer parties are taking the field, but they will be better organized and equipped, so that more effective work will be done. In Nova Scotia the work will be prosecuted by A. Fletcher, E. R. Faribault and Dr. Ami. In Ontario a party under the direction of Dr. Barlow will investigate the nickel and iron deposits. R. G. McConnell and J. Keele will continue to map out the mineral areas of the Klondike, with special reference to the gold-bearing gravels and reefs. R. W. Brock, accompanied by Mr. Boyd, will investigate the silver, lead, copper and other ore deposits in the Kootenay district, and the work of surveying the gold-bearing strata of the foothill district east of the Rockies and in the Bow River Pass, in Alberta, while W. Leach will continue his work on the coal deposits of British Columbia. W. McInnes and W. J. Wilson will each have charge of parties on the still unexplored region south-west of the Hudson's Bay.

TELEPHONING TO THE DOGS.

A French tourist relates that some time ago he set out to cross St. Bernard's Pass by himself, and got caught in the fog near the top. He sat on a rock and waited for one of the dogs to come, but in vain, and when the fog cleared away he managed to reach the Hospice. On arrival he observed that he thought the dog a rather over-rated animal. "There I was," he said, "for at least six hours, and not one came near me." "But why," exclaimed one of the monks, "did you not ring us up on the telephone?" To the astonished tourist it was explained that the whole of the pass is provided with shelters at short distances from each other, all in direct telephonic communication with the Hospice. When the bell rings the monks send off a hound loaded with bread and wine, and other comforts. The dog on duty is told what number has rung, and he goes straight to that shelter. This system saves the hounds their old duty of patrolling the pass on the chance of a stray traveller being found, and as the pass is for about eight months of the year under snow, this entailed very hard and often fruitless labor.

Hamiota, Man., proposes raising $20,000 by debentures for road-making.

—Twenty-seven cadets from the Kingston Military College are in Montreal, under the direction of Professor Buller and Lieut. Anderson, for the purpose of undergoing instruction in engineering at McGill University.



Panoramic view of Turtle Mountain. The course of the rock-slide is traceable by the light shade down the main mountain and across the valley to the extreme edge of the picture. The town site is behind the displaced rock at the foot of the main mountain. The enormous proportions of the slide may be realized when it is known that the valley shown in the picture is two miles across.

THE ROCK-SLIDE AT FRANK.

A rock-slide, which in magnitude of material displaced is beyond parallel in the annals of Canada, and perhaps unique in the recorded history of the world, occurred on the 29th April, at the mining town of Frank, situated in a valley which forms one of the approaches to the Crow's Nest Pass. The town, which was laid out less than three years ago by the Canadian-American Coal & Coke Co. (from whose president, Mr. Frank, it takes its name), had a population of between 800 and 1,000, largely employed in the company's coal mines, which were opened by a tunnel into the side of Turtle Mountain. This mountain, estimated by our correspondent to be 4,800 ft. high, with a summit 7,000 ft. above sea level, rises immediately above the town, its limestone cliffs being reared in places as perpendicular as the walls of a house. Loosened possibly by the unprecedented rains of the past year in that region, a section of these vast limestone cliffs, 4,000 feet long, and weighing millions of tons, broke away, and with awful noise and outbursts of flame, evolved by the grinding rock, covered the valley two miles wide, spreading out like a fan, and being followed by a back-wash of rock from the farther hills, like the action of a tidal wave. In its descent it overwhelmed a part of the village, killing over 60 people, and destroying all the company's outfit. The valley, for a breadth of 1½ miles, was covered with the fallen rock to a depth of from 50 ft. to 300 ft., the fragments of rock ranging from the size of apples to that of a seven-roomed house. The spur line of railway leading to the mine, and the main line of the C.P.R. for two miles was buried, the rails visible here and there being bent like hoops, and some of the telegraph poles being found butt-end in air.

The Old Man river, which ran through the valley at the base of the mountain, was diverted from its course, and a lake formed near the town by the dam of rocks. It was feared that the town would be inundated, but the water after rising for a distance, percolated through the rocks, and reached the valley to the east.

Some of the escapes seem miracles. A cottage occupied by Samuel Innes, with his wife and three children, was turned over three times, but the occupants were scarcely hurt. Another house was broken to bits, and seven of its occupants killed, but the eighth, a little baby, was found at day-break, a hundred yards from the site, in a crevice of a rock unharmed, except for exposure to the chill morning air. Alex. Leitch and his wife were killed in bed, but their seven-months' baby was found unhurt. A number of men were in the mines, but providentially the mouth of the tunnel was not covered deeply, and owing to the courage of one or more of the men, they were able to work their way out.

Thos. J. Cooper, late on the staff of the Canadian Engineer, was in the town at the time, and to him we are indebted for the following graphic account of the disaster, with the accompanying rough sketch of the site.

Frank, Alta, April 30, 1903.

You will already have heard of the awful catastrophe that has visited our town. Thank God, we are all alive and well, though in the midst of the most terrible scene of devastation that I have ever witnessed. Yesterday morning at 4 o'clock, we were awakened by noises and tremors that baffle description. I can best give a faint idea of them by saying that noise as if a thousand express trains were tearing at full speed over the house-tops greeted our ears on awakening. Whether an eruption, earthquake or landslide occurred, I knew not, but as actual fact, the side of the Turtle Mountain, which overhangs the town, was heaved away by some titanic force from the rest of the body, and cast fan-shape in the valley below, covering with rocks and mud a space measuring roughly, a mile by a mile and a half, carrying death and destruction in its track, and completely altering the face and appearance of the surrounding country. Depressions in the land are filled up, and in some places debris is piled up to depths varying from 150 to 300 ft. high. Houses, with their slumbering occupants, were swept along from their foundations, or buried with the families inside, whose bodies will never again see the light of day. The Coal Co.'s stables, a huge building, containing at the time, over 40 horses has completely disappeared, leaving no vestige behind. The C.P.R. main track for a mile and a half is covered with huge rocks, some of which must weigh hundreds of tons, completely stopping all communication with the East.

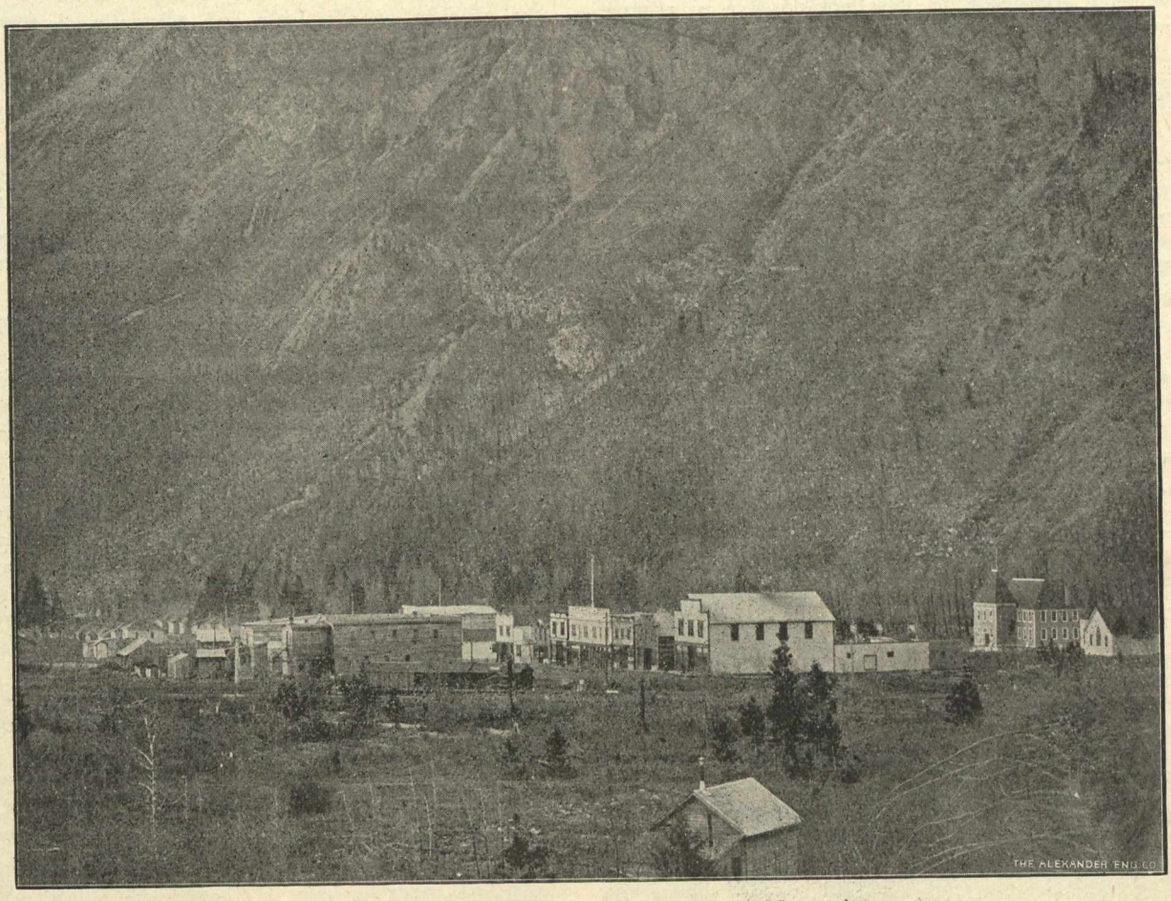
The Coal Company's weigh office, tipples, engines, new electrical plant, and entire works have absolutely disappeared, and not a sign of them or their location is visible; their sites being now occupied by a huge plain of rocks, in the centre of which is a small lake, about one-quarter mile long. The river course is completely blocked, and the lower portion of the town, and a lake is there rapidly forming, which, unless a new course for the river be formed by natural pressure or blasting, will ultimately submerge the greater portion of the town.

As far as can be gathered at present, nearly 100 lives have been lost, some entire families being killed. Even a mile and a half away, a camp of contractors' men engaged by Pouport & McVeagh, for the new C.P.R. track, is said to be buried beneath 100 ft. of rock, McVeagh himself being amongst the dead. A few bodies have been recovered, mangled and battered beyond description, and a few miraculous escapes are recorded; of the latter, an entire family were carried by the rocks about 200 feet in the house, which then fell to pieces, leaving the occupants battered and bruised, but living; the baby was found about 70 feet from the house alive and well. There has been a steady exodus ever since for towns further west. Rocks have been falling down from the mountain-side at short intervals since, increasing the fear and alarm of the towns-people.

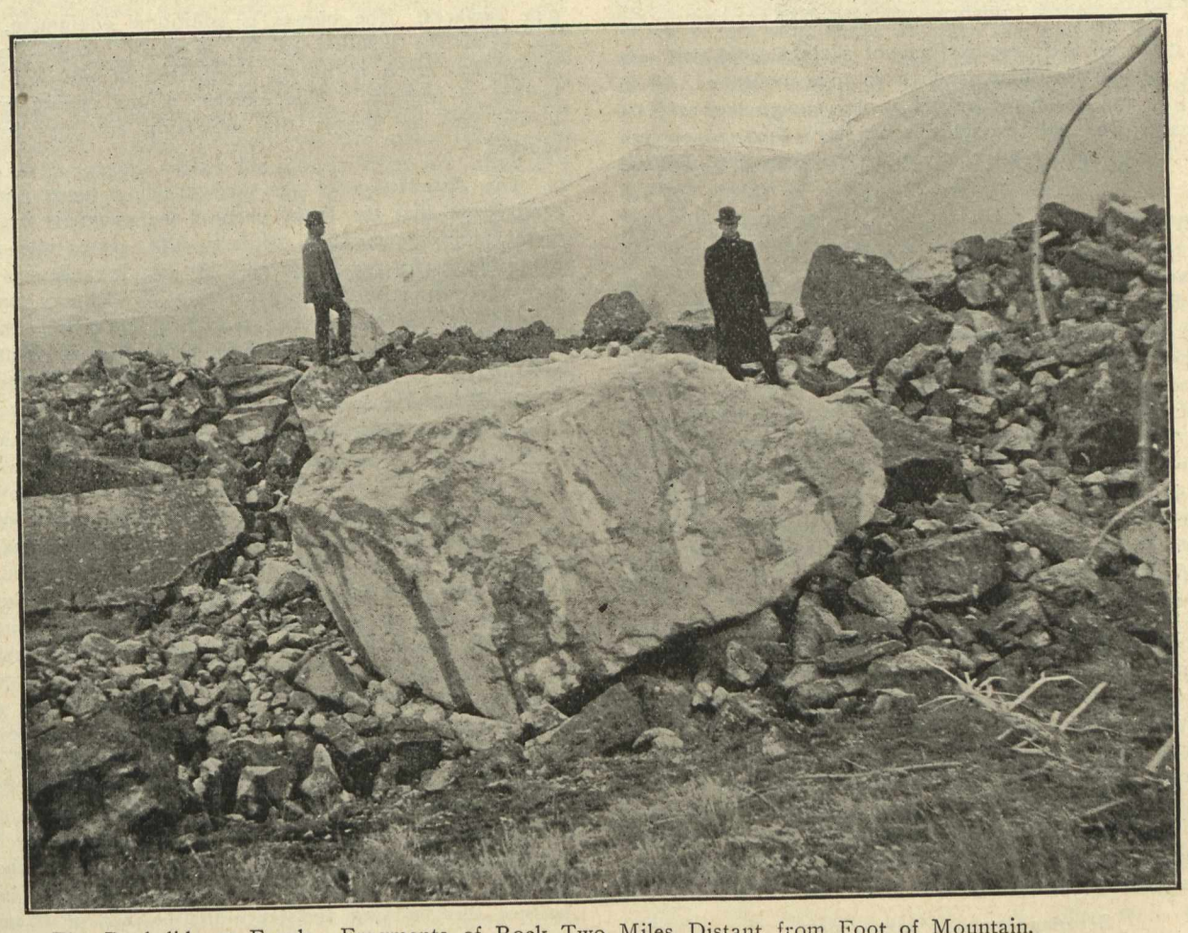
The night weighman, poor fellow, is buried deep somewhere, and I myself should have been had the accident happened three hours later.

Of course, nothing is known as yet as to what will be done regarding the mine. The officials and owners will gather together as speedily as possible, and come to some decision. If that be against resuming work, this town will empty like a rocket. Even if it be decided to resume work, it will be quite a while before anything can be done, as a fresh start will have to be made, and the railway-track rebuilt and rearranged.

One promising feature, however, is the report of the miners who escaped from the mine last night after a terrify-



View of Frank and Lower Slope of Turtle Mountain.

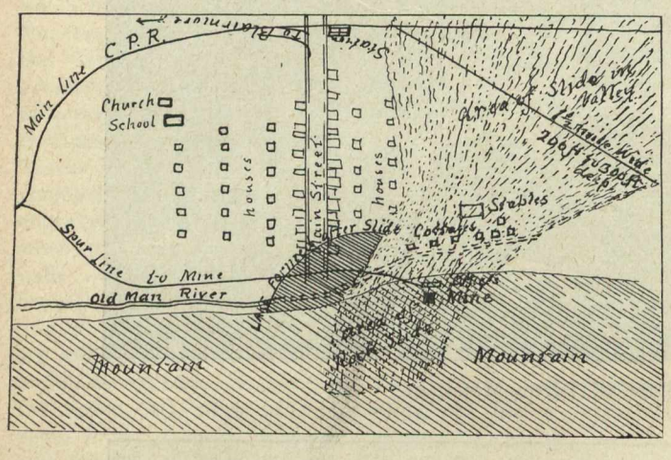


The Rockslide at Frank. Fragments of Rock Two Miles Distant from Foot of Mountain.

ing imprisonment. They were given up for lost, as all the entrances and air-holes were buried, and we naturally judged they were buried in the interior of the mine. But, strange to say, though the inside of the mine was shaken and rocked violently, yet the workings are practically intact, and only two lives were lost; those seemingly being due to compression of air or shock. The horses inside are still alive and now being fed inside, as it is not possible to remove them under present conditions.

The report of the escaped men will, no doubt, have a favorable tendency with the owners when deciding the future.

The cause of the whole affair is evidently not due to mine gas; the general opinion is that generation of gas has been caused by water percolating into the limestone strata, of which the outer surface of the mountain is composed. This in time by compression, assumed such power as to dislodge the entire mountain side, and cause the present disaster. The death-dealing rocks are but three or four hundred yards from our door. I have drawn a rough sketch, showing the track taken by the falling rocks. Even at the furthest point away from the mountain, the rocks are piled up so high as to lead many to think that the whole valley was violently upheaved and overturned. We shall only know the cause after the scientific experts have visited



us and made up their reports, as not a single soul that was working outside the mine is alive to give evidence. All is conjecture; and as this event is a new experience, at least for Canada, we shall probably soon have theories enough propounded to satisfy all the various opinions held on the subject.

Writing two or three days later, Mr. Cooper says: Owing to the dangerous condition of the mountain at Frank, another huge slide of rocks is threatening the whole town. Everyone was ordered out on Saturday, and the town is now absolutely deserted, the only living souls near being the police on guard. We had to leave at a minute's notice, and a four-miles' tramp across the mountains to the north of the town enabled us to reach the train waiting to go east. We had to leave, of course, just as we stood, the only things I brought being a brush and comb, and a loaf of bread! I am going to venture back possibly to-morrow, to get some bed-clothing, and whatever I can manage to carry—as no trains now go further west than Cowley. I anticipate quite a pleasant little trip, as I shall have to tramp and pack what I can on the pony.

One thing is certain, that however incorrect newspapers may be in detail, no report yet appearing has given any idea of the destructive energy of the rock-fall—only an actual sight can convey a true impression—and one must see the result from all sides before a true idea can be obtained.

A trail is being cut over the mountains, by order of Premier Haultain, who is on the spot; and a temporary track is being laid over the rocks by the C.P.R., but it must be weeks before either can be finished—meanwhile, the only access is by footpath across the mountains.

See page 154 for later report.

HEATING AND VENTILATION OF SHOPS.

At a recent meeting of the New York Railway Club, an interesting discussion took place upon the subject of heating railway shops and other one-story buildings of the same nature. While such buildings are very simple in construction, they are not so simple as might appear in regard to the problem of effectively and efficiently distributing heat and air. On account of the large amount of roof, wall and window surface, the loss of heat is very great, and also, because of this and the relatively great height of the building considered as a single room, there is a tendency towards unequal distribution of the heat, the warm air rising to the roof and the cold air flowing to the floor, where it renders the workmen uncomfortable. It is important, then, not only that a sufficient quantity of heat should be delivered to the building, but also that it should be delivered where it will do the most good.

If an attempt is made to supply the heat directly by means of steam or hot water coils, the best results are not obtained. The vicinity of the coils is apt to be uncomfortably hot from the heat radiated directly therefrom, while places at a distance are disagreeably cold. The heat transmitted to the air of the room by contact and convection from the coils is largely lost, since the hot air rises vertically and imparts its warmth to the roof and skylights. It is also to be objected to this system of heating, that it makes no provision whatever for ventilation, the extended system of steam or water pipes is subject to damage by freezing during the coldest weather and steam pipes have been shown to be frequently the cause of fire where they came in direct contact with wood or other inflammable materials.

Owing to the reasons given above, the direct system of heating for work of this character seems to be falling into disfavor and is being superseded by the fan or hot-blast system. The apparatus required for the latter consists usually of a steam coil for heating the air, an engine or motor-driven fan for propelling the air through the heater and to its destination in the shop, and a system of piping or ducts leading it where it is needed. The heater will contain a considerable less length of pipe than would be required for direct heating, due to the higher velocity of the air over the pipe surfaces. The blower is additional equipment, but its use would be justified on the score of ventilation alone, something which is hardly considered at all in the direct system of heating. The exhaust of the engine is usually turned into the heater, thus obviating any loss from that source.

The distribution of the air by means of pipes should be so carried out that the lower part of the room is kept at a comfortable temperature, while at the same time no disagreeable drafts are produced. It has been found that by properly proportioning and directing the delivery flues most satisfactory results can be secured. Illustrating this point some very interesting examples were cited at the meeting mentioned above, by C. H. Gifford, of the B. F. Sturtevant Co., Boston. He said:

"In the first place, if you desire air or almost any other form of gas or substance at any particular place at any particular time, the best way is to provide a suitable conduit to deliver it there, and I would add, if there is any difficulty, which there may be, by air blowing on an individual workman, it is a simple mechanical detail to rectify it and, if you are unable to predetermine where the men or machines are to be located in a building, you can simply have an adjustable discharge opening from the pipe delivering the air, and if, perchance, it blows upon someone there generally is some space near the person to which the air can be directed and therefore cause no inconvenience whatever.

"As an example of what can be accomplished by distribution, I have in mind a machine-shop, that of the New York Shipbuilding Co., which as a machine-shop, is not dissimilar to one designed for railroad work. They have a building which I believe is about 1,100 ft. long, about 250 ft. wide, and 82 ft. high. The proposition was to heat one half of this building and leave the balance of it unheated. It was a problem that came to me, and I must say that I was

a little phased at attempting to heat one end and not have any interference from the other end. We, however, conceived the idea that there could be a partition put across the middle of the building about 12 ft. high, and we could then bring the heated air down to the zone which it was desired to heat, which was not over 8 ft. above the floor, and in that way we could perhaps confine the air in the space, and not have very much effect on the rest of the building. It was something of a speculation and rather a bold attempt, when you consider entering into a guarantee which might involve a serious loss; nevertheless it was done.

"The apparatus is arranged under the landing platforms of the gallery which surrounds the shop, so that it is out of the way of the cranes. Pipes are carried along beneath the runway of the cranes, and branches are brought down on the posts and discharge the air towards the floor, the outlet being in the form of a Y, which is adjustable.

"We were very much gratified after the plant was started to find that it performed just as was expected it would, and it is surprising to note the difference in temperature between the two sides of that partition; it is almost the same as when you pass from the building out of doors. The result is simply due to the fact that the air was brought down and continually pressed down into the space which it was desired to heat."

Further emphasizing the advantages of correct distribution, Mr. Gifford says that it is "possible in some cases to introduce $50 worth of additional pipe to carry the air where it is most needed, so that you can, on account of this, leave out $100 worth of heating apparatus. That is, you can get equal results by using smaller apparatus and less steam."

The adoption of the fan system renders the control of the heating apparatus and of the ventilation ideal. During very cold weather, or in the morning, when the building is being heated up, the air supply may be drawn from within the building itself, thus effecting a great economy of heat. In some buildings having a very high cubic space per occupant, sufficient ventilation during the winter time will be supplied by the leakage of air through doors and crevices about the windows, by transfusion, etc. Quoting Mr. E. T. Child, also of the Sturtevant Co., some of these advantages are as follows:

"First, a great convenience in handling, since the entire heating-system of a building may be controlled from one point. Second, efficiency and economy, by controlling the speed of the fan and reducing the length of pipe to which steam is supplied, leaving more steam available for other purposes. Third, the fact that the entire heater coil is in a steel housing makes the danger from fire much less than with many pipes passing through partitions of wood. Fourth, in the summer time it gives the opportunity to ventilate the shops. This, I think, is quite important. Some shops are very apt to become overheated in the summer time and a current of cold air may be drawn from a basement, making them much more habitable.

"The pipes should be so arranged that the air will not be discharged directly upon the workmen; it is also true that hot air will do the most good if it is put where it is needed. If the space around the walls of a building is properly heated, one may never worry about the centre, as that will keep warm.

"We have found, therefore, the most satisfactory heating will result from numerous pipes discharging on the outside walls at a point about 6 ft. to 8 ft. above, and directed towards the floor. These pipes should be located from 25 ft. to 40 ft. apart, depending upon the character of the building. This arrangement causes hot air to be blown downward, whence it spreads on the floor, keeping it warm before the air has a chance to follow its natural tendency and ascend to the roof. Hot air has a very bad faculty of getting up in the trusses and if you blow the air directly at the floor and get the floor warm, at the same time keeping the outside of the building warm, your problem is practically solved. In the case of an underground duct, it is well to use short outlet pieces which will discharge the air along the walls at the floor.

"At the works of the Fore River Ship & Engine Building Co. they have an overhead pipe system with drops on the walls, which was put in according to the regular practice. Later they added 50 per cent. to the building and are now heating it with the same apparatus. That is, we picked out a fan heater which we considered to be the proper size for that particular building and it worked in a perfectly satisfactory manner. Later the ship company added 50 per cent. to the length of the building. We extended the piping and carried drops on the walls every 30 ft., blew the air on the floor with ample outlets on the ends, and in the coldest weather the heat of the building, which is 50 per cent. larger than we would care to guarantee with our apparatus, was perfectly satisfactory to them. Their success is entirely attributed to the excellent system of air distribution.

"At the shops of the Atchison, Topeka & Sante Fe Ry. Co. the underground system was adopted and low horizontal outlets were provided which distribute the air at the floor and along the walls. This is an extremely large shop, the contents being about four or five million cubic feet. The shop is heated by four large apparatuses and the underground ducts extend almost entirely around the building. The pipes are not over three feet high, the air being discharged horizontally along the floor, and I understand that the building is very satisfactorily heated.

"The galvanized iron pipe system with drop pipes on the walls has been used at the new shops of the New York, New Haven & Hartford R. R., at Readville, Mass., and with excellent results.

"The following general classification of railway shops may be made: First, machine, erecting and car shops; second, paint shops; third, round houses.

"The second and third require special treatment. Paint shops require to be practically dustless and, consequently, the air velocities must be low. The temperature requires to be higher, and it is customary to arrange to circulate the air in a much more thorough manner than in shops of the first class.

"This is done in the Pennsylvania railroad shops at Altoona by means of ducts and in the New Haven shops, Readville, by a similar overhead system. There has been a great deal of hesitation among railway men about installing the hot-blast apparatus in paint shops. They are afraid of getting their varnish dusty. But I might name a dozen or so paint shops all over the country, for instance, the Boston & Albany shops at Allston, the New Haven shops at Readville, and there are several Western shops, all of which are heated with the hot-blast system, by a very ample distribution of air. The circulation is brought about by a counter-exhaust system, which circulates the air, returning the whole or a part of the apparatus. There are two ways of establishing this return of the air; one by an underground duct system and the other by an overhead galvanized system. In the Pennsylvania railroad shops at Altoona, we have an installation that has been in a dozen years, I think it is one of the first we put in that returned the air from underground and back to the fans, using very ample distribution of air-pipe in the discharge.

"In the Readville shops the air is brought back by means of an overhead galvanized pipe. In this way circulation is kept up in all parts of the room, and thereby the paint is dried much more rapidly than it would be by any other system where the air in the room is practically still.

"Round houses have been much neglected up to recent years, but of late they have been receiving better attention. Their proper heating is a problem of no little moment.

"The hot-blast system of heating is a great improvement over the old method, since it allows for ventilation in the winter time with both windows and doors closed. In this class of buildings the air should be delivered through ducts which terminate in the walls of the pit, thus delivering the air where it will be most effective for thawing out engines that have come into the house covered with snow and ice. At the same time it is a very good idea to have a provision for admitting some of the air above the floor in case there are no locomotives which need special attention.

"A little official comment on this subject may be interesting. The following clippings are culled from the Pro-

ceedings of American Railway Master Mechanics' Association, 1902.

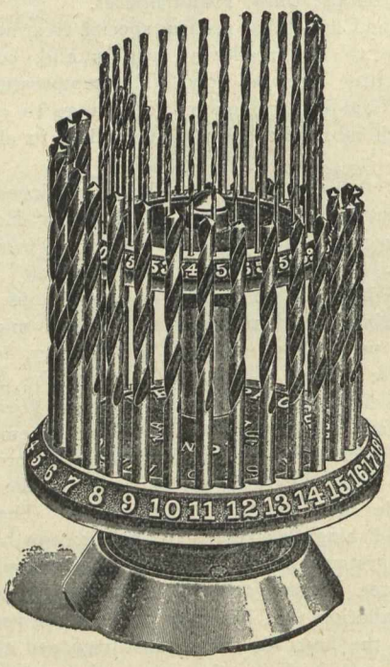
"A. Van Alstine, in describing an ideal round-house, says: 'It is heated by hot air from heater and fan, which passes around the house through an underground duct, on the inside circle it is distributed to pits through the under ground pipes.'

"On page 141, under Heating and Ventilation, we find the following: 'Nearly all large round-houses of recent construction are equipped with fan systems, these being considered as furnishing the ideal method of heating. Various methods are employed to distribute the hot air into pits, the chief point of interest being the method of delivering the air under the engines and tenders for the purpose of quickly melting snow and ice."

As further touching upon the subject of paint shops, Mr. Gifford stated that he had been told by a prominent railroad engineer, "that aside from the question of heating the shop, the drying of the paint and varnish is a chemical question and, for that reason, the advantage of the hot-blast system lies in the fact that you can handle large quantities of air, so that you have an active circulation and a rapid impingement of the air upon the painted surface, causing a rapid oxidation of the paint and varnish."

REVOLVING DRILL STAND.

The accompanying cut represents a revolving stand for holding wire gauge drills from Nos. 1 to 60, offered by the Fairbanks' Company, Montreal, Canadian agents for the New Process Twist Drill Company. The drills are placed in the



revolving plates and any size wanted can be instantly obtained by turning the plates in either direction. The holes in the plates are drilled with the drill belonging to them, so that the stand in a way is a drill gauge, and the drills cannot become mixed. For instance, the hole marked No. 9 is too large for a No. 10 drill, and a No. 10 drill will not go into a No. 11 hole. The stand is nickel-plated and nicely finished so as to make an attractive display of the drills either in a show window or about the store. It is also referred to as being a useful article in machine shops.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The final meeting of the Canadian Society of Civil Engineers for the session of 1902—1903 was held on the 21st ult. The session has been noteworthy for the large number of applications for membership, and for the number and quality of papers read. The special prizes for the best students' papers have proved a very interesting feature of the society's work during the year, and the council has decided to continue them for the coming year. Besides the prize offered by the Canadian Engineer, three others will be given again by the society this year. The Canadian Engineer prize essay appears elsewhere in this issue, and the other essays will appear in future numbers.

The following was the result of the ballot, at the last meeting, for new members and transfers from one class to another:

Members.—Richard Sutton Buck, of Montreal; Guy Colin Carman, of Iroquois, Ont.; Henry Goldmark, of Montreal; Ira Grant Hedrick, of Kansas City; Alexander James McMillan, of Vancouver, B.C.; Frank Moberly, of Victoria, B.C.; Charles M. Odell, of Sydney, N.S.; George Washington Stadly, of Sault Ste. Marie; Arthur B. Stephen, of Collingwood, Ont.; John Alexander L. Waddell, of Kansas City, Mo.

Associate Members.—Charles Alfred Abbot, of Toronto, Ont.; John Armstrong, of Edmonton, Alta.; Frederick William Farncomb, of London, Ont.; Joseph Eugene Larochelle, of Levis, P.Q.; George Peter MacLaren, of Caledonia, Queen's County, N.S.; Joseph Allyre Roy, of Montreal, P.Q.; Frederick John Ure, of Woodstock, Ont.

Transferred from the Class of Associate Member to the Class of Member.—Walter Peck Chapman, Hamilton, Ont.; Charles Burrard Kingston, of London, Eng.

Transferred from the Class of Student to the Class of Associate Member.—William Forrest Angus, of Montreal, P.Q.; Reginald Herbert Balfour, of Montreal; Lennox Thomson Bray, of Amherstburg; William E. L. Dyer, of Montreal; Wilford Almon Hare, of Joliet, Ill.; Levin James Houston, Jr., Stockton, Maryland; Charles Alexander Waterous, of Brantford, Ont.

Students.—James de Gaspe Beaubien, of Outremont; Douglas Edward Black, of Montreal; Samuel Blumenthal, of Montreal; Charles McKinnon Campbell, of Eganville, Ont.; John Alven Cameron, of Montreal; Mellis Urquhart Ferguson, of Kingston, Ont.; John Robert Grant, of Kingston, Ont.; Alexander Hunter Greenlees, of London, Ont.; Oliver Odilon Lefebvre, of Ottawa, Ont.; Allan Campbell Mackenzie, of Montreal; Alexander James Milder, of Kingston, Ont.; William James McAllister, of Montreal; Charles William Stuart, of Winnipeg; Clarence Richard Young, of Toronto.

The Iola Portland Cement Co., at Iola, Kansas, operates its plant upon natural fuel, and is one of the largest users of gas power in the cement manufacturing field. The present equipment comprises twelve engines of the Westinghouse vertical three-cylinder and two-cylinder single acting type, aggregating 2,100-h.p. These engines operate various classes of machinery, such as rock crushers, rotary kilns, line shafting and generators, for supplying light and incidental power throughout the works. The power plant comprises six engines of 280-h.p. each, five of 125-h.p. each, and two small engines. The 125-h.p. engines are used for driving the kilns, and the 280-h.p. for the rotary crushers. The machinery is in general arranged in groups upon sections of counter shafting driven by a single engine either direct-connected or rope driven.

The International Asbestos Co., H. S. Pridmore, Actinolite, Ont., agent; the Empire Wall Paper Co., H. C. Jarvis, Toronto, agent, and the Von Echa Co., S. R. Ickes, Woodstock, Ont., agent, all extra provincial companies, have been licensed to do business in Ontario.

Alfred Herbert, Limited, machine tool makers, Coventry, England, are laying plans for some important extensions to their works. These extensions will include additions to both erecting and machine shops, and will include a new stores and control department, a new mess-room for the workmen, a new pattern shop and an entirely new power house in which will be concentrated all the steam and electric power which is at present divided among several departments. The additions to the generating plant will include a 350-h.p. steam engine, driving a direct current multipolar generator. These developments have been forced upon the company by the increased demands for their turret lathes, milling machines, and other special machine tools. The number of employees at present is 930, which will be considerably increased when the new works are in shape.

Municipal Works, Etc.

A sewerage system is to be built at Pembroke.

A new bridge has been built over the Trent at Heeley's Falls.

Carleton, N.B., is agitating for a bridge to connect that suburb with St. John, to replace the present ferry service.

Dundalk, Ont., will vote on by-laws to provide $6,000 for waterworks, $4,000 for street improvements, and $2,000 for sidewalks.

A steel bridge, says the Kingston News, is to be erected over Batteau creek, on the lake shore road in the county of Frontenac.

Fifty thousand dollars has been voted by Parliament for harbor improvements at Port Arthur, and $35,000 for dredging the Kaministiquia river.

The Aylmer, Ont., council has decided that the water supply shall be obtained from the flowing wells a short distance northeast of the town.

The St. John's, Que., News is urging asphalt sidewalks instead of stone slabs. It takes the cost of asphalt in New York, and figures it at 73 cents, while stone, as laid down in St. John's, costs $1.30 per sq. yard.

Two survey parties are at work on the irrigation extension works in Southern Alberta, under G. G. Anderson, consulting engineer of the company, one to stake out the course of a new canal from Milk river to Raymond to supplement the water of the present canal, the other to lay out work for the extension of the system easterly in the direction of Chin coulee. One of these parties is in charge of A. M. Grace, C.E., constructing engineer on the first work of the Irrigation Company, the other is in charge of C. M. Arnold, C.E. The canal from Milk river is to be a twenty-five foot ditch with a capacity of 500 cubic feet of water per second; the other will be a ten-foot canal with a supply power of about 250 cubic feet per second.

The area of Ottawa is 3,365 acres; population, 61,151; mileage of streets, 100.21; of asphalt, 4.90; of granolithic walks, 83.66; of water mains, 101.08; of sewers, 68.65; of electric railway tracks, 24.44; of roadway occupied by the street railway tracks, 14. The minimum horse-power within a 45 mile radius is placed at 917,403, of which 83,400-h.p. is developed, and 834,003 available. Average number of gallons of water pumped per day of 24 hours during the year was 11,016,276. The average daily consumption per head is 180 gallons. This is double what it should be, and is chiefly caused by consumers allowing their taps to run in cold weather to prevent freezing. The consumption on a day in January varies from 25 to 33 per cent. more than in July, showing the enormous waste from this cause. The cost of furnishing each thousand imperial gallons during the year was 4 7-10 cents.

The proposed route of the Montreal subway is as follows: Commence near the site of the Methodist church in Montreal South, extending in an open cut toward the river for a length of 1,350 feet to a portal, thence by tunnel under the shallow channel south of St. Helen's Island, under the easterly end of St. Helen's Island to the north shore of the river near Monarque street, thence by a curve under private land to Notre Dame street, thence by Notre Dame street to the yard of the C.P.R., thence to private land on Craig street, under Craig street, Viger Square, and private land to City Hall avenue, near its intersection with Dorchester street, thence under City Hall avenue to Duluth avenue, thence by curves under private land to Laval avenue, thence under Laval avenue to a portal on the north side of Mount Royal avenue, thence by an open approach to vacant land on the northerly side of St. Louis street, at which point it is intended to place assemblying yards; a total length of structure, including approaches, of 21,368 lineal feet.

A new bridge has been opened across the Lachine Canal at Montreal, furnished by the Dominion Bridge Co. Mr. Lordley was the engineer in charge.

The Montreal Business Men's League is urging the need for an underground conduit system for electric wires in the business portion of the city, and also in selected residential streets.

Forest fires have done much damage during the past month, and many bridges have been destroyed. This is specially the case in the northern part of the county of Hastings, and thereabout.

A culvert bridge is to replace what is known as the Spider bridge on the Hamilton and Flamboro road, the present bridge having been condemned. The cost will be about $4,000.

St. John, N.B., is considering plans of harbor development, which would give 30 more steamer berths and an esplanade from Fort Dufferin to Partridge Island, with roadway and street car lines. The esplanade would be 1,000 feet wide and act as a breakwater.

The 15-ton road roller, purchased by the town of Lindsay, as mentioned last month, was built by the Waterous Engine Works Co., of Brantford, who are also finishing one for Sydney, Cape Breton, one for Collingwood, one for Ottawa, and have already shipped three this season to Farnham, Welland, and Moncton, N.B.

The Stuart Machinery Co., of Winnipeg, is filling an important machinery order for the town of Prince Albert. It comprises a complete electric light plant with power. The engine is a 150-h.p. Leonard Corliss, with boilers and other appliances to correspond, also patent feedwater heater. The dynamo is of the induction type. When this plant is complete it will be the finest electric lighting installation in the West.

The British Columbia Government is erecting a large two-decker steel bridge over the Fraser river at New Westminster, the cost of which will be $850,000. It will be half a mile in length and 19 feet wide. It will have a single track road for the railway, 18 feet above high water, and a road for pedestrians and wagons 21 feet above the railway. The bridge will rest on 11 piers and have a draw in the centre. It is expected that the Great Northern will use this bridge to cross the Fraser river to get to Vancouver.

A number of municipalities have recently purchased road-making machinery, among others the following: Collingwood, a 15-ton steam roller and is considering a rock crusher; Wentworth county a stone crusher, six road scrapers, and a 10-ton steam roller; Montague Tp., a stone crusher; Eganville a stone crusher, which will probably be operated by electric power; Arnprior a grader; Montreal a crusher and a civic asphalt plant. The Montreal crusher in a test broke 32 tons, 700 lbs. of macadam in an hour, the contract requiring at least 20 tons. The Wentworth County graders are to be drawn by traction engines instead of horses.

The water supply for Regina has been looked upon as a difficult question, but John Galt, C.E., who has been employed to look into it, says it is not difficult to solve. He proposes to obtain a supply of spring water at Boggy creek, where a dam thrown across the creek would provide a million gallons a day. The level at the selected point is 103 feet above Regina, and the dam would give a height of 110 feet. The depth of the necessary cutting would not be more than 22 feet, and that for one mile only. This would supply Regina with water for many years, and the reservoir would form a beautiful lake in the midst of a pleasant landscape. The cost would be about $180,000. There is, he says, an abundant supply of water under Regina, at a depth of 90 or 100 feet, but it is hard and contains alkali salts, so it would have to be softened, as is done at Winnipeg, by chemical means. At Winnipeg this costs 3½c. per 1,000 gallons, but it is hoped by recovering waste products, which are marketable, the figure will be reduced to 2½ cents. At Regina it would cost 5 cents, or $10 a day on a 200,000 gallon consumption, which is about what the city at present requires.

Wentworth estimates provide $10,685 for road repairs.

Niagara Falls has carried a by-law to instal a third pump in its waterworks.

The Charlotte street bridge, over the railway at Sydney, C.B., is to be widened and levelled.

Athens, Ont., is moving in the direction of a local telephone system.

Thornbury freeholders will vote on a by-law to give a loan to the Star Gasoline Co.

St. Catharines ratepayers will vote on a by-law to purchase the gas plant of that city.

The village of Buckingham is going to spend $10,250 in macadamizing the streets and putting in more sewers.

Winnipeg asks authority to develop the water power of the Assiniboine river, and to build a canal between the Assiniboine and Lake Manitoba.

Regina, N.W.T., has decided that a system of waterworks, electric lighting and drainage shall be installed. John Galt, of Toronto, will act as consulting engineer.

St. John, N.B., will instal a new fire alarm system in five circuits. There is now only one circuit, and because of an accident recently, not a box in the city could send an alarm for six hours.

R. E. Milligan, a New York expert engineer, reports in favor of the Thames as a source of water supply for London, Ont. The Springbank water now used is good, but a larger supply cannot be obtained. Either branch of the Thames may be used.

The snowfall for Montreal during the past winter is officially stated to have been ninety-seven inches. Of this, 218,800 loads were drawn to the dumps at a cost of $94,301, half of which was paid for by the city and half by the Montreal Street Railway Company.

The Bank of Ottawa will build a fireproof ten story office building in Montreal, steel frame, first two stories granite, remainder light grey stone, two fast steel elevators, and a line of vaults from cellar to roof. It will have a frontage of 38 feet on St. James street, and be 130 feet high from the sidewalk.

Railway Matters.

Snowsheds are to be build along the Newfoundland Railway line to prevent a repetition of last winter's blockade.

The grading of the C.N.R. east from Edmonton is to be proceeded with at once.

A survey has been made for an extension of the electric railway from Long Branch to Oakville, along the lake shore, connecting at Oakville with the Hamilton Radial Railway.

The Montreal and Southern Railway Co. are hopeful of joining Montreal and New York by means of an electric road. They are going to equip their lines so as to attain a speed of 60 miles an hour.

Arrangements are being made between the Montreal Street Railway Co. and the Grand Trunk which will enable the former to lay their rails and send their cars across the St. Lawrence by way of Victoria Bridge.

A charter is asked for the Keewatin and Ontario Railway Co. to construct a line from the western boundary of Ontario to Rat Portage and thence to the mouth of the Albany river at James' Bay, with branches south to the C.P.R. and Lake Superior.

It is stated that it is the intention of the Government to extend the Intercolonial Railway from St. Rosalie, where it now connects with the Grand Trunk, to Longueuil, and enter Montreal over the new bridge which is to span the St. Lawrence. The idea is ultimately to continue the I.C.R. to the Great Lakes.

The Irondale, Bancroft and Ottawa Railway engineers are at work on an extension eastward from the present terminus to near Bancroft.

A survey is being made for a branch railway from Stirling to Cardston, N.W.T., under Mr. Bryce, C.E. It is to be pushed to completion at once.

A scheme is on foot to build a railway from New Liskeard to Lake Abbitibi by Iroquois Falls. A land grant is asked from the Ontario Government.

The Canada Atlantic is asking for power to build from Depot Harbor to Sault Ste. Marie, where connection will be made with the Western United States lines.

Sir Wm. Van Horne, John Bertram, of Toronto, and E. C. Fry, of Quebec, have been appointed a transportation committee to enquire into the whole system of transportation in Canada. Sir Wm. Van Horne will represent the railway interests, Mr. Bertram, shipbuilding, and Mr. Fry, the shipping interests.

The C.P.R. has been granted an extension of time for the construction of its Great Northwest Central branch. A clause has been inserted in the charter which provides that the line is not to approach within 40 miles of any existing railway, and not more than 250 miles is to be built without further permission from the Government.

Sir Charles Rivers Wilson, president of the G.T.R., attributes the prevalence of railway accidents on this continent to a cause which he says is very obvious, namely the great pressure of business, and does not appear to regard the introduction of the block system favorably on account of the long distances.

The Grand Trunk is asking for power to issue $20,000,000 of new stock to provide for elimination of grades, double-tracking, terminal facilities, elevator accommodation, etc. Contemplated improvements at Toronto, including terminals on the old Parliament House grounds, will cost between $300,000 and $400,000. A considerable sum will also be spent at Hamilton.

A by-law to grant the Berlin and Preston Street Railway Co. the sum of $6,000 in lieu of purchasing a right of way for it through private property was defeated at Berlin. Right of way over certain streets will now be asked so the line can be extended to Waterloo. Two motor cars, built for the road at Ottawa, are handsomely finished, and will carry sixty passengers each.

Observation cars are to be run over portions of the Montreal street railway. They will be leased and operated by the National Observation Car and Coach Co., of Boston, who operates a similar service in several large cities of the United States, including Philadelphia, Denver, Salt Lake City, Boston, etc. A lecturer will accompany each car to point out and explain places of historical interest.

The Phoenix, B.C., branch of the C. & W. division of the C.P.R. is now equipped with the two most powerful locomotives in the world, built at the Shay Engine Works, Schenectady, N.Y., for the C.P.R. They are to be used in ore hauling from the Phoenix camp to the Granby smelter, and work on the cog system. They are seventy feet long, over all, and on a level track the hauling capacity of each engine is sufficient to draw a train of loaded cars a mile and a half in length.

About 60 miles of the Temiskaming Railway have been graded. Track-laying is to commence June 1st. The terminal arrangements between the Temiskaming and C.P. Railways at North Bay provide that the latter will do all the switching, making up of trains, housing of engines, handling of passengers and freight, issuance of tickets, cleaning of cars, supplying coal and water, and all other work pertaining to a terminal, the employees of the C.P.R. being considered employees of the Government line while doing the work. The advantage will be that the construction of terminal facilities, costing at least $80,000, will be avoided, and the Temiskaming commission will pay for each service rendered at a price named in the schedule.

The Cape Breton Electric Co.'s road has been extended to North Sydney.

A preliminary survey has been made for a railway between Kingsbury and Windsor Mills, Que.

Wm. Robinson, a former resident of Owen Sound, and a railway contractor, proposes to establish car works there.

A bridge over the Detroit river, from Windsor to Detroit, is again being agitated. The railways are interested and plans have been prepared.

Construction is to be pushed on the Restigouche and Western Railway, from Campbellton to St. Leonards. Malcolm & Ross have the contract.

It is rumored that a syndicate has offered to take the Prince Edward Island Railway off the hands of the Government and run the trains by electricity.

The C.P.R. has decided to build a line south from Winnipeg to Minneapolis, instead of having to depend upon running rights over the Great Northern.

The street railway men in Montreal struck May 23rd, but the strike was broken on the 27th. Another strike was threatened in Toronto, but was averted.

The new bridge across the Saskatchewan, by which the C. & E. Railway is to enter the town, will be a high level one, and one of the finest structures in Canada.

The rails have been laid on the G.N.R. extension to the mouth of the Fraser river. The steamer Victoria will connect and form a ferry service to Vancouver Island.

The H. G. & B. electric railway has installed a 400-h.p. generator at Grimsby, and the cars are now run by power supplied by the Cataract Power Co. from De Cew's Falls.

The C.P.R. is building at its Montreal shops six new sleeping cars which will be named "Thrums," "Thurso," "Trail," "Tyndall," "Trudeau," and "Treherne." Each car will cost about $17,000.

The Canadian Northern Railway Co. will grade one hundred miles more of road than intended this year, so as to provide work for the Barr colonists, but the iron will not be laid.

Fifty years ago, on May 16th, the first passenger train ran out of Toronto, over the Ontario, Simcoe & Huron Railway, afterwards the Northern, to Aurora and return. The conductor, John Harvie, is still alive and a resident of Toronto.

Schell & Purcell have been given the contract for that section of the Chateauguay & Northern Railway, from Bout de l'Isle to Maisonneuve. J. W. Poupore will construct the bridge over the River des Prairies and the line between Joliette and Charlemagne.

The C.P.R., which has been operating the Calgary & Edmonton Railway on a short lease, has acquired it on a 99 years lease, and will put it in thorough repair, and probably extend it into the Peace River country and elsewhere. It is 300 miles long and is one of the best-paying parts of the C.P.R.

An extension of time for the completion of the Manitoulin & North Shore Railway, one of the Clergue enterprises, is being asked for. By the terms of the act granting a subsidy, the section between Meaford and Owen Sound should be completed this year. A small section southwest of Sudbury is all that is built, though a good deal of survey work has been done.

While raising a heavy steel girder at the new bridge over the Kootenay, near Nelson, on the C.P.R., the chain on the derrick broke, letting the girder fall. One man was knocked off the bridge to the rocks beneath, another was pinned down by the falling debris, and several others were thrown about, but only one was seriously hurt. The Rossland train was passing over the bridge at the time and the trainmen and passengers witnessed the accident. The new bridge, which is a modern one, with stone piers, takes the place of the original wooden one built by the late Mr. Duchesnay.

The I.C.R. is to be extended to Sydney Mines.

The yard of the G.T.R., Bonaventure Station, at Montreal, is to be roofed.

An electric power brake is being tested. It was invented by some Toronto men.

Construction work on the Bay of Quinte Railway extension has been commenced at Actinolite.

Electric automatic signals are to be put in at the crossings of the I.C.R. at Campbellton, N.B.

The Nova Scotia Steel Co.'s limestone quarries at Point Edward are to be connected with the I.C.R.

Construction is to be commenced on the V. V. & E. branch of the G.N.R. from Grand Forks to Phoenix.

The Hopewell-Leslie-McPhee cattle guard has been selected by the commissioners as the best of about 200 tested at Ottawa.

In the inquest held on a man killed on the Toronto Street Railway the jury condemned the fender in use as inadequate.

The contract for the erection of the new C.P.R. machine shops, at Nelson, has been let to A. G. Creelman, of Rossland. The building is to cost $10,000.

The Canadian Northern Railway Co. has submitted plans to the city of Winnipeg for a new station and hotel, new shops and a steel bridge across the Assiniboine.

Engineer C. Russell's camp, on the Temiscaming Railway, was destroyed by fire, started from sparks from a bush fire. Nearly all of the men's clothing was burned.

A 500-mile stretch of the Great Northern Railway, between the Manitoba boundary and Edmonton, is to be aided by a Government guarantee of bonds for $13,000 a mile.

Construction work has been begun on the Rosendale branch of the C.N.R. The line of the extension from Neepawa to Carberry has been located, and work will shortly commence.

Oil as a fuel has proved such a success on all the lines of the Southern Pacific Railway that general orders have been issued for the conversion of all the engines into oil burners as soon as possible.

Two compressed air locomotives, of thirty-five tons each, are being used at Dominion No. 2 colliery, at Glace Bay, and two more are expected in a short time. They are the first to be installed in any mine in Canada. The compressed air will have a pressure of 650 pounds to the square inch, and they will carry twenty-five two ton cars up a four per cent. grade, and return the empties with one charging. Reservoirs will be placed in a number of parts of the pit and at those the supply of air when exhausted can be renewed.

A number of railway accidents have occurred during the past month. The worst was on the C.P.R., near Dexter, 52 miles east of Fort William, where a tie train was ditched, and 12 men in a boarding car burned to death, and a number seriously injured. The cause is supposed to have been a broken wheel. By a rear-end collision on the Lake Erie & Detroit River Railway, at West Lorne, three men were killed. Ten cars of wheat were wrecked on the Midland division of the G.T.R., at Lindsay. The accident was caused by a broken axle, the result of an overheated box. A C.P.R. freight engine rolled down an embankment, and four cars were burned, near Magog. The cause was a burned bridge.

A meeting of ratepayers of Toronto Junction was held last month to consider the telephone situation. The Bell Company charges Toronto Junction citizens $35, with a toll of 10 cents for connection with Toronto, an average of three to five miles distant. Where through connection is made free to subscribers, the charge is $110. F. Dagger, a telephone engineer of Toronto, told the meeting that an automatic system, under municipal ownership, could be installed for annual rental of $9 a year for houses and $12 a year for business places. If operators were employed the cost would be $12 and $15 respectively. The council appears to be acting

on the information, as a by-law for the installation of a municipal system has been introduced, and has received its second reading. The by-law provides for a vote of the ratepayers on the question.

Light, Heat, Power, Etc.

Emerson, Man., is to have a telephone exchange.

Galetta has been connected with Arnprior by telephone.

Clarksburg, Ont., is contemplating an electric light system.

Sackville, N.B., seeks power to purchase the electric lighting plant and waterworks.

An extension of time is being asked for the completion of the second power canal on the Canadian side at Sault Ste. Marie.

The Chambers' Electric Light Co., Truro, has installed a ten-ton boiler, one of the largest ever built by the Robb Engineering Co.

The Cumberland Telephone Co. is seeking incorporation to build a line from Pugwash to Amherst via North Port and Shinimicas.

The generators of the Toronto & Niagara Power Co. will be the largest in the world. They will at first be five in number of 12,000-h.p. each.

The Marconi wireless system is fully described in a little book published by Munro & Munro, Montreal, which they send to any applicant.

The largest electrical pumping plant in the world is that at Utah Lake. It raises 65,000,000 gallons of water a day for irrigating the Great Salt Lake Valley.

The Bell Telephone Co. has expressed its willingness to accept the terms of the town council for a renewed five years' franchise at Galt, namely, $375 a year.

The Moosomin Telephone Co. will extend its long-distance line to Fleming, nine miles east, to Valley, twelve miles south, and to St. Andrea, fifteen miles southwest.

The C.P.R. Telegraph Co. is putting down an underground cable between the Board of Trade's new building and the company's offices on St. Francois Xavier street.

The North American Telegraph and Cable Co. has been incorporated to lay a submarine cable from Seattle to Valdez and other points in Alaska and thence to Vladivostok.

Changes have been made in the wiring system of the Marconi station at Table Head, to overcome difficulties in its operation. It is evident the system is not yet perfect.

Work on the American Cereal Co.'s dam and power house, at Peterboro, has been retarded by the difficulty in getting the necessary steel work. John O'Toole has the contract.

Mr. Coady, city treasurer, Toronto, advocates the acquiring of the water power on the Severn to generate electric power for Toronto, supplemented, if necessary, by the Muskoka power at Bala.

The Ontario and Quebec Power Co. is asking power to build dams in the Ottawa river above Chaudiere Falls. The application is opposed by the Eddy and Booth interests and the Consumers' Electric Co.

A power plant is to be erected on the Wahnapitae river, two miles below the station. A 1,000-h.p. generator will transmit electric power to Sudbury, Copper Cliff and elsewhere. The estimated cost is $100,000.

The St. Francis Hydraulic Power Co. has been organized to supply power to the mines at Black Lake and vicinity. A. G. Sangster, assistant superintendent of the Sherbrooke Power, Light and Heat Co., will be superintendent.

The North Shore Power and Railway Company has signed a contract with Michael Connolly for the completion of their works, including the construction of a short railway line, pulp mills, wharves and buildings at Seven Islands.

Windsor Mills, Que., is considering the establishment of an electric light system.

Coaticook has bought out the plant of the Electric Light & Power Co., and will come into possession on October 1st.

The corporation of Fenelon Falls has purchased from Brandon & McDougall the water power, roller flour mill and electric light plant. A new power-house will probably be built, and cheap power offered to industries locating there.

Marconi operators on the new Kaiser Wilhelm II. state that they have broken the record for wireless telegraphy between ships at sea, having communicated with the Minneapolis, of the Atlantic Transport Line, when the ships were 210 miles apart.

La Compagnie d'Electricite de Roberval, Saint Prime, with capital of $40,000, headquarters at Roberval, has been incorporated to develop electric power on the river Ouiatchouianish or elsewhere about Lake St. John. Arthur Du Tremblay, of Roberval, with others, are the promoters.

D. W. Ackerman has secured a water power at the mouth of the Severn, and will organize a company to generate electric power. He has secured promises from Coldwater, Waubashene and Midland manufacturers to take power as soon as ready. The water power is sufficient to generate 5,000-h.p.

The Erie-Ontario Power Co. is seeking incorporation to construct a water course and raceway to develop electrical power and transmit it from the Grand river to points in Ontario. D. Carter and others, of Port Colborne, are the promoters.

Mr. Douglass has been awarded the contract for the tunnel in connection with the development of the Toronto and Niagara Power Co., at Niagara Falls. The tunnel will be 2,100 feet long, and will extend from the power house, under the bed of the river, and have its discharge under the sheet of water at the Horseshoe Falls.

Senator Forget, H. B. Rainville, H. S. Holt, H. I. Corthray, H. H. Henshaw, P. G. Gossler, I. S. Mackenzie, Senator Mackay and H. Montague Allan will probably form the board of the amalgamated electric companies in Montreal. The nine names will be divided into three boards, one for Lachine Hydraulic, one for the Citizens, and one for the Standard.

A daily paper is published at Avalon, Santa Catalina Island, Cal., which receives its news by wireless telegraphy. A summary of the news is telegraphed from Los Angeles to White's Point, from where it is flashed across the water by wireless telegraphy to Avalon. The Wireless, for that is the name of the paper, is particular to announce that the system, which is a pronounced success, is not that of Marconi.

The Government will appoint a commission of expert engineers to consider how the waters of the Ottawa and Trent rivers may best be conserved for power purposes. Deputations have waited upon them to urge the matter. In the case of the Ottawa a dam at the lower end of Lake Temiskaming is proposed, the Nile dam at Assouan being cited as an example of such work. A great amount of water is now said to run to waste.

A Marconi money order for five pounds was paid by the Cunard Company at sea the other day. A passenger handed a lace vender a ten-pound note instead of a five-pound note, and the mistake was not discovered by the Irishwoman until after the ship had gone. She handed five pounds to the representative of the Cunard Company at Queenstown. The boat was caught by Marconigraph in mid-ocean, and the five pounds refunded to the passenger.

Recently the New Brunswick Telephone Co., of St. John, N.B., which is understood to be a subsidiary company to the Bell, advanced rates considerably. On the 26th of May, Alderman MacRae, at a meeting of the Board of Works, brought up the question of telephones, and decided to recommend to the common council that a committee be appointed to secure subscribers for a term of years to a municipal system to be established by the city of St. John, with the understanding that the rate charged shall be only enough to cover interest, sinking fund, expenses and a percentage on the wear and tear.

A professor at Kieff, Russia, has invented a garment of metallic gauze for electricians, which is adequate protection against electrical currents.

Brantford city council has granted the Imperial Gas Co., of Attercliffe, the right to sell natural gas in the city for 20 years at a rate not to exceed 50 cents per 1,000 feet for power, and 90 cents for heating and lighting. The gas is to be piped 40 miles.

A charter has been secured for the Sault St. Louis Light & Power Co. to develop power from the Lachine Rapids, and at Ile Heron, Ile au Diable, and adjacent islands in the St. Lawrence, to connect Ile Heron by bridge with the north and south shores and Ile au Diable with the south shore, to manufacture calcium carbide and to operate vessels. The capital is one million dollars and the headquarters in Montreal.

Industrial Notes.

Tin plate works are projected at Berlin, Ont., to employ 50 hands, if a loan of $15,000 for fifteen years is given.

The Page-Hersey Co. has spent $100,000 so far on the erection of their pipe mill at Guelph, and now claims the first instalment of the bonus. They employ over 100 men.

The Lunkenheimer Company, Cincinnati, Ohio, report that on account of the unprecedented demand for their brass and iron steam specialties, they have been compelled to increase their foundry output 50 per cent. Machine tools of the most improved type are being installed in various departments as fast as they can be obtained.

The Snowball Wagon Works, of St. George, have been purchased by the Hamburg-American Wagon Company, of New Hamburg, Ont., and a new factory has been erected, three stories high and 200 feet long. The New Hamburg Brass Works has also erected a three-story brick building, and gives employment to 60 hands.

The J. Stevens Arms & Tool Co., of Chicopee Falls, Mass., have added a new line of double barrel guns having a twist barrel, and being listed at $27.50; also a new gun with Damascus barrel, listed at $30. Both these guns will be ready next month. This company's single barrel guns are also being made with twist barrels.

A heating and ventilating outfit, recently furnished by the E. F. Sturtevant Co., consists of a steel-plate exhauster, direct-connected to a horizontal, side-crank engine. The exhauster draws air from out-of-doors through a large steam heater built up in sections of 1-in. pipe, one of the sections receiving the exhaust from the fan engine.

The Toronto officers and repair shops of the Canadian Otis Elevator Co. have been removed to 74 York street. Owing to the rapid growth of this department, it has become necessary for the company to enlarge its facilities, and it has equipped this repair shop with the latest tools for handling all classes of repair work quickly and at reasonable prices. The company has also added an electrical department, under the charge of a capable superintendent, and can now take contracts for rewinding armatures, etc., and repairing any class of electrical machinery.

The Canada Paint Company, of Montreal, and Toronto, is the only company in Canada which takes the graphite and oxides from their own Canadian mines for bridge and structural work. They are prepared to supply all large corporations, direct from their works in Montreal and Toronto, with high-class painting materials, suitable for girders and all exposed structures. The Canada Paint Company export their graphite and oxides largely to the United States and to the Old Country, and assert with confidence that their paints are much superior in texture, analysis and spreading power to any yet discovered. Booklets showing the colors will be mailed upon request made to the Canada Paint Company, Limited, Montreal, mentioning the Canadian Engineer.

A by-law has been carried at Elmira, Ont., to bonus a furniture factory.

The name of the Canada Metal Milling Co. has been changed to Canada Brass Rolling Mills.

More than thirty great manufacturing companies of the United States are establishing factories in Canada.

The New Brunswick Wire Fence Co. has been granted leave to increase its capital from $9,900 to $40,000.

The Kingston Locomotive Works recently turned out three locomotives complete, for the I.C.R., inside of a week.

Thornbury, Ont., has carried the by-law to establish a gasoline engine and foundry works, only two votes being recorded against it.

McGregor, Banwell & Co. have put up a factory at Walkerton, for manufacturing wire fence. It will be operated by steam.

Building operations in Toronto have been almost at a standstill for some time, in consequence of strikes among almost all branches of the building trades.

The Canadian Skewer Co. recently shipped a carload skewers from their factory at Hespeler, to England. It contained 200 barrels, or about 10,000,000 skewers.

The Ottawa City Council will insist on lumber piles being removed outside the city, and J. R. Booth announces that in that event he will remove his extensive sawmills.

Arrangements have been concluded between the Dominion Iron & Steel Company and the Government of Nova Scotia, the city of Sydney, and the Dominion Government, whereby the steel company will receive from the first two named the bonuses offered for the establishment of a shipbuilding plant, $250,000 and $100,000, and from the latter, the bonus, $100,000, for the erection of a dry dock. The work will not be proceeded with just at present.

The Walsh Improved Double Acting Water Wheel Governor is much used where an inexpensive, but accurate regulator is needed for ordinary requirements. This regulator, is made by J. C. Wilson & Co., Glenora, Ont. Among their recent customers are Geo. Pattinson & Co., woolen manufacturers, Preston, Ont., and W. J. Sutton, Victoria, B.C.

J. C. Wilson & Co., Glenora, Ont., manufacturers of the "Little Giant" turbine and other specialties, report continued activity in all lines. The domestic trade is good, and the foreign demand shows a large increase. For the four months ending April 30th, their English representatives have sold twenty-one "Little Giants," nineteen of which were of the vertical, and two of the horizontal type of wheel.

The following new works are projected, or under way: Car works, by Portland Rolling Mills Co., N.B.——Automatic scale works, at Amherst, N.S., O. A. Nickerson.——Trunk factory and another rubber factory at Berlin, Ont.——Aluminum works at St. John and Grand Lake. N.B., Jas. Robinson and others.——Sash and door factory at Fernie, B.C., Fernie Mfg. Co.——Two new brick plants at Winnipeg, Kelly Bros. & Co., and Winnipeg Brick Co.——Shingle mill on the Capilano, near Vancouver, J. W. Doherty and Walker, of Moodyville.——Extension of Wilson Carbide works at Merritton, Ont.——Additions to the Sherwin-Williams paint works, Montreal.——Enlargements of Emerson & Fisher's and Chas. Fawcett's foundries, at Sackville, N.B.——Manufacture of stoves, by the St. John, N.B., Foundry Co.——Enlargement of the Gould Mfg. Co.'s foundry at Smith's Falls.——Rolling mill at Guelph, by the Page-Hersey Co., the only one of its kind in Canada, with puddling furnaces, etc.——Extension of the Silicate Brick works at North Sydney, C.B., for which David Rudderham, president of the company, has gone to Sweden and Germany to select additional machinery of the latest and most approved design.——Large brick-yard at Hamilton, by the Barton Building Co.——Brick and pottery works at Estevan, Assa., by an United States Co.——Steam brick making plant at Lethbridge, N.W.T.

Mr. Kirkwood, of Toronto, the owner of the Belleville rolling mills, has decided to put the plant in operation himself, and will turn out thirty tons per week. His agent has been instructed to purchase scrap-iron in all the neighboring towns.

"Power Transmission Eronomics" is the name of a twenty-page publication to be issued monthly, by the Dodge Mfg. Company, of Toronto, to give information in regard to the economical distribution of power, and while a good part of its space describes transmission machinery, manufactured by this concern, space will be given each month to matters of general interest to the manager and head of any manufacturing concern. Copies are sent free on request.

J. C. Wilson & Co., Glenora, Ont., make a specialty of mill-gearing of all kinds. With their special machines for dressing the teeth, whether of wood or iron, all gears turned out by this firm are mathematically true, and consequently run light and smoothly. Among their recent customers are the following, namely, the Canadian Col. Cotton Mills Co., the Rathbun Co., Deseronto, Ont.; the Lakefield Portland Cement Co., Lakefield, Ont.; the Canadian Portland Cement Co., Deseronto, Ont.; J. H. Mullin, Bear River, N.S.; S. Waldock, Glenville, Ont.; C. C. Brown, Danville, Que.

Marine News.

The schooner Gloriana has been wrecked near Canso, where the Tiber was lost. Fifteen of the crew were drowned.

The steamer Monteagle, from Chicago, got out of her course in Kingston harbor and ran on a shoal. She had to be lightened to get off.

The Buffalo Dredging Co., Buffalo, has begun work on an $800,000 contract. It consists of a channel 350 ft. wide and 23 feet deep in Niagara river.

Stephen & McKinnon, of Rat Portage, have been awarded the contract for two new lighthouses on Lake of the Woods at the mouth of Rainy river.

The C.P.R. will soon add another steamship to their Pacific fleet sailing between Vancouver and China and Japan. She will be similar to the three Empresses.

The new tug boat Lord Kitchener will be used as a fire boat as well, at St. John, N.B. She carries a powerful fire and wrecking pump, throwing 500 gallons a minute.

A contract has been let by the Government to the Nova Scotia Steel Co. for a weekly summer service from Pictou to Souris and the Magdalen Islands for a term of years.

The Government steamer Lady Laurier has been to Sable Island with supplies. She reports no wrecks. Many of the trees and shrubs planted there have died, but a number are growing and thriving well.

The Burrill-Johnson Iron Co., Yarmouth, N.S., is building the machinery for the steamer Westport, for a freight and passenger steamer for St. Pierre, Miquelon, and a freight steamer for J. W. Hutt, of Liverpool, N.S.

Sir A. L. Jones, head of the Elder-Dempster Company, of Liverpool, and Sir Alston Dixon, a great shipbuilder in North England, are said to be interesting themselves in a project for the erection of a steel shipbuilding plant at some port in Nova Scotia.

The steamer Turret Cape took to Kingston from Fort William 101,000 bushels of wheat, the largest single cargo that ever arrived there. She ran ashore on Four Mile Point, Lake Ontario, having mistaken the channel, but was got off by lightening her of a portion of her cargo.

The Dominion liner Kensington has made her first trip to Montreal. She is a fine twin-screw steamer of 8,669 tons, with accommodation for 240 first-class passengers, and a steerage passenger capacity of one thousand. She is fitted with large refrigerators for carrying dressed beef and other perishable cargo.

A steamer has been placed on Lake Temagami, running from the northeast corner, which will be touched by the Temiskaming Railway.

The Prince Edward Island Ferry Company, of Charlottetown, is applying for a charter. It will operate a steam ferry from Cape Traverse or Carleton Point to Cape Jourmain or Cape Tormentine.

While passing through the Narrows, at the harbor of St. John's, Nfld., the schooner Cabot caught the fluke of her anchor in the rail of another vessel and both narrowly escaped going aground, the rail being cut away just in time to free them. The accident was the result of trying to pass too close.

The new Cunard steamships now being built will be 54 feet longer than the Kaiser Wilhelm II., now the longest vessel afloat. Their displacement will be 32,000 tons, which is 6,200 tons less than the Cedric, which still remains the largest vessel in existence. Their engines will be 65,000-h.p., and their speed 25 knots.

Capt. William Leslie, of the Collins Bay Rafting Co., has applied to the Dominion Government for a bonus to keep his steamer, the Petrel, and a wrecking outfit at Cape Race, so that immediate assistance can be given to vessels that get into trouble in that locality. A wrecking station is needed in the gulf, and it is likely the request will be granted.

The wooden steamer, Simla, the largest ever built by the Calvin Co., was recently launched at Kingston, and is now getting her engines at the Polson Co.'s works, Toronto. She is 240 ft. long, 37 ft. beam and 15 ft. deep, and has a capacity of 70,000 bushels. She will carry timber between Upper Lake ports and Garden Island, and occasionally a cargo of grain.

The business of the port of Montreal has been seriously interfered with during the past month by the longshoremen's strike, which completely paralyzed the loading and unloading of vessels. The carters joined in the strike, and refused to handle goods unloaded by non-union men. The troops had to be called out to preserve order. Finally the strike was settled by mutual concessions.

A number of Cleveland parties have given an order to the Columbia Iron Works, St. Clair, Mich., for a steamer, which will be the largest on fresh water, to be ready for next spring. Her dimensions will be: Length, over all, 500 ft.; keel, 480 ft.; beam, 52 ft.; depth of hold, 30 ft., with a 6-ft. water bottom. She will be built on the 3-ft. frame space system and will have fifteen hatches, each 9 ft. long. Her motive power will consist of triple-expansion engines furnished with steam from three Scotch boilers.

The new steel steamer, Wacondah, which recently arrived from Greenock for the Ontario Steamship Navigation Co., has already had her share of misfortune. When 85 miles off Tory Island on her way out, she had to put back, eighty tons of pig iron, which formed part of her cargo, having shifted. Her engines broke down ten times, and she had to heave to several times on account of cargo having been displaced by rough weather. She took eighteen days to cross the ocean. When on her way up the St. Lawrence she struck near Farran's Point and sunk in 17 feet of water, with a lot of firebrick on board. She was raised without much difficulty and taken to Buffalo for repairs.

In order to encourage the construction of dry docks at suitable ports, the Dominion Government has raised the subsidy to 3 per cent. upon the cost of the work, which sum is payable for twenty years after the completion of the work. It is now expected that work on the proposed dock at St. John, N.B., in which G. Robertson, M.P.P. is largely interested, will be proceeded with and proposals are also being made for a dock at Halifax, N.S., one at Montreal, and another on the Pacific coast, for deep sea ships. On the Great Lakes additional dock accommodation is required, notably at Toronto and on Georgian Bay. The enlargement of the Collingwood dock is not regarded sufficient to answer the requirements of Georgian Bay. A dock is needed on Lake Superior, either at Sault Ste. Marie or Fort William.

The St. Lawrence in front of the C.P.R. yards at Prescott is being dredged to a depth of 16 feet.

A Government engineer is to report on the relative merits of the Trenton and Port Hope outlets for the Trent Valley canal.

The Canadian Transportation and Storage Company seeks incorporation to operate vessels on the Great Lakes, and to construct elevators.

The Department of Marine and Fisheries is about to establish a depot at Morrisburg for the preparation and distribution of buoys.

The SS. Carrington Head went aground in Lake St. Peter, and on investigation it was found that the buoys had got out of place.

The steamer Midland King will soon be ready to launch at Collingwood, and the new boat for the M. & St. L. Navigation Co. is also approaching completion.

The steamer Cambria, which ran in connection with the C.P.R. on the Georgian Bay, on Lake Huron and on Lake Ontario, has passed into the hands of some Americans.

The floating elevator, St. Lawrence No. 1, belonging to the Montreal Grain Elevator Co., was sunk at Montreal by running into a stone pier opposite the Rubber Works.

The Canadian grain fleet on the Upper Lakes now numbers 61 ships, 20 of which have a carrying capacity of over 100,000 bushels each. The total capacity of the fleet is 4,704,000 bushels.

The steamer Jubilee has been launched on Lake Temiskaming, after being enlarged, and is now 87 feet long, 16 feet beam, with three decks and will run 12 miles an hour. She will ply between Temiskaming and New Liskeard.

Ten thousand tons of steam coal from Japan will be landed at Vancouver within thirty days for the use of the steamships operated by the Canadian Pacific Railway. The importation of this coal is rendered necessary by the strike of the Dunsmuir miners.

The first turbine steamer intended for the service across the English Channel was recently launched at Dumbarton. A feature is the accommodation and attention that will be given to women passengers, who will have practically the whole forward end of the steamer.

The schooner Acacia recently sank at the Main Ducks, Lake Ontario, in an odd manner. She had to take shelter, and dropped her anchor in shallow water, after which she ran upon the anchor and one of the flukes knocked a hole in her. She was raised and taken to Kingston dry dock.

The Warroad Navigation Co. has been incorporated under the laws of Minnesota, to build a steamer to ply between United States ports on the Lake of the Woods and Rainy River, and to run special excursions from Winnipeg in connection with the Canadian Northern Railway.

There have been thirty regular students in attendance at the Montreal School for Navigation, and application has been made to the Government to place a training vessel in the Gulf of St. Lawrence on which those who have taken theoretical instruction during the winter can obtain such practical experience as would be necessary to pass the Government examinations. Twenty-two of the pupils signed for instruction on the vessel when ready.

The following new vessels, among others, will be engaged in the Canadian carrying trade this season: Dominion line SS. Mayflower, 13,000 tons; R. & O. steamers, Virginia and Georgina, purchased in Philadelphia, three steamers for the Inland Lakes Transportation Co., built in Great Britain; Cape Breton SS. Co. iron steamer, Baines Hawkins, 900 tons, purchased in England, to do a coasting trade in the Maritime Provinces; three new vessels of 7,000 tons each for the Manchester line; double hull ferry boat being built by W. J. Mohr at Fitzroy Harbor for the Quyon ferry.

The Stratford Gas Co. will replace its present steam electric plant, by a new one.

Mining Matters.

A summer school of mining has been opened at Sydney.

Rossland's ore shipments for 1903, up to April 16th, were over 100,000 tons.

Six carloads of feldspar were recently shipped from the mines at Verona to the United States.

Owing to the rise in the price of mica, the Sydenham district is showing considerable activity.

By an accident to the skip at the Belmont mine at Cordova, Ont., three miners fell 140 feet. One was killed and two fatally injured.

A complete new drilling oufit, valued at $16,000, has been forwarded to the Kootenay oil fields in charge of an experienced driller from Pennsylvania.

A fine gas well has been struck at Winger, not far from St. Catharines, with a flow of 1,000,000 ft. a day. It will probably be piped to St. Catharines.

Harry Oldland, of Pittsburg, has the contract for a lot of new coke ovens at Morrissey. E. Wriglesworth and F. D'Alexander will each build 125 at Michel.

It is understood the Government will take over the School of Mines, at Kingston, and make it part of the educational system of the province. It will be affiliated with Queen's.

Floods in the Yukon have carried away large quantities of pay dirt, and destroyed valuable machinery, especially on Bonanza creek. Sluicing is in progress, and the output is placed at $15,000,000, against $12,000,000 last year.

The Londonderry, N.S., Iron and Mining Co. is rebuilding furnace A at Acadia Iron Mines, and will blow it in. It will have an annual capacity of 48,000 tons of foundry iron. Furnace B will not be blown in at present.

During April, the Fairview, B.C., mines shipped 450 oz. of gold bullion, and 36 tons of concentrates. The number of stamps now running is 34, and as soon as another bleaching tank can be added to the cyanide plant, 12 more will be put in. At present 100 tons per day is being crushed.

The Cape Breton Coal & Iron Company will shortly develop their coal areas at Cariboo, Marsh and Mira Road, a few miles from Sydney. This will be a very large industry. A large quantity of machinery has been ordered, and a line of railway will be constructed into Sydney, where the shipping piers will be.

Men identified with the Granby Consolidated Mining and Smelting Company have been buying coal lands in British Columbia, to secure an unfailing supply of fuel. The mining will be done by the International Coal and Coke Company. The coal field is seven miles long, and carries nine seams, four of which have an aggregate width of 60 feet.

The Lytton Mining & Manufacturing Co. are setting up on their eighteen claims, at Lytton, B.C., dredges and other machinery, with which they will work the property which contains rich deposits of oxide of iron. The ore is said to carry gold as high as $16 to the ton, and running between 35 and 40 per cent. oxide of iron. The latter would be utilized in making paint.

Tables published in "Mineral Industry" show that the world's annual output of gold has increased 170 per cent. and that of this total the British Empire now produces 60 per cent., assuming the output of the Transvaal to be what it was at the outbreak of the war. It might be feared that gold as a standard of value would be depreciated by this increase, but the output of other metals, such as steel, copper, lead, nickel, etc., and the production and utilization of other materials, such as cement, wood, stone, brick, etc., has increased in equal ratio, so that it appears that man must still pay for his gold.

—The Dominion Motor & Machine Co. has been absorbed by the Power Accessories, Limited, and has removed to 231 King St. East, Toronto, where it is installing a modern plant for automobiles, etc.

Personal.

Jas. I. Dickey, who with his brother and the late John Neill, established and carried on the Soho foundry, Toronto, for many years, is dead.

J. W. Bowden, chief engineer of the New York Life Building, Montreal, was badly burned by an explosion of gas, caused by looking for a leak with a light.

C. E. Perry, the engineer formerly in charge of the trans-Canada surveys, has gone to Fort Simpson to take charge of the Grand Trunk-Pacific surveys there.

Sidney L. E. Rose, B.Sc., of Tamworth, a graduate of Queen's, has been appointed assistant in the electrical and mechanical departments of the Science School at Kingston.

Oscar Barnhart, a C.P.R. engineer, was killed by his train running into a landslide, near Markstag, which threw engine, mail, baggage and express cars off the track. The slide occurred at a sharp curve and the train was running at a high speed.

George L. Griffith, consulting, civil and mining engineer, 14 Bank of Hamilton Chambers, Winnipeg, Man., would like to receive for filing, reference and specification purposes, descriptive catalogues from manufacturers of machinery and special appliances.

E. Hacking, superintendent of the washery plant of the Dominion Iron & Coal Company, Port Morien, C.B., has gone to Sault Ste. Marie to take a position with the Lake Superior Consolidated Company, under C. Shields, formerly with the Dominion Co.

David Willox, a chemical manufacturer of Glasgow, and bailie of the Clyde, is on a visit to Canada. He is a strong advocate of municipal ownership of gas, water, telephone and street car franchises, and is looking into such matters in this country. He is a poet and humorous writer of some note.

A. M. Wickens, engineer at the Parliament Buildings, Toronto, has resigned to take the position of chief engineer of the Canadian Casualty & Boiler Inspection Co., a new company, which has entered the field of steam boiler insurance. Thos. Burns, second engineer, has been promoted to the vacant position, and Richard Griffith has been appointed to succeed him.

Mrs. J. L. H. Bogart, and her sisters, Misses Irene, Hilda and Wilhelmina Moore, of Kingston, have joined Capt. Bogart's survey party at Marmora, and will live in the woods for four months. Captain Bogart is in charge of a party sent out by the Bay of Quinte Railway to locate the most suitable place for a branch of that railway into the mineral country northwest of Tweed. He has assisting him F. H. Mackie, leveller; T. E. Fairlie, rodman; B. Horsey, fore picket; R. Moore and Ed. Bolger, chainmen.

Charles Brandeis has opened offices as consulting, electrical and mechanical engineer at 112 St. James St., Montreal. Mr. Brandeis was born in London, England, and graduated from the City and Guilds of London Central Institute at the age of twenty, when he was awarded the diploma and associateship of the institute. Subsequently he obtained a large experience with leading electrical companies in Continental Europe in the design and operation of electric lighting, power and railway plants. He came to the United States in 1898, and worked for a couple of years with the General Electric Co., at Schenectady, N.Y., and with the Westinghouse Electric and Mfg. Co., at Pittsburg, Pa. He came to Canada in 1900, as designing engineer to the Lachine Rapids Hydraulic & Land Co. When the latter company was recently absorbed by the Montreal Light, Heat & Power Co., he resigned in order to take up consulting engineering work. Among the works he has on hand are electric light plants for three provincial towns, and he is also interested with a number of capitalists in the development of a large water-power for manufacturing purposes.

PROFITS OF GERMAN INDUSTRIES.

The state department has issued a consular report showing the dividends paid by some of the principal industrial undertakings in Germany during 1902, as compared with 1901; most of the industries show a falling off in profits. The textile line and the porcelain and glass industry show some improvement, while the chemical industry about holds its own, and upon the whole makes a favorable showing. The average dividend paid by stock companies in the more important branches of manufacturing in 1901 was 7.98 per cent. In 1902 the same industries paid an average dividend of 6.69 per cent., or a falling off of 1.29 per cent. The following table shows the average dividends paid in 1902 and 1901 by some of the principal industries carried on by stock companies:

Description	Per cent 1902.	Per cent. 1901.
Porcelain and glass	12.98	12.93
Chemical manufacture	10.39	10.43
Mining and bl. furnace	7.73	9.66
Sugar manufacture	7.64	10.88
Brewing business	8.86	9.04
Textile industry	4.69	2.91
Machine manufacture	4.77	6.13
Electrical industry	4.13	5.92
Cement industry	4.51	5.24
Paper industry	8.76	8.76
Milling industry	1.47	3.09

It is generally believed that the turning point in the business depression in Germany has been reached, if not passed. Many corporations which had fallen into financial difficulties have been reorganized and put once more upon a stable foundation. American orders have been instrumental in reducing the surplus stock of the iron and steel companies. Building enterprises are being undertaken, and there is a demand for construction material. The number of applicants for labor at the Government employment offices has decreased. The passage of the new tariff law has removed an element of uncertainty, and, with the new commercial treaties which are being negotiated, the impression prevails that business will once more assume a normal condition. modifying influence on the conditions, but it is not likely to seriously affect the position above set forth.