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CANADIAN
ELECTRICAL NEWS
AND
STEAM ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 6.
NEW SERIES, VOL. VIII.—No. 1.
JANUARY, 1898
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CANADIAN

ELECTRICAL NEWS

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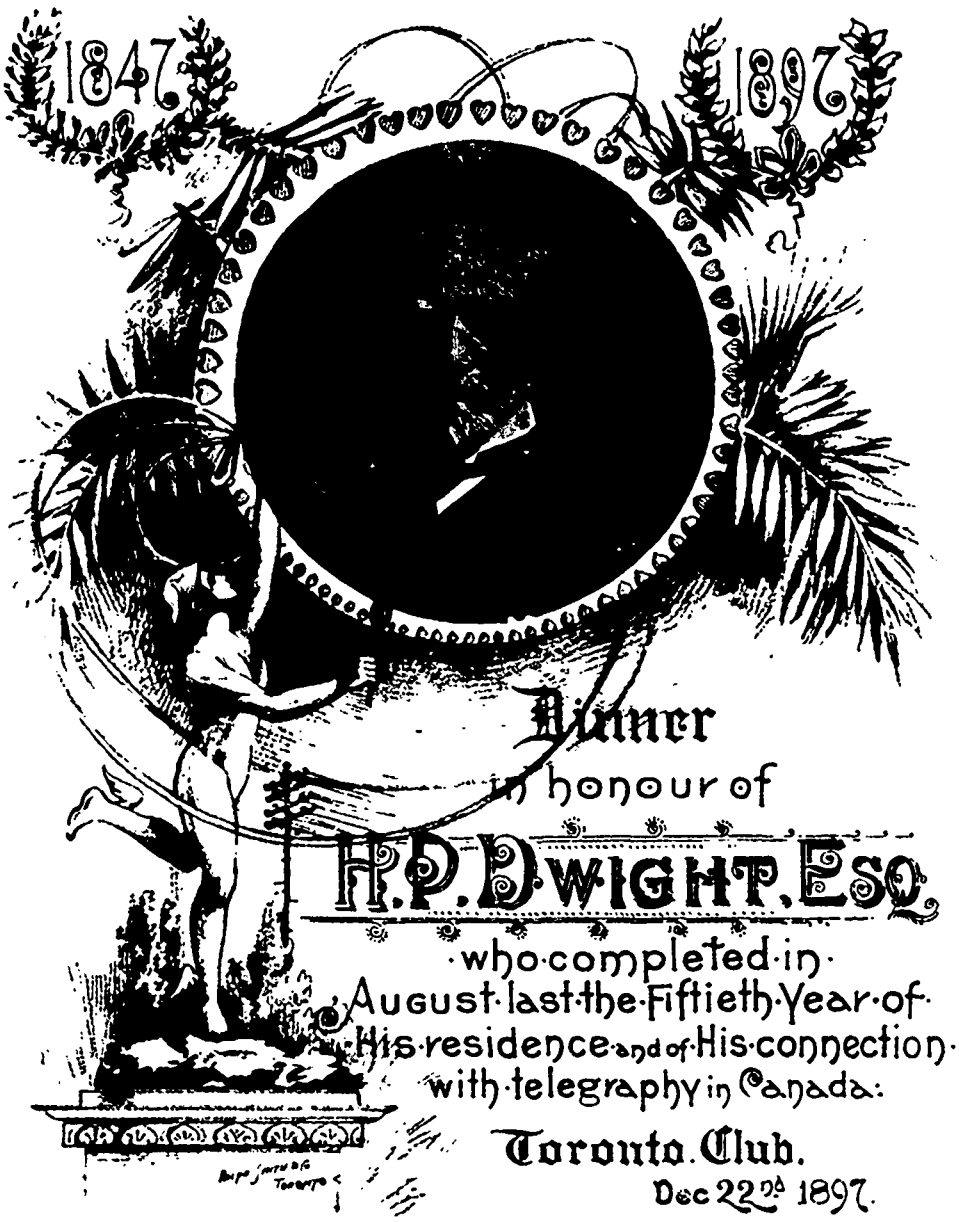
VOL. VIII. JANUARY, 1898 No. 1.

COMPLIMENTARY BANQUET TO MR. H. P. DWIGHT.

RARELY does it happen that a man spends fifty years in the service of one corporation, beginning at the bottom rung of the ladder and climbing to the top, without other assistance than natural ability and indomitable perseverance. Still less frequently is it that one occupying a semi-public position, manages to retain throughout so long a period the good will and high esteem of all his acquaintances and those with whom he is brought into business relations. Such, however, is the record achieved by Mr. H. P. Dwight, president and general manager of the Great Northwestern Telegraph Company, and veteran of the telegraph service in Canada. Notwithstanding the scriptural injunction "Beware when all men speak well of you," Mr. Dwight has cause for the highest gratification in the fact that his conduct during more than half a century has been such as to call forth a spontaneous expression of public esteem such as the complimentary banquet tendered to him by his more intimate friends at the Toronto Club on the 22nd ultimo, and the praise and good wishes from all classes of the community in which he resides.



The banquet, which was presided over by the Hon. G. A. Cox, was one of the most enjoyable and, in every particular, successful affairs of the kind ever held in the city. The character of the table decorations was calculated to remind the company that they had met to do honor not only to a gentleman of tried business aoility and manly worth, but also to one who is an ardent sportsman. In the center of the large oval table was a miniature lake in which fishes darted to and fro, and on the surface of which floated facsimiles, to a small scale, of the light birch bark canoe with which Mr. Dwight has become so intimately acquainted in connection with his yearly visits to the Muskoka and Nipissing districts for a quarter of a century past. The menu card, the front page of which is herewith reproduced, was also suggestive in this particular, on page showing an illustration of Dwight camp and its surroundings on Long Lake, Muskoka, followed from this quotation from Rudyard Kipling:

"Who hath seen the beaver busied? Who hath watched the white tail mating?
Who hath lain alone to hear the wildgoose cry?
Who hath worked the chosen water where the ouananiche is waiting,
Or the sea trouts jumping crazy for the fly?
Do you know the blackened timber, do you know that racing stream?
With the raw right-angled log-jam at the end
And the bar of sun-warmed shingle where a man may bask and dream,
To the click of shod canoe poles round the bend,
It is there that we are going with our rods and reels and traces
To a silent smoky Indian that we know;
To a couch of new pulled hemlock, with the starlight on our faces,
For the Red Gods call us out, and we must go."

The menu card, which was nicely lithographed in

two colors, also bore inscriptions such as the following:

"A sudden thought strikes me—Let us swear an eternal friendship."

"Man is the nobler growth our realms supply,
And souls are ripened in our northern sky."

The chairman eulogized the many admirable qualities of head and heart of which Mr. Dwight is the possessor, and was followed, in similar vein, by Mr. B. E. Walker, who concluded by proposing the toast to "The Guest of the Evening," at the same time placing in Mr. Dwight's hand a handsome album containing the photographs of all present, and an illuminated address which read as follows:—

DEAR MR. DWIGHT, In August, 1847, you came to Canada to enter the service of which you have been for many years the chief executive officer. Of these fifty years of continuous residence in the country of your adoption, forty-seven have been spent in Toronto.

In the course of your long connection with the telegraph system of Canada you have seen it grow from small beginnings to its present large proportions, and it has been your fortune to aid, more than any other individual, in its great development.

While seeking to honor you for your persistent devotion and signal ability in enlarging the use and extent of this wonderful machinery for diffusing information, we desire more warmly still to honor that quality of unselfishness which, while you held no public office and sought no reward, has prompted you throughout a long life to do innumerable public and private acts of usefulness and kindness. Nor can we forget that there are many persons scattered over this continent, besides those gathered here, who have long admired your energy in a great and arduous work, your steadfastness in trying circumstances, and your consistent uprightness of character throughout.

We have, therefore, invited you to be present with us to-night, in order that this small section of your host of friends may drink with you the loving cup in commemoration of an eventful year in your life, and as a token of our personal affection.

Mr. Dwight replied with deep feeling, expressing his sincere appreciation of the honor conferred upon him, after which he read a very interesting sketch of his life, in which are embodied many reminiscences of the early history of telegraphy in Canada. He said:

I was brought up on a small, stumpy, stony farm of 25 acres, a few miles south of Oswego, where my father, with such assistance as I could render him, occupied his spare time in making flour barrels for the mills at that then small village at the mouth of the Oswego river. When about 18 years of age it dawned upon my mind very forcibly that I had better get away and find some way of making a better living for myself, and with better prospects if possible than I seemed likely to ever find at home. The erection of a telegraph line had just been completed between Oswego and Syracuse, and I made application and obtained permission to enter the Oswego office, in order to learn the business of an operator. I had heard about this time that a telegraph line was being built by the Montreal Telegraph Company in Canada, where I thought I might get employment. After ascertaining the name of the superintendent, Mr. O. S. Wood, I wrote to him applying for employment, and received a prompt reply, in which he asked me to report myself as soon as I was able to manage a small office, which in due course I did. I came over from Oswego to Kingston on the 27th of August, 1847, where I met Mr. Wood by appointment, and proceeded with him on the same day to Belleville, for the purpose of opening an office there, on the line which had been erected during that season between Quebec and Toronto, a distance of 500 miles, on which some 12 or 15 offices were being opened. Mr. Wood, I might mention, was the first pupil of Prof. Morse, the inventor of the Morse system of telegraphy, and one of his most intimate friends. We took instruments along with us, and opened the office in Belleville the following day, where I was left in charge, and where I performed the duties of both operator and messenger and remained for a couple of months. At the end of that time I was ordered to Montreal, to take my place in that office as an operator. In these early days, I may tell you, a telegraph operator was looked upon as of some importance, and the telegraph office as a decided curiosity.

EARLY ACQUAINTANCES.

During my stay in Belleville I became acquainted with Mr. John Ross, now Hon. John Ross, Mr. William Darling, and Mr. Mackenzie Bowell, the young editor of the Belleville Intelligencer, now Sir Mackenzie Bowell. A few months ago I received a letter from Sir Mackenzie in which he wrote as follows: 'Seeing your name reminds me of the time about 50 years ago when you were a telegraph operator in Belleville, when you one day read off from the instrument, while I copied down, the first telegraph news despatch ever sent over the wires, and which I printed in my little newspaper.'

I took my place as operator in the Montreal office, and remained there until the spring of 1850. While acting as operator I also acted occasionally as messenger, batteryman, line repairer, and, in fact, did everything more or less that was necessary to be done in connection with the business of the office. During the time I was in Montreal our staff consisted of four or five persons, Mr. Wood, our superintendent, myself as chief operator (and sometimes the only one), one or two clerks, and one messenger, a faithful old soldier, who delivered messages with a good deal more reliability than speed.

I remember well being terrified and almost paralyzed one day when the clerk from the outer office came rushing into the operating room in an excited manner, to tell me that Lord and Lady Elgin had called to see the working of the telegraph, and almost before I knew it they were both beside me as I was sending a message over the line. They were accompanied by Lady Alice Lampton and Lord Mark Kerr. Mr. Wood, our superintendent, soon came in, and relieved me from the duty of explaining to the distinguished party the working of the instruments.

The Postoffice Department, at the time I was in Montreal, was in charge of the English government, and the Postmaster-General, Mr. Stayner, was stationed in Montreal, as I have special occasion to remember. A mail steamer was one day reported from below in a message addressed to Mr. Stayner. Knowing that this news was being anxiously looked for, and on discovering that our only messenger was out on his rounds, I put on my cap and ran to the postoffice, a short distance up St. James street, without waiting to put the message in an envelope, and delivered it in breathless haste to the great man personally. Instead of receiving thanks, however, for my zeal, I was treated to the severest kind of reprimand for the liberty I had taken in delivering the message in such an informal manner. It is needless to say I never repeated the offence.

REMOVED TO TORONTO.

In the spring of 1850 I was sent to Toronto to take charge of the company's business here, and to be in a position to recommend such extensions in the province of Ontario as might seem desirable. During my first year in Toronto I sent and received myself on the instruments every message which passed over the line to and from this point. These messages were delivered by one small, freckle-faced Scotch boy, with a plentiful growth of hair on his head, named Robert Easson. I remember well how he ran with his messages as if his very life depended upon it. That boy is now in charge of our Press News Department, and is here to-night. You will notice that he has scarcely a particle of hair on his head.

I had not been long in Toronto before I began to suggest to the head office various extensions of our lines; and as these suggestions were almost invariably adopted, I grew bolder and more reckless, until the head office began to get nervous and frightened. It was finally concluded, however, and I was notified by Mr. Wood, our superintendent, that I should have carte blanche to do as I liked, it only being required that I should give notice each winter of what lines I proposed to build during the ensuing season. During the following years arrangements were made for building a line along the Great Western Railway, and from time to time other railways, as they were projected and built in Ontario, such as the Port Dover & Lake Huron, the Toronto & Nipissing, the Northern, North Simcoe, Port Hope, Peterboro & Lindsay, the Midland, Grand Junction, Victoria, Hamilton & Lake Erie, the Hamilton & Northwestern, the Lake Simcoe Junction, Welland, Whitby & Port Perry, the Victoria, the Toronto, Grey & Bruce, etc. Not only did we arrange to build lines along these different railways, most of which were afterwards consolidated with the Great Western, and the Great Western and finally all the others with the Grand Trunk, but we also covered all the principal highways in the province. I remember well an occasion when a rather sarcastic enquiry came

from the secretary of the Montreal Telegraph Company, as to whether I had found any more saw mills to which I proposed to extend the lines. The policy of extension adopted, however, turned out to be a fortunate one, and to-day the map of wires covering the country looks like a thickly woven spider's web, through which a fly could scarcely escape. There is hardly a town or village of the least importance in the country which is not included in this net work of lines, to say nothing of the present telephone system, so that instantaneous electrical communication is almost within the reach of every man's door.

I trust it may be considered a pardonable pride on my part that I have had something to do with the extension of an enterprise which has done so much towards facilitating the business and promoting the happiness of the Dominion and the world generally, and I have always esteemed it a matter for thankfulness that my attention was turned at an early time in this direction.

When I commenced my career as an operator there were only two railways in the country, a short line of nine miles between Montreal and Lachine and the other between Laprairie and St. Johns. There was not a mile of railroad in Ontario or any other part of the Dominion, and, as illustrative of how one enterprise may help another, it may be said that railway traffic is enormously increased by the assistance rendered by the telegraph in facilitating the movement of trains.

FROM HIGH TO LOW RATES.

The tariff on messages in the early days was reckoned in Halifax currency, not dollars and cents as now. On any extensions of the lines in any direction a small additional rate was charged on through messages, until finally, after a great many extensions had been made, the tariff became a complicated affair; charges ranging from 1s 3d to 5s or 6s, and it became a question for careful consideration as to how so complicated a scale might be simplified. My advice was asked for in the matter, and I procured statements from all the different offices showing the exact number of messages handled under the different rates. From these statements it was discovered that over 90 per cent. of the messages sent were under the lower rate, and, consequently, between offices nearest to one another. I submitted a report to show that the difference between these high rates and a uniform rate of 25 cents would involve no great loss to the company, even if there were no increase in the number of messages, while it would appear to the public a very great concession, and recommended that the uniform rate should be adopted, which was done. The consequence was that business soon began to increase between remoter points on the line, and the policy proved satisfactory to all concerned.

You are all well acquainted with the extraordinary development in the application of electricity, as shown in the telephone, electric railway, fire alarm systems, transmission of power, and in other directions. It has been a common saying ever since I entered the business that electrical development was only in its infancy, and, notwithstanding all that has taken place, I am still convinced that the saying is almost as true to-day as it ever was. Great as the development has been in the past, there is a vast field in the future yet to be occupied. Not only will every water fall and rapid be utilized for the production of electrical energy, but the force in every gale of wind will be called into use for the same purpose. Electric or trolley lines of railway will be extended over all the principal highways of the country, and all steam railways will be run by electric power. Our houses will not only be lighted, but heated, by electricity, and we shall require no more coal in our houses for any purpose. Horses will largely disappear, and we shall have better and cleaner streets. Tall and smoky chimneys will disappear. Every farmer will have an electric motor for use in his work of various kinds, and this wonderful energy will be conveniently available in cities and towns everywhere throughout the country for any and every purpose under the sun where power is required.

MANY INGENIOUS IMPROVEMENTS.

Our system of telegraphs is in some respects precisely the same as when I learnt the busines fifty years ago, but there have been many ingenious improvements made in the instruments and in the use of the wires. One of these improvements is what is known as the quadruplex system—that is, the use of one wire between two terminal points, Toronto and Montreal, for instance, made to answer the purpose of four—one real wire, three phantom wires. Four operators do duty at each end of the line, and work independently, precisely as if there were four separate wires. Before this method of using the wires was discovered such a thing would have seemed as impossible as it would now to make a single railroad track answer the purpose of four independent lines. Successful experiments have recently been made in sending messages for a considerable distance without any wires at all. These electrical matters are full of wonders. I never get into a trolley car but I think of how wonderful a thing it is that by mere contact with a slender overhead wire the power of 40 horses can be brought into the motor, as well as current that can be utilized to heat and light the car. It is a wonderful thing that a slender wire strung about the city should be made to burst out into a thousand brilliant lights at different points wherever required by the simple insertion of a certain amount of resistance to the flow of current at given points on the wire. It is a marvelous thing that by speaking into a simple little instrument, which contains a small metal disc, which corresponds to the drum of the human ear, our voices can be carried for 100 or 500 miles, and recognized by our friends at the other end of the wire, as distinctly as if we were together in the same room. These and other electrical developments are wonders which no man can explain. Can you wonder that such a business should be of sufficient interest to keep me in connection with it for 50 years? If I were to fall heir to a million dollars to-morrow I would ask leave of absence from my work long enough to visit Egypt, but only on the condition that I might return to my work again, and continue in it as long as possible. While the business with which I am connected has had its worries and anxieties, as well as other business has, its still retains for me its attraction, and I hope to be allowed to take an active part in it as long as I am able to be of any use or service.

It has been one of the pleasures of my later years to know that so many operators who learned their business upon our Canadian lines are now filling important positions with other companies. Upon taking a trip over the line of the C. P. R. to British Columbia, in company with my friend, Mr. Fred Nicholls, and returning over the Union Pacific, at many of the stations along the route, both coming and going, in British Columbia and the United States, I was constantly accosted by operators, station masters and others, who reminded me that they were once operators on our Canadian lines, and had kindly recollections of their Canadian associates. I have reason to know, for I have often been told, that Canadian operators are looked upon most favorably by their employers in the United States. During the American War some of the most expert field operators were Canadians, and the celebrated Southern Raider, Morgan, had on his staff an operator named Ellsworth, who became celebrated during the war, and who learnt his business in our Whitby office.

The Canadian General Electric Company have recently shipped to the Canadian Pacific Railway, for lighting their construction shops at Fort McLeod, N.W.T., a 400 light incandescent plant, from which constant potential arc lamps will also be operated.

A company from Bellechasse, Que., have asked for letters-patent, under the name of the Ste. Philomene Telephone Company. They will place telephones in the counties of Bellechase, Montmagny and Dorchester, with headquarters at St. Raphael, and a capital of $1,500.

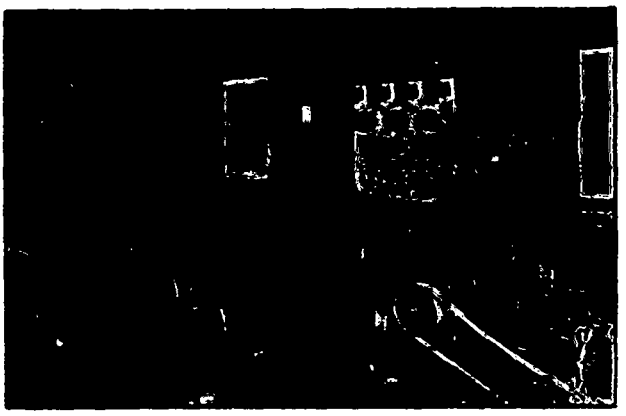
Friends of Mr. J. A. Kammerer, manager of the Toronto branch of the Royal Electric Company, will regret to learn that one week ago he was stricken with typhoid fever. Although the critical point has, perhaps, not yet been reached, it is hoped his constitution will prove sufficiently strong to overcome the disease, and that he may soon be restored to convalescency.

A comparative statement of earnings of the Montreal Street Railway shows the earnings for December last to have been $113,128.91, as against $103,116.02 in 1897, an increase of $10,012.89. The total earnings for the first three months of the fiscal year, viz., October, November and December, were $340,351.60, as against $313,44.97, an increase for the three months of $27,306.63.

The Guelph Light & Power Company have decided to replace their arc lighting machinery for supplying the street circuits with the latest and most approved machinery for the purpose, and have placed an order with the Canadian General Electric Company for an 80 light Brush arc machine, equipped with automatic regulator. These large Brush machines, of which eight, having a capacity of 125 lights each, have been purchased by the Toronto Electric Light Company, four of the same size by the Montmorency Company of Quebec, and four for direct connection to synchronous motors by the Lachine Rapids Hydraulic & Land Company, represent the successful development of arc lighting machinery along the lines which have been established as approved practice in direct current and alternating work.

THE GRAVENHURST LIGHTING PLANT.

THE town of Gravenhurst, situated at the south end of the Muskoka Lakes and a divisional point on the line of the Grand Trunk Railway, with its population of about 2,500, and its celebrated hospital for the cure of pulmonary diseases, since the fall of 1892 has enjoyed the benefits of electric lighting, having its streets illuminated by arc lights and its stores and residences by incandescent lights. The first electric light plant, installed by the Gravenhurst Electric & Trading Co., and situated in a lumber mill at the lakes, was operated with indifferent success until about a year ago, when it was purchased by Mr. E. Fletcher, who formed the Gravenhurst Electric Light & Power Company.



GRAVENHURST LIGHTING PLANT—VIEW OF GENERATORS.

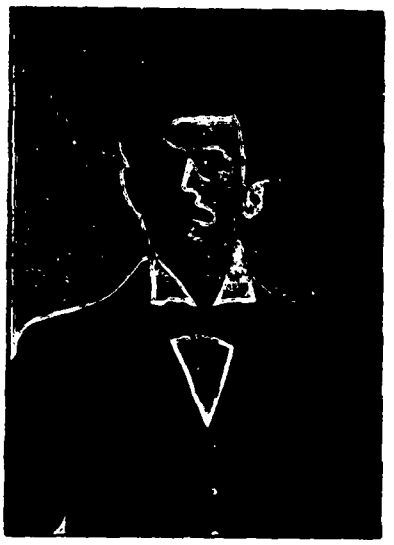
The new company built a power house on the shores of Lake Gull, closer to the town, and with easy access to wood and water. The station is a substantial brick structure, and almost fire-proof. The new steam plant, of which a view is given, consists of a Wheelock engine of 150 h.p. and a boiler of the same size, both purchased from the Goldie & McCulloch Co., of Galt. This slow-speed simple condensing engine and boiler of the ordinary tubular flue style has proved to be an eminently efficient combination, and one with which the company is well satisfied.

Upon taking possession of the business, it was decided by the new company to remodel the entire old plant. The primary wiring was overhauled, and the secondary system changed from 52 to 104 volts, substituting throughout Stanley transformers for those of the old type. In the station the old single-phase alternator of the revolving wire-wound type was replaced with a 50 k.w. S.K.C. two-phase generator, and the T.H. arc system, which had given the old company good results, was kept in service.

GRAVENHURST LIGHTING PLANT - VIEW OF ENGINE ROOM.

The new plant was started about fifteen months ago, and from that day until the present time Gravenhurst has not been without light for street or indoor purposes. The company have now upon their system over 1,100 incandescent lights and 16 arc lamps, and Mr. Fletcher's management has proved a success both from an operating and financial standpoint.

The corporation of the town of Gravenhurst will in January next submit a by-law to the ratepayers asking for $9,000 to purchase the electric lighting system and $25,000 for a new waterworks system.



MR. E. FLETCHER,
Manager Gravenhurst Electric Light and Power Company

SAMPLES OF SCALE AND FEED WATER WANTED.

MR. Wm. Thompson has in course of preparation for this journal a series of articles on "Corrosive and Scale Forming Agents in Boiler Feed Waters." To make these articles of special value to our readers, Mr. Thompson wishes to receive from responsible steam users in all parts of the Dominion samples of scale and feed water, accompanied by as full particulars as possible. It is Mr. Thompson's intention to make complete analysis of the various samples, using them as practical illustrations of the formation of scale through various sources. These samples should be addressed to Mr. Thompson at Montreal West, Que.

THE TORONTO ELECTRIC LIGHT COMPANY'S ALTERNATING PLANT.

THE Toronto Electric Light Company are now installing in their new station four 200 kilowatt, 60 cycle single phase alternators of the Canadian General Electric Conpany's latest type. These machines are of the iron-clad armature type, and embody the most recent improvements in the design and manufacture of alternating generators for lighting service. They will be belt driven from the large vertical engines recently installed for the company by John Inglis & Sons, each engine driving a pair of alternators and a 450 kilowatt direct current generator.

The plant of the Phelps Machine Co., of Eastman, Que., has been bought out by the Jenckes Machine Co., of Sherbrooke, who will continue the manufacture of the Dake engine in their Sherbrooke works.

THE STEAM ENGINE GOVERNOR AND ITS REGULATION.*

THE matter of governing steam engines for a uniform speed under the greatest variation of load and steam pressure, and the economy in the use of steam, is no doubt one of the principal features in steam engineering, and I believe the same is absorbing more thought and receiving more attention from the engineer and engine builder than any other adjunct of the steam engine to-day. I will endeavor to point out the fundamental principle upon which the governor acts, and why it acts. There are two conditions of principle, one known as the centrifugal and the other inertia action. The ordinary centrifugal fly ball governor consists principally of a pair of cast iron balls or weights suspended on an arm and at an angle of about thirty degrees from its vertical axis, and made to revolve round its axis as free as possible, generally driven by a pair of mitre gears. This principle of fly ball or centrifugal governor was embodied in the first governor invented by James Watt, which has been more resorted to than any other, but aside from this the governor has been so improved, altered and reconstructed since its time as to be almost unrecognizable. Still the old principle is there, as well as nearly all, if not all, the prominent defects which so materially interferes with its efficiency. The three principal defects are: 1st, friction; 2nd, unbalanced force, caused by the different position of the levers and arms; 3rd, unequal resistance offered to counteract the centrifugal force.

Now, we will take the first, friction. It may be said it has been fairly well overcome for the most practical purposes, so far as the builders are concerned; but much depends on the engineer, as it is his place to see that no excess friction is allowed through improper lubrication of the working parts, poorly packed valve stems, etc.

Then the second is unbalanced force. This defect appears to be much more difficult to overcome and is certainly a greater detriment to the action of the governor. Like other parts of the steam engine, some governors are designed much worse than others in this respect, but the best of them are a long way from being perfect, and the reason may be explained in this way: Suppose, we take, for example, the ordinary centrifugal fly ball governor, and assume that the balls are travelling round in their normal plane, and that the arms are at an angle of 45 degrees and travelling through the path of a 12 circle. The engine is now running 100 revolutions per minute, and the mean effective pressure is 40 pounds. So long as these conditions are left that way, and there is no change in the load, the speed of the engine will be most perfect. But we cannot maintain this, so we will suppose the first change to be that the steam pressure shown by the gauge is allowed to increase. Now, then, the mean effective pressure becomes greater and the engine begins to move faster, and the governor in turn; now there has been a change. The balls have moved to a higher and wider plane. This change simply means that the line of force has become closer to right angles with the vertical axis of the governor, therefore travelling through a greater radius, and the line through the point of gravitation has become farther away from the fulcrum, therefore the speed has to be increased to overcome the increased weight of gravity, caused by the change of angularity, and so the engine continues to increase in speed until enough momentum has been stored to balance the balls in their new position. Therefore it is quite consistent that the force that will support the balls in one plane will not support them in a higher one. Consequently the speed of the engine must vary when controlled by such a governor.

The third was said to be unequal resistance offered to counteract the centrifugal force. This is sometimes applied by a lever and ball and sometimes by a spring. Where the ball is used we still have the same trouble as in the second fault, namely, angularity, and where the spring is used, it is much worse than the ball, because the tension of the spring increases as the spring is drawn out. For example, if we have a spring attached, and offered 20 lbs. resistence when it was drawn out say one inch. Supposing now that part of the load was thrown off, the balls would then have to be speeded up to a higher plane, say enough to cause the springs being drawn out another inch; then the spring would be holding 40 lbs. and of course the balls would have to be speeded fast enough to support this extra 20 lbs. Possibly this might mean two or three revolutions faster for the engine.

The object of applying resistence to the governor may be said to have two purposes: First, to assist the gravitation of the balls when coming to a lower plane, and, second, to permit the changing of the speed of the engine by adjusting the ball or spring until the required speed is maintained.

This resistance, however, has been made automatically adjustable by several inventors in the last few years. This has bettered matters considerably, but still the speed of the engine must change before the attachments are caused to act. So, as it is, the engine has first felt the change of load, causing it to slow up in speed, then the governor feels the change, which in turn causes the attachment to act, therefore it is just a little too late in acting, as the speed has already slowed up, but if the governor had felt the change before the engine, then things would have been different; and so it is with the centrifugal governor that the momentum has to be increased to act one way, and decreased to act the other way. Now, I will leave the centrifugal governor and take up the other principal of governor called inertia. As it would make this paper very lengthy to go fully into this, I will only endeavor to touch on a few principal points.

First, we will suppose this to be connected as a shaft governor. The principal part of this apparatus consists of one straight arm with a fixed weight on each end, and pivoted in the centre to a fixed point of the wheel near the centre of the shaft, thus allowing the balls to move in a rotating direction only, and always in the same plane, thereby doing away with the troublesome change of angles as well as the use of the centrifugal action; there is a spring attached to the arm about the centre of its radius and the other end to the rim of the pulley which surrounds the governor. This spring is used to offer resistance to the acting energy of the rotating weights, and also to assist the momentum in opening the valve. It will be seen that when this apparatus is put in motion the pulley and engine will gradually advance ahead of the suspended weights and continue on so until the valve is adjusted to the proper cut-off to balance the load, and when any extra load is felt by the engine the weights will continue to go on in advance of the engine, thereby increasing the travel of the valve and permitting a later cut-off. So with this apparatus there is no reversing of motion before the governor responds.

* Paper read by Mr. F. G. Mitchell, president Ontario Association of Stationary Engineers, before the Hamilton branch, C A S.E., December 28th, 1897.

ERRATUM.

In the paper on the "Indicator" read by Mr. Wickens and published in our last number, two errors occurred. The last sentence of the paragraph ending nearly the centre of the second column should read as follows: "The height of the diagram at the first point of measurement is $\frac{1}{8}$ less than two inches, and represents 77 lbs.; the second is exactly 2 inches, representing 80 lbs.; 3rd, 80 lbs.; 4th, 57 lbs.; 5th, 41½ lbs.; 6th, 34½ lbs.; 7th, 27 lbs.; 8th, 20 lbs.; 9th, 16 lbs.; 10th, 13 lbs., making a total of 446." In the eighth line from the end, the words "piston across head" should read "piston and cross head."

ENJOYS IT VERY MUCH.

MR. Geo. W. Vincent, of Acton, Ont., in remitting his subscription to the ELECTRICAL NEWS, writes: "I enjoy the paper very much, and hope to continue taking it.

The board of directors of the Hull Electric Company have appointed Mr. W. R. Taylor as secretary-treasurer.

A meeting was held at Bobcaygeon, Ont., to consider the question of building an electric railway connecting Fenelon Falls, Bobcaygeon and Peterboro'. A committee was named to obtain particulars and report. Mr. W. J. Read is acting secretary.

Special illustrated articles in the January Cosmopolitan are: "The Real Klondike," by J. S. Easby-Smith; "The Great and Small of Family Trees," by A. L. Benedict; "An Island on the Georgia Coast," by John R. Van Wormer; and "Some Society Tableaux," by M. E. W. Sherwood.

Mr. A. Drouin has been appointed engineer at the city hall, Montreal, to succeed Mr. Felix Decarrie. The following persons were applicants for the position: J. O. Joly, Thomas McHugh, E. J. Hatton, N. E. Barsalou, William Morrow, A. Drouin, Alph. G. Lapointe, S. Richard, M. E. Bellevance. Mr. Drouin has been in the service of the corporation for eight years and is attached at No. 10 station. He has a certificate of inspector of boilers and was formerly attached to the steamer Miramichi. For five years he has been president of the French section of the Stationary Engineers. The present assistant, William Morrow, has been permanently appointed on the staff.

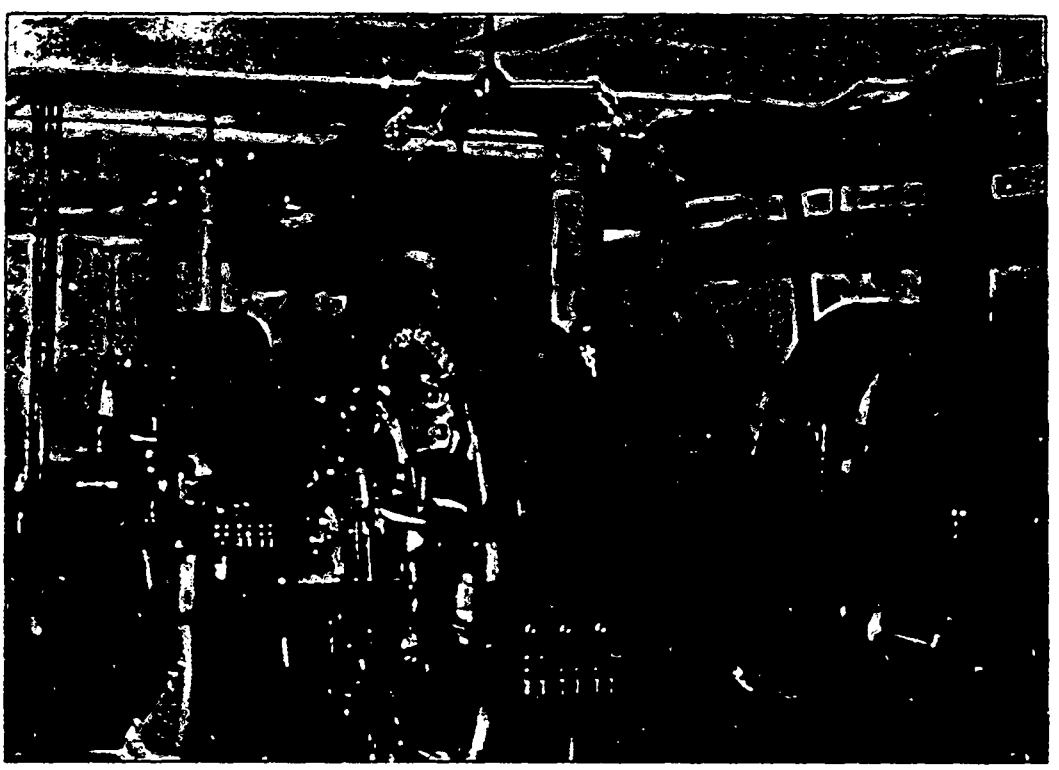
STEAM AND ELECTRIC PLANT AT THE FORESTERS' TEMPLE.

Perhaps the largest isolated lighting plant yet installed in an office building in this country has recently been completed at the new Foresters' Temple, corner Bay and Richmond streets, Toronto. This building is one of the most modern in Canada, is ten stories in height, with a frontage of 96 feet on Bay street and 132 feet on Richmond street. In keeping with the general high-class character of the building is the steam and electric plant, an inspection of which was made by a representative of the Electrical News. The general arrangement of the plant is such as to insure the greatest convenience and economy of operation, the apparatus being of the most improved type and reflecting credit alike upon the owners, architect and contractors. From a brief outline of the installation some points of interest and instruction may be gathered.

The boiler room, located in the southern portion of the basement and beneath the Richmond street sidewalk, is oblong in shape, being about sixteen feet wide and extending nearly the total length of the frontage, some 130 feet. Luxfer prisms in the sidewalk provide the required light, thus removing the necessity of artificial lighting. The battery consists of two Heine boilers of 120 horse power each, manufactured by the Canadian Heine Boiler Company. Instead of being placed side by side as is usually the case, these boilers are set in line, the arrangement bringing the fuel door of each boiler in close proximity to the coal bunkers, of which there are two, one at each end of the boiler room. The boilers are guaranteed at 50 per cent. above rated capacity, and are fitted with two Jones' Underfeed Mechanical Stokers, built by the Weeks-Eldred Company. In connection with these stokers is one of McDonough's electric damper and pressure regulators, working on a quick opening valve on steam line, connected to a six horse power engine driving a No. 7 Sturtevant fan forcing air into the furnace, and so arranged that when steam is at 90 lbs. the engine is cut down and simply kept moving by a by-pass. This device simply permits sufficient steam to enter to keep the engine off the centre. The Sturtevant fan and 6 h. p. engine was also supplied by the Weeks-Eldred Company. The belt connecting same, furnished by the A. R. Williams Machinery Co., is laced with wire, making it appear endless. The fan also draws air from the boiler room, ventilating this room and supplying the furnace with air.

Coal screenings are used for fuel. These are unloaded direct from the wagon to the storing bins and conveyed to the furnaces by means of a trolley, the track extending from one end of the boiler room to the other, with switches, Mr. R. L. McIntyre, of Toronto, being the builder. An hydraulic hoist provides a convenient means of disposing of the ashes. This hoist can be drawn about 3 feet 6 inches above the sidewalk, thus placing it on a level with the wagon and rendering loading and unloading comparatively easy.

Passing to the generating room, 50 × 32 feet in size, with concrete floor, we first reach the electric generators and engines, the contract for which was completed in a highly satisfactory manner by the W. A. Johnson Electric Company, of Toronto. Three direct current 50 kilowatt Walker generators, for which the above company are Canadian representatives, are direct connected to "Ideal" engines, 12 × 12, the latter manufactured by the Goldie & McCulloch Company, of Galt. One of these generators is wound for 250 volts, is running at 275 revolutions per minute, and is supplying current for motors and electric elevators. The motors drive the fans for ventilating purposes, and will also be required for other power service. The other two generators are wound for 125 volts, and are furnishing current for electric lighting throughout the building, which is wired for a capacity of 2,800 16 c. p. lights. In addition to these generators there is a motor generator of 80 lights capacity, built at the works of the W. A. Johnson Electric Co. This machine takes current from the power generator and supplies lighting during the day-time. This portion of the installation has many points of merit, the



Electric Light Plant, Foresters' Temple, Toronto.—View of Generators.

three direct connected generators only occupying a space of about 12 by 33 feet. The economy in space by means of the direct connected generators is a great consideration in plants of this character, and should result in the almost universal adoption of this type of machine. The running of the engines and dynamos is practically noiseless, and not a spark can be seen on the generators. They are also perfectly dry, and persons can place their hands on any part without feeling the least current. The carbon brushes are provided with a new patent brush holder, which permits of proper regulation in a simple manner. No adjustment of brush swivel is necessary for changes of load on dynamos. The above machines have a greater capacity than those of any other isolated plant in an office building in Canada.

The switchboard and wiring were contracted for by the Bennett & Wright Company, and are most complete. The switchboard is arranged so that the entire lighting and power service in the building will be controlled by the switches mounted thereon. It is constructed of white Italian marble on an iron frame, 15 feet 0 inches in length by 7 feet high. The board is set 2 feet 6 inches out from the wall, and all connections made at the rear. There are seven panels in all, six being provided for switches and a seventh for pressure gauges, pneumatic clock and Paul system jets. Of the six panels referred to three are provided for the generator, each having double pole main switch, field rheostat and Weston volt and ammeter. One panel has the four power service switches for elevators and other motors, and two double throw main switches, by means of which the entire lighting and power service may be thrown instantly from the generators before mentioned to the Toronto Incandescent Company's service, or vice versa. The other two panels contain the lighting service switches for the building, of which there are thirty-six. All the switches except for equalizer are double pole and have fuse terminals.

The wiring throughout the building is most secure, Habershaw wire in iron-armoured conduits having been used. The wires are continuous and always accessible, and can be drawn out and replaced at any time. The distributing circuits throughout are connected to slate tablet boards, no porcelain cut-outs being used.

Next we come to two boiler feed duplex pumps, 7½ × 4½ × 10, made by the Northey Mfg. Company. An Excelsior feed water heater, purifier, filter and oil separator is located near these pumps, and is a device especially worthy of mention. It is manufactured by the Excelsior Heater Company, of Chicago, and was installed by the Bennett & Wright Company. A few words of explanation may here be required, as it is claimed that this is only the second machine of the kind to be introduced in Canada, the other one being in the new municipal buildings in Toronto. The building is heated by the exhaust steam from the engines by the one pipe overhead system. When the steam reaches the separator, all the oil and grease is exhausted therefrom, and it passes to the heating mains and is supplemented through a pressure reducing valve with live steam as required. The condensed water returns to the heater, is pumped back to boilers and used over again. By this arrangement it is possible to exhaust into the heating system or direct into the atmosphere. The pumps work automatically by float attached to quick-opening valve.

Another interesting feature of the plant is a duplex air pump, made by the Johnson Electric Service Company, of Milwaukee, its purpose being to pump air to control the diaphram air in the radiators. There is also a water plunger pump for same purpose, to be used as an auxiliary, and two air storage tanks in connection therewith attached to the ceiling. The steam pump works automatically by a governor. To provide ample fire protection is an underwriters' fire pump, 14 × 7 × 12, built by the Northey Mfg. Co., and of a capacity of 500 gallons per minute at a pressure of 250 pounds to the square inch. A twelve-ton ice machine built by the Buffalo Refrigerator Co., and used for cooling air for ventilating purposes, a Tobey water heater supplying hot water to all lavatories throughout the building, and a Westinghouse air pump for operating the pneumatic gates on elevator enclosures, are other interesting features of the plant. These pneumatic gates are splendid safety devices, it being impossible to open them excepting when the elevator is level with the floors, and then all that is required is to simply touch a button. In the building are three Standard elevators, which run on the low amperage of 50 amperes at full load. The easy motion in starting and stopping and the smooth running of these elevators is the subject of comment by passengers. A novel device in connection with them is an indicator, which indicates to passengers desiring to ascend or descend just where the elevator is, and whether it is going up or down.

The two boilers are connected by a four-inch pipe, and extending from this connection to the engine is a six-inch pipe. The distributing pipe for the heating system is twelve inches in diameter, and from it the various riser pipes are taken. The steam pipes are protected by mineral wool from the works of the Toronto Mineral Wool Company. The exhaust pipes are placed under the floor, with removable metal plates covering them.

Adjoining the engine room is the supply and repair department, 50 × 20 feet, well equipped with cupboards for storing electric lamps, tools and general supplies, oil tanks, pipe racks, drawers for fittings, etc. The space devoted for this purpose permits of everything being arranged in the best possible manner.

The complete electric and steam apparatus and fixtures, excepting the dynamos and engines, were contracted for by the Bennett & Wright Company, who are among the foremost experts in their line in Canada. Mr. T. F. Pickett, foreman electrician for the company, had charge of installing the electric fixtures throughout, including switchboard and wiring, and nothing more than an inspection of the work is required to convince one of its thoroughness.

Mr. G. A. Wilkie is chief engineer, and upon him devolves the duties of the mechanical superintendence of the building. In Mr. D. A. Dixon he has a valuable assistant. To these gentlemen the writer is indebted for courtesies extended while obtaining the above description.

Mr. R. Mackie has been appointed chief engineer of the new sewage disposal works at Hamilton. Mr. Mackie holds a first-class certificate, and has been engineer at the Hamilton Bridge and Tool Works, Copp Bros., and the Rolling Mills.

The Shawenegan Manufacturing Company has asked for letters-patent of incorporation, with a capital of $500,000. Its object is to develop the water power of the St. Maurice river, in the province of Quebec, for the production of calcium carbide and electricity. Among the promoters are Peter Lyall, contractor, Montreal, and Charles Riordon, paper manufacturer, St. Catharines.

CORROSIVE AND SCALE-FORMING AGENTS IN BOILER FEED WATERS.

By Wm. Thomson.

INTRODUCTION.

In introducing the above subject to the readers of the CANADIAN ELECTRICAL NEWS, I do so with a great deal of pleasure. Generally speaking, no branch of steam engineering receives less intelligent attention on the part of steam users and engineers than does this most important subject. The great importance of the subject itself is but vaguely understood, and the attention it generally receives is of a kind that in the interests of either economy, safety or science, might be very easily dispensed with.

It has been my privilege during the last few months to have handed to me samples of feed water and boiler scale from every part of this Dominion. An examination of these proves to me the great necessity of the whole subject being discussed in a thorough manner.

I do not hope to add any new scientific facts on this subject, but rather to make present well-known facts plain to my readers. For this reason I shall endeavor to confine myself to the four general headings:

1st. The presence of corrosive agents in feed waters—their nature and action on the boiler plates.

2nd. Scale-forming agents and nature of scale formed by different materials.

3rd. Combined action of scale-forming and corrosive agents.

4th. Reaction necessary to prevent the formation of scale.

This covers an immense field, and entails a lot of labor, which I cheerfully undertake for the mutual benefit of myself and fellow engineers, my only cause for regret being that a more able Canadian engineer has not seen fit to undertake the task.

I have to thank those of you who so kindly placed feed water and scale at my disposal, and sincerely hope that a perusal of these articles will amply repay you for any trouble you have taken in this respect.

Very truly yours,

THE AUTHOR.

[ARTICLE I.]

Water is universally conceded to be the greatest of all known solvents, consequently it never occurs in a state of purity as a natural supply. The foreign matter may be composed of either solids or gases, or both, and may be in suspension, mechanical or chemical solution with the water. By the term suspension is meant a state in which the foreign matter is present in the water in its original state, no matter how finely divided, and when it can be abstracted from the water by filtration, having the same properties as when it entered the water in the first place.

In boiler feed waters this usually consists of vegetable organic matter, finely divided clay, etc. The coarser and heavier the particles the sooner will they separate out and settle to the bottom of any receptacle in which water may be contained. It is possible, however, to find water with foreign matter in suspension so minutely divided that it is impossible to detect them except by slight turbidity or characteristic coloring given to the water. I have in my laboratory samples of water taken from freshly drilled artesian wells in the vicinity of Montreal, containing particles of clay held in suspension so minutely divided that it took weeks for complete settlement to take place, and the slightest movement of the containing vessels would cause particles to again rise in the water, thus causing turbidity.

Matter in mechanical or physical solution, on the other hand, has entered into combination with the water and cannot be again abstracted except by means of a change of state or evaporation. For instance, to pure, distilled water add common salt; this at once dissolves, and until water is saturated, if salt was pure, no apparent change takes place in the appearance of the water itself, and if solution was passed through the finest possible filter, salt would still remain in solution, but if we carefully evaporate off the water, salt will finally remain in its original state, no evident change having taken place.

If to pure water (H_2O) we add oxide of sodium (Na_2O), soda at once combines with the water, or part of it, with generation of heat, a chemical reaction taking place in accordance with following equation:

$$Na_2O + H_2O = 2NaOH.$$

In this case one molecule of sodium oxide enters into combination with one molecule of water to form the new chemical compound, sodium hydro-oxide, which dissolves in the excess of water present, and remains in chemical solution; and if water was evaporated off, sodium oxide would not be recovered in its original state as an oxide, but in the state of sodium hydroxide.

The reader will note the difference here. On the one hand, addition of sodium chloride to the water made no apparent change in general appearance of water to the naked eye, and no heat was evolved, and on evaporation it was again recovered in its original state, and without any change in weight. In this case salt simply entered into mechanical solution with the water, due to the solvent powers of that menstrum, and is really but a physical change. In the other case, sodium oxide first entered into chemical combination with a portion of the water (due to the chemical affinity of the one compound for the other) with evolution of heat, and excess of water present dissolved new chemical compound, which then remained in chemical solution. On evaporation solid sodium oxide would be found to have gained in weight in direct proportion with the number of molecules of water required for chemical change from the oxide to the hydroxide.

Changes of this description are constantly taking place, and it is with these we shall particularly deal at a later stage in these articles.

Not only do a great many solids dissolve in water to a greater or less extent, but many gases also dissolve very readily, and to these can be traced phenomenon occurring in some feed waters known as pitting corrosion and grooving.

The first of these may be very properly described as corrosion, occurring in small spots on parts of a boiler, and is quite distinct from general corrosion, which wastes away an extended area of surface. Pitting is both annoying and generally very destructive, in some cases burrowing holes through the affected parts of a boiler as completely as if it had been drilled. This action was formerly and is to-day occasionally attributed to poor material used in construction, the theory being that weak spots exist and are attacked by corrosive agents found in the material itself. There remains practically no doubt but that a condition of affairs of this kind existing would have an effect on the boiler parts, and would facilitate the pitting action. An explanation of this kind falls very far short of a satisfactory answer, however, in either theory or practice, as it is applicable to very few cases.

Careful experiments made by leading chemists and a review of the whole subject go to prove quite conclusively that pitting occurs most frequently when gases are found dissolved in the water, oxygen and carbonic acid gas being the most active agents, and more especially when present together. These gases under certain conditions are very soluble in water, and in examining a water for boiler feed purposes require just as careful consideration as does dissolved solid.

Atmospheric air dissolves in water very readily, and contains at all times a certain percentage of carbonic dioxide, and here a very peculiar fact is to be noted that has an important bearing on the point before us. It is a well known fact that atmospheric air is composed of nitrogen and oxygen in mechanical combination, four of nitrogen to one of oxygen by volume, or very nearly 79 volumes of nitrogen to 21 of oxygen. When atmospheric air is dissolved in water these proportions are found to have changed, said to be due to the greater solubility of oxygen in water.

It is worthy of note that water dissolves very unequal quantities of the different gases, and very unequal quantities of the SAME GAS, at different temperatures. One volume of water absorbs at the temperatures stated in the following table under atmospheric pressure equal to 30 inches of mercury, according to Bunsen, the following volumes of the different gases:

Degrees Fah.	Oxygen. (O)	Nitrogen. (N)	Hydrogen (H)	Carbon Dioxide. CO_2	Chlorine. Cl	Sulphur Dioxide. SO_2	Hydric Chloride. HCl
32°	.041	.020	.019	1.80		53.9	505
50	.033	.016	.019	1.18	2.59	36.4	472
68	.028	.014	.019	.90	2.16	27.3	441

While not altogether applicable to our point, it may be stated that as the pressure increases a correspondingly larger quantity of the gas is absorbed, and as the temperature increases the solubility of the gas decreases in many cases. (Carefully refer to table on this point.) It is, however, important to note that the pressure which determines the rate of absorption of a gas is not the general pressure to which the water or other absorbing liquid is exposed, but that pressure which the gas under consideration would exert if it were ALONE PRESENT in the space in which the absorbing liquid is in contact. It is necessary to bear this in mind to understand why atmospheric air absorbed by water differs in composition from ordinary air.

As I have said, atmospheric air consists of 79 parts of nitrogen

and 21 parts of oxygen. In atmospheric air, acting under a pressure of 30 inches of mercury or one atmosphere, the oxygen exerts a partial pressure of $\frac{21}{100}$, and the nitrogen $\frac{79}{100}$. At 50 F, according to table, one volume of water at atmospheric pressure absorbs .033 volume oxygen and .016 volume nitrogen, supposing these gases to be in a pure state. Then under the partial pressures above indicated water cannot absorb at 50° F. more than $\frac{21}{100} \times .033 = .007$ volumes of oxygen and $\frac{79}{100} \times .016 = .013$ volumes of nitrogen.

Then, in .007 + .013 = .020 volumes of atmospheric air absorbed by water there are consequently .007 oxygen and .013 nitrogen, or in 100 volumes, 35 volumes of oxygen and 65 volumes of nitrogen. Atmospheric air then dissolved in water is seen to be very much richer in oxygen than is the air itself in its ordinary condition. This fact is in itself worthy of the most careful consideration, and explains clearly what is too often considered purely accidental phenomena.

Before proceeding to discuss what action takes place during the act of pitting, I wish to digress from the subject to point out to the reader that the capacity of water to absorb gases of fixed chemicial compounds, such as carbonic dioxide (CO_2), sulphur dioxide (SO_2), and hydric chloride (HCl), must not be confounded with the behavior of atmospheric air. Thus hydric chloride must not be understood as being absorbed by water in the same proportions as its elements, hydrogen and chlorine. It is a complete gaseous chemical compound of itself, and combines as such; in other words, nitrogen and oxygen retain their own peculiar properties in atmospheric air, but just as soon as hydrogen and chlorine combine together to form hydric chloride, an entirely new chemical compound is formed, with quite different properties from the elements of which it is composed, and with entirely different degrees of solubility.

When water is strongly heated for a long time, atmospheric air is completely expelled, and at once resumes its normal composition; thus we have present a quantity of free oxygen, which is the cause of a great deal of our trouble. While the action of oxygen on iron is well understood, it is not easy to explain the action of gases producing pitting in a steam boiler, particularly to explain why isolated spots are attacked while surrounding metal remains unaffected. If we heat water gradually in a glass retort, open to the atmosphere, bubbles of gas or air expelled from the water are seen clinging to the sides and bottom; and if we purposely scratch the inner surface of the glass, or in other manner create an imperfection of a similar nature, it presents a wonderful attraction for these little bubbles, more collecting there than at any other part of the retort. And so tenaciously do these bubbles cling to their selected places that it requires considerable agitation to remove them.

In steam boilers the same conditions prevail, and there remains but little doubt that these bubbles contain free oxygen and other gases in a favorable condition to act on the metal beneath. Temperature being high, they necessarily act with a great deal of rapidity. When the oxygen has combined with the iron of the metal, protoxide of iron (FeO) is formed, and a little excresence appears on the surface of the metal, due to the expansion of the iron by the addition of oxygen, and occupying more space than the iron acted upon. Subsequent expansion and contraction causes this small excresence to burst, and leaves a small pit or *roughened surface, which readily attracts the gas bubbles, and* the process is again repeated until finally a hole has been eaten a considerable distance into or completely through the part affected.

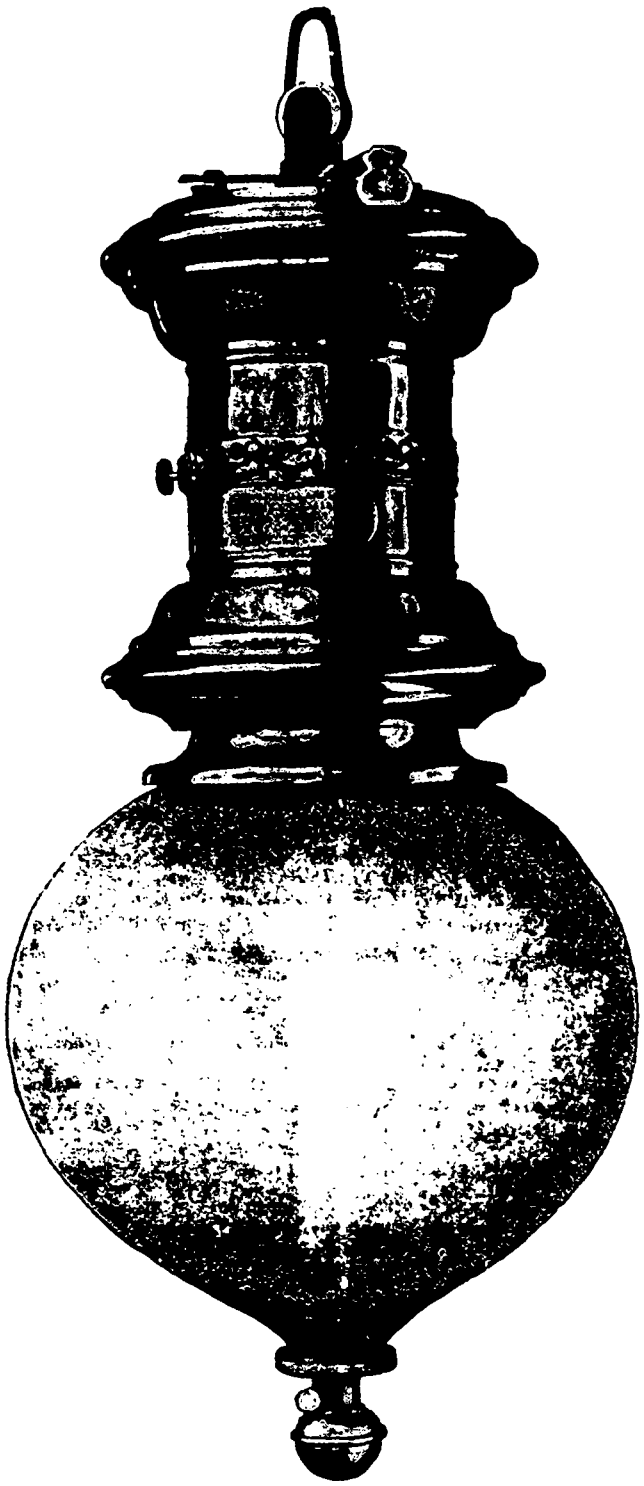
(To be Continued)

NEW ARC LAMP.

THE accompanying cut represents a new type of arc lamp recently placed on the market by the Canadian General Electric Company. This company announce that they are now prepared to furnish a satisfactory and economical arc lamp for constant potential, alternating current circuits. The problem is said to have been a difficult one to solve, but the results obtained are claimed to be such as to warrant any apparent delay.

The principal features of the new lamp are briefly as follows: Small maintenance account, by reason of a life of 60 to 70 hours, with one pair of carbons; the lamp is simple in construction, has few moving parts and operates quietly; great economy, ninety-three per cent. (93%) of the energy being utilized in the arc; operates independently on circuits of 100 to 120 volts, and frequencies of 60 or 125 cycles.

The lamp requires 70 volts potential to the arc, and consumes six amperes. The difference in the potential at the arc and at the terminals is taken up by an inductive resistance, which is the unique feature of the lamp. This inductive coil does not consume in excess of 25 watts, and is placed within the interior of the



C. G. E. COMPANY'S NEW ARC LAMP.

ornamentation. The use of high grade carbons is essential. The lamp is artistic in appearance and especially suitable for interior illumination. The ornamentation is finished in ground brass and black enamel. The company are also prepared to furnish a weatherproof lamp suitable for outside service.

The renowned LeRoi Mines of Rossland, B. C., are extending their pumping system, and have placed an order through the Rossland branch of the Jenckes Machine Co., Sherbrooke, Que. for a large size special Knowles sinking pump.

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Correspondence is invited upon all topics legitimately coming within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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MONTREAL BRANCH NO. 1.—Meets 1st and 3rd Thursday each month, in Engineers' Hall, Craig street. President, Wm. Smyth; 1st Vice-President, Wm. Bowden, 2nd Vice-President, P. McNaughton, Recording Secretary, J. O'Rourke; Treasurer, G. Jones.

ST. LAURENT BRANCH NO. 2.—Meets every Monday evening at 43 Bonsecours street, Montreal. R. Drouin, President, Alfred Latour, Secretary, 306 Delisle street, St. Cunegonde.

BRANDON, MAN., BRANCH NO. 3.—Meets 1st and 3rd Friday each month in City Hall. A. R. Crawford, President; Arthur Fleming, Secretary.

HAMILTON BRANCH NO. 4.—Meets 1st and 3rd Tuesday each month in Macrabee's Hall. Wm. Norris, President; G. Mackie, Vice-President; Jas. Ironside, Recording Secretary, Markland St.

STRATFORD BRANCH NO. 5.—John Hoy, President; Samuel H. Weir, Secretary.

BRANTFORD BRANCH NO. 6.—Meets 2nd and 4th Friday each month. J. B. Forsyth, President. Jos. Ogle, Vice-President. T. Pilgrim, Continental Cordage Co., Secretary.

LONDON BRANCH NO. 5.—Meets on the first and third Thursday in each month in Sherwood Hall. D. G. Campbell, President; B. Bright, Vice-President; W. Blythe, Secretary.

GUELPH BRANCH NO. 6.—Meets 1st and 3rd Wednesday each month at 7.30 p.m. H. Geary, President; Thos. Anderson, Vice-President; H. Hewelling, Rec.-Secretary; P. Ryan, Fin.-Secretary; Treasurer, C. F. Jordan.

OTTAWA BRANCH NO. 7.—Meet every second and fourth Saturday in each month, in Borbridge's hall, Rideau street; Frank Robert, President; T. G. Johnson, Secretary.

DRESDEN BRANCH NO. 8.—Meets 1st and Thursday in each month. Thos. Steeper, Secretary.

BERLIN BRANCH NO. 9.—Meets every Friday evening. G. Stemmett, President; J. Heyd, Vice-President; W. J. Rhodes, Secretary, Berlin, Ont.

KINGSTON BRANCH NO. 10.—Meets 1st and 3rd Thursday in each month in Fraser Hall, King street, at 8 p.m. President, F. Simmons; Vice-President, C. Asselstine; Secretary, J. L. Orr.

WINNIPEG BRANCH NO. 11.—President, G. M. Harlett; Rec.-Secretary, J. Sutherland; Financial Secretary, A. B. Jones.

KINCARDINE BRANCH NO. 12.—Meets every Tuesday at 8 o'clock, in McKibbon's block. President, Daniel Bennett; Vice-President, Joseph Lighthall; Secretary, Percy C. Walker, Waterworks.

PETERBOROUGH BRANCH NO. 14.—Meets 2nd and 4th Wednesday in each month. W. L. Outhwaite, President; W. Forster, Vice-President; A. E. McCallum, Secretary.

BROCKVILLE BRANCH NO. 15.—Meets every Monday and Friday evening, in Richards Block, King St. President, John Grundy; Vice-President, C. L. Bertrand; Recording Secretary, James Aikins.

CARLETON PLACE BRANCH NO. 16.—Meets every Saturday evening. President, Jos. McKay; Secretary, J. D. Armstrong.

ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

BOARD OF EXAMINERS.

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KINGSTON—J. Devlin, (Chief Engineer Penitentiary), J. Campbell.
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Information regarding examinations will be furnished on application to any member of the Board.

The Operation of Street Car Motors.

FEW street railway managers are aware of the importance of teaching their motormen to economize power by an intelligent handling of their controllers. The controller is intended to take the place of the old method of slowly accelerating cars, and of avoiding a rush of current through the motor when at rest, and instead of simply interposing a resistance in series with the motor which can be gradually cut out, it so arranges the armature and field coils of two motor cars as that they are all placed in series with each other at the start, so that each motor actually has then a difference of pressure of about 250 volts across its terminals, without their having been any useless consumption of power in a rheostat. The idea of this is, of course, in order that there may not be a sudden rush of current through the motor, which would be the case if it were subjected, when at rest, to a pressure of 500 volts. When it has accelerated to some extent, then a second step of the controller throws each motor in parallel with its own fields, but in series with the other motor, which combination reduces the total resistance and more current flows, until finally, after the successive steps of the controller have been finished, both motors are in series with their own fields and in parallel with each other, each one taking the full 500 volts. A speed regulation is also often effected by manipulating the controller, it being kept at some intermediate position when it is desired to run slowly, or creep up to some stopping point. Any position, however, except the last, that is, the motors in series with their fields and in parallel with each other, causes the motors to work at very low efficiency, and should be avoided as much as possible. If it be desired to go slowly it is better to open the controller full for a few moments periodically and then shut it right off, "drifting" until the speed becomes too low, and then opening full again and so on, rather than to run at any

intermediate point. A little practice will soon enable an intelligent motorman to run slowly and smoothly. It is also preferable to use a break strongly to stop, than to slow down by intermediate steps.

The Chambly Power Plant.

A NUMBER of prominent persons last week made an inspection of the works of the Chambly Manufacturing Company, now in course of construction at Chambly, Que., and a description of which appeared in the ELECTRICAL NEWS for December last. The party included Mr. F. S. Pierson, chief engineer of the Metropolitan Traction Company, of New York, and several officers and directors of the Montreal Street Railway Company. A thorough examination of the entire plant was made, and the unanimous expression was that the works were of the highest possible character. This opinion from an expert such as Mr. Pierson must be a source of gratification alike to the promoters of the undertaking and the citizens of Montreal and vicinity, who will be consumers of the current.

Guaranteeing Street Railway Bonds.

A BILL has passed the Ontario Legislature which is regarded as being somewhat of an innovation. It provides that the city of St. Thomas shall guarantee the Street Railway Company's bonds to the amount of $50,000, to enable the company to electrify its street railway system. In the event of the company failing to keep up its payments on the bonds, the city is permitted to take over the road and operate it. Hon. Mr. Gibson, in referring to the bill, stated that the provision for municipal operation was something that had never been introduced in the Legislature before, but he believed that in the modern view such powers were proper ones to bestow upon the municipality.

Decision as to Smoke Consumers.

A BY-LAW of the city of Montreal provides that steam users must equip their plants with proper apparatus for consuming the smoke. An action was recently entered in the Recorder's Court by the Boiler Inspector against a saw-mill owner for not complying with the provisions of the law. The defendant contended that residents in the vicinity had entered no complaint, and that, owing to an increase in the height of the chimney, no nuisance now existed. The court, however, decided against the defendant, pointing out that according to law every steam user was obliged to provide smoke consuming apparatus, and no complaint from the neighbors was necessary. The decision was looked forward to with much interest, as a number of similar cases were pending at the time, which were subsequently dealt with in a like manner, the Recorder allowing eight days in which to provide the apparatus. It is claimed that in the city of Montreal ninety-seven factories are equipped with means of consuming the smoke, while perhaps five times that number of establishments contain steam boilers. It is quite probable that action will be taken to compel every steam user to comply with the law, in which case the manufacturers of smoke consumers will reap a harvest. In Toronto the law in this respect differs from that in Montreal, inasmuch as only when the smoke from a factory can be shown to be offensive or destructful are steam users compelled to provide a remedy. A number of the largest manufacturers, however, have found it profitable to equip their plants with mechanical stokers, which besides effecting a large saving in fuel, also remove the necessity of providing smoke consumers, owing to the method of firing employed. As the number of steam plants in Toronto and other large cities becomes greater, it may be found necessary to adopt regulations such as those in force in Montreal.

Electric Cabs vs. Street Railways.

MR. A. H. St. Germain, of North Toronto, has announced his intention of organizing an autocar service between York Mills and the city of Toronto. He is said to have ordered three electric busses from an English firm, to be delivered early in the spring. This service will come in direct competition with the Metropolitan Street Railway, and may also affect the receipts of the Toronto Railway Company. The success of the venture will therefore be watched with more than usual interest. The electric cabs will be entirely different from any heretofore seen in Canada, and will have a carrying capacity for thirty passengers, which would seem to strengthen the probability of their successful competition with street railways. In London, England, these cabs are becoming a familiar sight, and are believed to have passed the experimental stage so far as energy is concerned, but the cost of the maintenance of the battery is a point that has not as yet been demonstrated. While not forecasting any serious loss of revenue to the street railways effected, the proposition made by Mr. St. Germain is doubtless of some interest to street railway companies as showing what may be attempted at other places under similar circumstances. The reason for Mr. St. Germain's decision to inaugurate such a service is probably to be found in the present unsatisfactory means of reaching the central part of Toronto from points on Yonge street adjacent to the city, it being necessary to transfer from the cars of the Metropolitan Street Railway to those of the city line, and also to pay an additional fare. It will be remembered that at the last session of the Ontario Legislature the Metropolitan Railway Company sought to obtain running rights over the Toronto Railway Company's track to the Union Station, but the application was refused for the reason that the two companies could not come to an agreement as to terms. Had such an arrangement been made, probably nothing would have been heard of the proposition to run a system of autocars. The interests of both railway companies and municipalities would, we believe, be best conserved by the appointment of a Board of Arbitrators to decide the question of running rights of one railway over the tracks of another, and to fix the rates of fares and matters of this character.

ELECTRICAL EXPOSITION IN 1898.

A COMPANY of New York gentlemen has been formed, with a capital of $20,000, to conduct an electrical exhibition in that city some time during the present year, to follow the line of the show held in May, 1896, and which was a pronounced success. Mr. Marcus Nathan has been chosen as general manager. The new electrical inventions and improvements developed within the past two years will be an important factor, and it is hoped to greatly surpass the former effort.

The bill permitting the city of St. Thomas, Ont., to guarantee the bonds of the Electric Street Railway Company to the extent of $50,000, has been passed by the Private Bills Committee of the Ontario Legislature.

MR. ALFRED T. SMITH.

PRESENTED herewith is the portrait of a gentleman well known in telephone circles, Mr. Alfred T. Smith, District Manager for the Bell Telephone Co., with headquarters at Kingston. Mr. Smith has just emerged from a serious illness, covering a period of more than two months. His friends will be glad to learn that although a month ago he was declared by the physicians to be beyond recovery, his excellent constitution enabled him to withstand the ravages of disease, and he is today out of danger and on the road to convalescence. A few weeks spent in a milder climate will, it is hoped, be the means of completely restoring him to health again.

Mr. Smith has been in the employ of the Bell Telephone Company for nearly twenty years, having entered their service at Hamilton in the year 1879, when 18 years of age. One year later found him in charge of construction, and the following year he built the first long distance telephone line in Canada, connecting the cities of Toronto and Hamilton. His ability and careful attention to business led to his appointment in January, 1882, as local agent for Peterborough and

MR. ALFRED T. SMITH.

Lindsay; from thence he was transferred to the Halifax agency in August, 1884. While in charge of this district the telephone system was installed on Sable Island much to the convenience and comfort of the guards. The electric light system of Halifax was also constructed under his immediate supervision. In 1886, at his own request, Mr. Smith was transferred to the Kingston agency, and in May, 1897, his faithful services were further recognized by his appointment as District Deputy of the Ontario Department. He is a brother of Mr. A. B. Smith, superintendent of construction for the G. N. W. Telegraph Company.

THE LATE WILLIAM BELL.

EARLY in December death removed ex-Alderman William Bell, Dominion government engineer, and possibly one of the best known men in Toronto. His illness was of a lingering nature, an attack of typhoid fever subsequently developing into jaundice. Deceased was 61 years of age. He was born in Woolwich, England, in 1836, and came to Canada when quite young. He settled first in Montreal, and came to Toronto in 1857, since which time he had gradually become a prominent figure in municipal and political life, serving as a member of the School Board and City Council. For four years he held the position of tax collector. In 1890 the late Mr. Bell stood as an equal rights candidate in the provincial elections, but was unsuccessful. In 1894 his services were recognized by his appointment as government engineer at the Customs House in Toronto. Ever since 1854 Mr. Bell was connected with the Orange Lodge, having been County Master for two years. He was also a member of St. George's Masonic Lodge and of the Sons of England.

MUNICIPAL LIGHTING PLANT AT MAGOG, QUEBEC.

THE turning on of the power and light in connection with the new municipal lighting plant at Magog, Que., was made the occasion of a reception given by the mayor and councillors in the opera house. The hall was brilliantly lighted by many incandessent lamps, and the whole town turned out. Speeches were made by Mayor Bessette and other councillors, and a very pleasant evening was spent. Magog is one of the first towns in the eastern townships to adopt, own and operate its own lighting plant. The power is obtained from the Magog river, just below the cotton mills. The water wheel plant of the Crocker special type was furnished by the Jenckes Machine Company, of Sherbrooke, Que., and the generator, wiring and electrical plant by the Canadian General Electric Company.

The town have under consideration the control of the water works, with a view of locating a pumping station alongside the lighting plant, as plenty of power is available for this purpose.

BELL TELEPHONE COMPANY'S ASSESSMENT.

JUDGE Snider has given a written judgment in the assessment appeal of the Bell Telephone Company at Hamilton. The company was assessed for $27,200 on land and buildings, $24,700 on poles, wires, etc., $5,000 income and $21,600 personalty, on instruments, etc. The assessment on land and buildings was reduced to $17,000, the income and personalty assessment was struck off, and the assessment on the poles, wires, etc., was reduced to $13,940, the value of the poles, etc., in Ward 2. The judges held that the poles, wires and conduits were assessable as real estate, but the way the assessment was made they could only assess the poles, etc., in Ward 2. The judges held that the telephone instruments were personal property, and that under the act the company was not assessable for personalty. It was held that a reduction should be made for the cross-arms used by the city for fire alarm purposes, and that no agreement existed between the city and the company in reference to the aseessment. The judges considered that the assessment should be made as a "going concern," and that the poles, etc., should be assessed up to 85 per cent. of the cost. While the assessment was reduced from $78,500 to $30,900, it is only $2,200 less than last year. The judges decided in favor of the principle of assessing poles, etc., as real estate, and would have allowed the whole amount had the assessment been divided among the different Wards and not all in Ward 2.

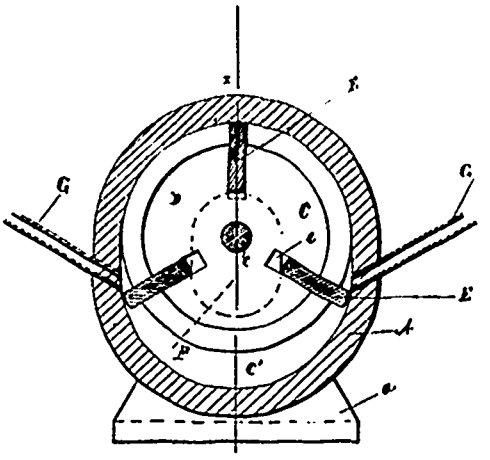
APPRECIATES IT HIGHLY.

MR. Roderick J. Parke, electrical engineer, Montreal, writes: "I am a regular subscriber to the ELECTRICAL NEWS, and appreciate it highly—in fact, I would not be without it for triple its cost."

RECENT CANADIAN PATENTS.

THE Patent Record contains descriptions of the following devices, for which patents have been granted in Canada:

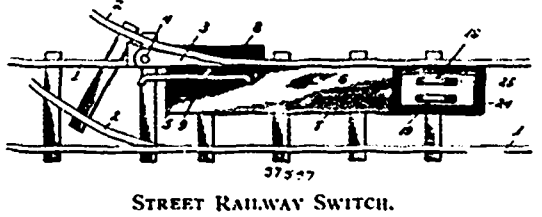
Steam engine indicator, Peter E. Apgar, Philadelphia, Pa.; smoke consumer, Chas. C. Bruckner, Chicago; apparatus for utilizing exhaust steam, Herman Ten Winkel, Denver, Col.; car brake for street railway, Patrick Flood, New York; gas engine, W. E. White and E. A. Myers, Garnett, Indiana; gas engine, Mexwell, Wyeth & Co., Brooklyn, N. Y.; motor vehicle, Charles H. Barrows, Williamantic Conn.; apparatus for attaching electric lamp bulbs, Olney Smith, Detroit, Mich.; rotary engine, Charles A. Ingerham, Wabigoon, Ont.; smoke consumer, J. H. Saunders, Buffalo, N.Y.; meter, Canadian General Electric Co., Toronto; system of electrical transportation, Philip K. Stern, St. Louis, U. S.; system of electrical distribution, Canadian General Electric Co., Toronto; electric meter, Canadian General Electric Co., Toronto; motor reversing switch, Canadian General Electric Co., Toronto; grate for steam boilers, Alfred Davy and John Edey, London, Eng.; armature, Abe L. Cushman, Concord, U. S.; valve indicator, John T. Christie, Troy, N.Y.; storage battery, Lee & Co., Chicago; trolley wheel, R. I. McPhail, Toronto; system of electrical distribution, J. F. Kelly and C. C. Chesney, Pittsfield, Mass.; speed gear for motor cars, George G. Hardingham, London, Eng.; smoke consuming apparatus, Michel E. Bernier, Montreal; governor for steam engines, Edwin J. Armstrong, Oswego, N.Y.



ROTARY ENGINE.

Patentee: Walter F. Clements, Winnipeg, Man., granted 17th September, 1897.

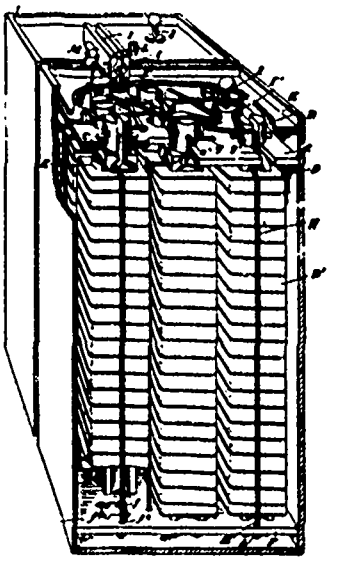
Claim.—In a rotary engine, the combination with a cylinder eccentric in cross-section, of a revoluble piston bearing against one side of the cylinder and forming a steam chamber on the other side, said piston being provided with radial slots and recesses in its sides, stationary cams arranged inside the said recesses with their peripheries concentric with the periphery of the cylinder, and abutment plates slidable in the said radial slots between the said cams and cylinder, substantially as set forth.



STREET RAILWAY SWITCH.

Patentee: Wm. A. Grant, assignee of Filmore Peters, both of Cornwall, Ont., granted 23rd September, 1897.

Claim.—In an automatic switch, the combination with an operating lever connected to a switch-tongue, of mechanism adapted to actuate the lever when operated by devices carried by a car. The combination of an operating lever arranged beneath the surface of the track, operating cams provided with bevelled surfaces, a friction-reducing device, and means for depressing the cams. An automatic switch comprising a box, a covering-plate therefor, an operating lever pivotted to the under side of said covering-plate and working within said box, said operating lever being suitably connected to a switch-tongue, an anti-friction roller carried by the operating lever, a series of operating cams pivotted adjacent to said lever and provided with bevelled surfaces adapted to contact with said anti-friction roller for shifting the lever, means for returning the cams to their normal position and for assisting movement of the operating lever, in combination with a series of swinging arms carried by a car, a series of cam-levers also carried by the car, and suitable connections between said cam-levers and the swinging arms, the latter being adapted to contact with the operating cams for shifting the switch.



STORAGE BATTERY.

Patentee: Charles Riordon, assignee of Wm. J. Still, both of Toronto; granted 23rd October, 1897.

Claim.—In a storage battery, an electrode, comprising a rectangular, *hollow spiral of flat strip sheet lead in flexible form with* both edges free, an interposed hollow spiral of active material, exposed at the inside and outside, a rectangular supporting post for the electrode extending up through the spiral longitudinal grooves in each side of the post, and a lead from the centre edge of the spiral extending up through one of the grooves through the central opening of the spiral. The combination with the spirally formed electrodes, having the reduced top and bottom ends forming shoulders, of the top and bottom plates, slots in the same through which the leads extend, binding posts to which the leads are connected, and the top sealing plate resting on the tops of the posts and having openings through which the binding posts extend. The combination with the electrodes and leads therefrom, and binding posts to which the leads for each cell are connected, having stems with spherical heads, of a pair of connecting plates for the cells having arc-shaped grooves and clamping means for holding the spherical heads in the grooves, as and for the purpose specified.

PERSONAL.

At a meeting of the board of directors of the Niagara Falls Park and River Railway, held in Toronto, Mr. Wilfred Phillips, who had completed his first year as acting manager of the road, was appointed general manager.

Prof. Alexander Melville Bell, of New York, the distinguished scientist and father of Mr. Graham Bell, the inventor of the telephone, has chosen a Canadian lady as a partner in life, in the person of Mrs. H. G. Shibley, of Harrowsmith, Ont.

Mr. R. C. Pettigrew, of Hamilton, treasurer of the Executive Council of the Canadian Association of Stationary Engineers, was elected alderman for the Seventh Ward at the municipal elections this month. Mr. Pettigrew was formerly a member of the School Board.

Mr. T. R. Rosebrugh, lecturer in electrical engineering at the School of Practical Science, Toronto, was married on the 30th of December last, at Syracuse, N.Y., to Miss Jessie Aeolia Whyborn, only daughter of Dr. Whyborn, of that city, the ceremony being performed by Rev. R. Calthrop. The ELECTRICAL NEWS joins with the many friends of the bride and groom in wishing them many years of wedded happiness.

Mr. Walter Rogers, brother of Mr. Joseph Rogers, of the Rogers Electric Company, died at St. Joseph's Hospital in London last month, after an illness of a couple of months. Deceased was an electrical construction man of wide experience and exceptional ability. Before going into business with his brother he spent two years at electrical work in Vancouver, B.C., for the Vancouver Street Railway, and one year in Chicago with the Edison Electrical Construction Company.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

NOTE.—Secretaries of Associations are requested to forward matter for publication in this Department not later than the 28th of each month.

TORONTO NO. 1.

AT a meeting of Toronto No. 1, held on December 15th, there was a large attendance. The trustees of the hall reported that the Queen City Insurance Company had allowed the sum of $154.71 for damages occasioned by the recent fire, which will nearly cover the the loss. A letter was read from Mr. J. J. Main, regretting his inability, owing to business engagements, to deliver a promised lecture. He hoped to be able to favor the association at a later date. Mr. Milne worked out some problems in electricity. Over fifty members were present at the regular meeting on January 5th. There was one initiation and four propositions for membership. The association was notified that the new association started in the west end of the city would hold a formal opening on Thursday evening, January 13th, to which all the members of No. 1 were invited. A committee was appointed to arrange for an At-Home to celebrate the re-opening of the hall. On Tuesday, the 11th inst., an open meeting was held, at which Mr. James Milne, manager of the Weeks-Eldred Company, delivered an interesting lecture. The regular meetings are held on the first and second Wednesdays of each month, and the president especially requests a a large attendance during the winter months.

HAMILTON NO. 2.

THE above association is keeping up its standard in educational work. At a recent meeting Mr. A. M. Wickens, of Toronto No. 1, read a paper on Latent Heat, and at a later meeting a paper was presented by Mr. F. G. Mitchell, which will be found on another page.

QUESTIONS AND ANSWERS.

A CORRESPONDENT sends the following as a partial answer to "Amateur" in the December issue of the NEWS:-

Absolutely correct results cannot be obtained from the diagrams, for the reasons (1) that they are not full size, and (2) they are not all to the same reduced scale. The results given below, however, will be correct for all practical purposes. In taking pipe diagrams, care should be taken to have them the same length as the others taken from the engine. When this is the case the proportions between them are exact, and when not the case the proportions must be determined by calculation. For convenience let us number the diagrams 1, 2, 3 up to 9, where 1 is the first set of exhaust cards. In comparing 1 and 3 there is a difference of 5-16 inch in their lengths, and between the first and last cards of No. 1 set there is a difference, showing that the cord must have been stretching.

We do not know exactly what is required in the nature of calculation of the exhaust cards, whether "Amateur" means to determine the point of release, etc., in terms of the stroke, or whether he desires the amount of horse power the engine exerts in working against the back pressure. We are inclined to think it is the latter, and if so this must be calculated from the other diagrams. In diagrams 3, 4, 5 and 6 we have respectively mean forward pressures of 19.6, 44, 15.4, 23 lbs., and mean backward pressures of 11.9, 9, 11.2, 9.7 lbs. respectively, giving us mean effective pressures of 7.7, 35, 4.2, 13.3 lbs, which, when calculated, gives forward horse powers of 24.6, 54, 19.3, 28.6, backward horse powers of 14.93, 11, 14, 12; the difference between the two being the resultants or indicated horse powers, which are 9.67, 43, 5.2, 16.6 respectively. It is not customary to calculate the gross forward and backward h.p., it being far easier to get the net or i h. p. directly from the diagrams. The M.E.P. of diagrams 7, 8 and 9 are 3.9, 9.1 and 3.2 lbs., and the indicated horse powers are 7, 16.2, 56 respectively.

In the exhaust diagrams, No. 1, when measured to scale, we find that release takes place when piston is about 2¾ inches from head end of stroke and 3¾ inches from crank end. Compression commences about half-stroke.

From the above "Amateur" can draw his own conclusions regarding straight and centre connections. Probably some of the rest of your readers will answer whatever else is necessary.

M. J.

A NEW DETERMINATION OF THE VALUE OF THE OHM.

WITH the aim of obtaining a standard value of the unit of resistance, which value should not change with time, the machine known as the Lorenz apparatus has been developed. The British Government has adopted a standard known as the "Board of Trade Ohm Standard, Verified, 1894," which is a purely physical standard, the constancy of which, with time, depends on the assumed absence of any changes in its molecular structure or physical strains. The Lorenz apparatus, says the Electrical World, depends upon the demonstration by the dimensional system, that a resistance is proportional to a velocity, and hence can be measured by standards purely of length and time, which are less likely to change in centuries to come than the physical aggregation of the molecules of any standard resistance.

The Lorenz apparatus, as built by Messrs. Nalder Bros., of London, for the McGill University, of Montreal, consists of a bronze disc, mounted centrally on a shaft, by which it can be rotated in its own plane at high speeds, and concentric with this disc a solenoid surface in a helical groove of semi-circular section cut in the cylindrical surface of a massive marble ring. The ring is about 21 inches outside diameter, 15 inches inside diameter, and 7 inches in azial length.

The determination of the ohm involves the exact calculation of the co-efficient of mutual induction between this coil and the periphery of the disc, and therefore involves the exact measurement of the diameter of the coil and disc. This was done with a Whitworth measuring machine, a long series of observations in different directions giving a highly accurate result. To prevent any leakage of current from turn to turn, double silk-covered wire was used, brushed over with melted paraffin wax. The co-efficient of linear expansion of the marble was also determined. The phosphor-bronze disc was ground in place, so as to be made true on its axis of rotation, and its diameter and co-efficient of linear expansion were carefully measured.

Contact was made with the centre of the disc by a tube projecting into an axial hole in the disc and carrying a small stream of mercury. Three small tangential phosphor-bronze tubes were pressed lightly against the

periphery of the disc at three points, separated by an angular distance of 120°. Mercury was passed through these tubes also, the effect being to greatly diminish the disturbances due to thermo-electric effects.

The method of determining the resistance was a zero method, the current in the field coil being passed through the resistance to be determined; and the E.M.F. set up in the disc at the proper speed, being balanced against the fall of potential in this resistance. For balancing an extremely sesitive Ayrton-Mather galvanometer of the d'Arsonval type was used. Extreme care was taken in the preparation of the resistance coils, their comparison with the Board of Trade standard, and the determination of their temperature co-efficients. The thermometers used in the investigation were carefully calibrated at Kew, and the clock which was used for the determination of the speed was compared with the time set from Greenwich.

The results of the successive measurements of the absolute resistances became very concordant after various possible causes of small errors had been gradually eliminated. Nine sets of observations taken on July 30, 1897, gave results for the value of the Board of Trade ohm in true ohms, which showed, when all corrections had been made, that one Board of Trade ohm = 1.00026 true ohms.

This result was then discussed in the light of all sources of error that could enter into it, and the effects that would be produced by such errors. The marble ring and the phosphor bronze disc were carefully tested in induction balances for the presence of possible traces of iron which would affect their permeability, no such effect being detectable with a sensitiveness to one part in 15,000. The final conclusion of the series of tests was that the Board of Trade ohm is between two and three parts in 10,000 larger than the true ohm. This is probably the most precise comparison of physical standards of resistance with their defined value ever made.

MOONLIGHT SCHEDULE FOR FEBRUARY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1. ...	A.M. 2.40	A.M. 6.40	4.00
2....	" 3.30	" 6.40	3.10
3....	" 4.00	" 6.40	2.40
4....	No Light.	No Light.	.....
5....	No Light.	No Light.	.....
6....	No Light.	No Light.	.....
7....	No Light.	No Light.	.....
8....	P.M. 6.00	P.M. 9.40	3.40
9....	" 6.00	" 9.50	3.50
10....	" 6.00	" 11.00	5.00
11....	" 6.00	A.M. 12.10	6.10
12....	" 6.00	" 1.20	7.20
13 ...	" 6.00	" 2.30	8.30
14....	" 6.00	" 3.40	9.40
15....	" 6.00	" 4.50	10.50
16....	" 6.10	" 5.50	11.40
17....	" 6.10	" 5.50	11.40
18....	" 6.10	" 5.50	11.40
19....	" 6.10	" 5.50	11.40
20....	" 6.10	" 5.50	11.40
21....	" 6.10	" 5.50	11.40
22....	" 6.10	" 5.50	11.40
23. ..	" 8.10	" 5.50	9.40
24....	" 9.20	" 5.50	8.30
25 ...	" 10.20	" 5.50	7.30
26....	" 11.00	" 5.50	6.50
27....	" 11.20	" 5.50	6.30
28....	" 11.50	" 5.50	6.00
		Total.....	191.30

SPARKS.

The London Electric Light Company have erected a small addition to their building.

Leonard & Son, of Dundas, Ont., have purchased an incandescent lighting plant from the Canadian General Electric Co.

The Danville Electric Light Co. have purchased a 60 kilowatt single phase alternator from the Canadian General Electric Co.

The Canadian General Electric Company are installing an isolated plant for R. F. Hicks, of Norwich, Ont.

The corporation of Magog, Que., have placed an order with the Canadian General Electric Company for a 2,000 light alternator of their single phase, revolving armature compound type.

The Richmond Light and Power Co., of Richmond, Que., are adding to their electric lighting equipment, and have placed with the Royal Electric Co., Montreal, an order for one of their 75 k.w. "S.K.C." generators and switchboard apparatus complete.

The Toronto Railway Co. have given an order to the Canadian General Electric Co. for an 850 kilowatt direct-connected generator. This machine will be a duplicate of that which has been in operation in their power house for two years past.

Messrs. Edgar & Roy, of North Hatley, Que., are at present enlarging their electric lighting plant, and propose to furnish power as well as light in the future. In order to be in a position to do this they have placed their order with the Royal Electric Co. for a 60 k.w. "S.K.C." two-phase generator, which will be installed immediately.

The Dechenes Electric Company are lighting the Russell House and Opera House in Ottawa They have recently placed an order for several induction motors with the Canadian General Electric Company, to be operated from their monocyclic circuits.

The Edmonton Electric Light Co., of Edmonton, N.W.T., are improving and extending their plant. The new electrical equipment purchased by them from the Royal Electric Company consists of one 75 k.w. "S.K.C." two-phase generator, complete, with exciter and switch-board, as well as the necessary material for the other changes.

At the last meeting of the town council of Granby, Que., the question of a more complete and efficient electric light system was considered. It was moved that the secretary be authorized to advertise for tenders for an arc and incandescent plant, but at the suggestion of Mayor Miner the motion was allowed to stand pending definite information in regard to the tannery water power.

The new 100 arc light plant at Chatham, Ont., has been taken over from the contractors by the city, and is said to be running satisfactorily. The electrical apparatus, including dynamos, lamps and circuits, was furnished by the Thompson Electric Company, of Hamilton. In a later issue we hope to present an illustrated description of this plant, which is one of the largest yet to be installed in Canada under civic control.

The contract for the power transmission plant of the British Columbia Railways Company at Victoria, B.C., reference to which has already been made in this journal, has been awarded to the Canadian General Electric Company, and will consist of three-phase generators adapted for direct connection to Pelton water wheels, having an aggregate capacity of 1,500 horse power.

For the past two years a philanthropic association of Montreal, the St. Jean Baptiste Society, has organized a series of free lectures in their edifice, the Monument National. This year a series of lectures on "Practical Electricity" has been added to the programme, the lecturer being Mr. Louis A. Herdt, E.E., Consulting Engineer and Lecturer in Electrical Engineering at McGill University. These lectures were begun in October last, and are exceedingly well attended, over 200 people, young and old, in search of learning, having availed themselves of the opportunity thus afforded.

The Toronto branch of the Bell Telephone Company have issued to subscribers an improved telephone directory, which in point of convenience and general arrangement is especially worthy of mention. The book is well printed, and the absence of advertisements throughout the pages is a noticeable improvement. A complete list of the offices in Ontario and Quebec connected with the long distance lines appears in the front, while a numerical list of the telephones of the Toronto exchange, showing in the order of their numbers the page in telephone directory on which any number may be found, is also included.

The town of Parrsboro, N. S., is installing a complete arc and incandescent system, and has awarded contracts for apparatus as follows: Complete steam plant, including Monarch Economic boiler and two engines, Robb Engineering Co., Amherst, N. S.; arc dynamo and lamps, Thompson Electric Co., Hamilton; alternating generator, Munderloh & Co., Montreal, as agents for the Warren induction type; transformers, W. A. Johnson Electric Co., Toronto; lamps and meters, Packard Electric Co., St. Catharines; supplies, Canadian General Electric Co., Toronto. The plant is expected to be in operation by February 1st. Mr. Geo. White-Fraser, of Toronto, is consulting engineer.

EDUCATIONAL DEPARTMENT

INTRODUCTORY

After mature deliberation the publisher of this journal has decided to devote a certain amount of space each month to what may be termed an Educational Department, wherein both mechanical and electrical formula and mathematical problems will be discussed, illustrated, and as far as possible rule and example given. At the request of the editor, I have with pleasure undertaken to contribute to this department regularly each month, and before discussing actual mathematical problems, wish to briefly introduce the subject at issue.

The primary object of this department is chiefly to increase the value of an already valuable paper, by placing in the hands of every engineer who has any knowledge of the rudimentary principles of mathematics, such matter as will enable him by a little study to master the most intricate mechanical and electrical formula. Many of our most valuable engineering works and publications from time to time contain formula that is in many cases but vaguely understood, and very often entirely misunderstood, thus rendering an otherwise valuable work practically valueless to the reader.

Just at what particular point our calculations should commence became a matter of serious thought, and past experience had to be carefully considered, bearing in mind the fact that there are many really good engineers whose early education has, through force of circumstances, been deficient, and many others who, through lack of opportunity, have not been able to review their early education for years. Knowing by observation and experience the great necessity of having a thorough elementary education before attempting to digest and calculate problems, and the almost utter impossibility of the student arriving at a satisfactory conclusion of his studies without a thorough knowledge of the principle of mathematics involved, I have decided to commence at a point and carry out the programme outlined in this journal—commencing at the foundation and advancing by easy stages until the principles underlying the most obtuse and difficult formula can be readily explained and easily understood. The advantages to be derived from an education of this kind, coupled with practical mechanical ability, is too well understood to require comment.

The programme which has been outlined for the succeeding nine months will embrace:

DECIMAL FRACTIONS—Definitions and explanation of principles of, and method of reduction to common fractions, and vice versa.
SQUARE AND CIRCULAR MEASURE—Definition and explanation and practical demonstrations of.
CUBICAL AND CYLINDRICAL MEASUREMENTS—Definitions and explanations of, with practical hints.
SQUARE AND CUBE ROOT—Definitions and explanations of.
SAFETY VALVE CALCULATIONS—(Spring and Lever Types)—Principles of, with practical demonstrations.
BOILER CONSTRUCTION—Stays, rivets, joints and seams, iron and steel plate—strength of, with formula and practical demonstrations.

It is not the intention to fill these columns with a mass of figures hastily compiled without reference to any particular object; on the contrary, every problem will be carefully thought out, and only such information given as will be of use to you, and an effort will be made, based on experience and a knowledge of the requirements, to make his series of tests complete in every particular.

WM. THOMPSON.

[ARTICLE IX.]

DIVIDED AND SHUNT CIRCUITS.

A conductor from one terminal of a generator may be divided into any number of divisions or branches. Each branch or division may vary in resistance, and they may all unite on reaching the other terminal.

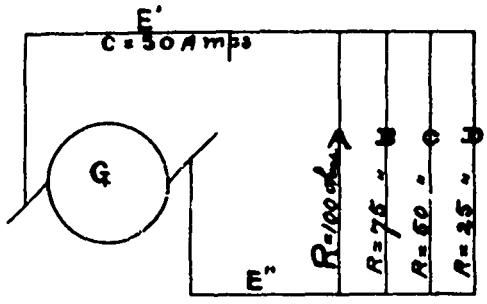


FIG. 2.

Example 6: A portion of the circuit connected with generator G in Fig. 2 consists of 4 parallel conductors, A, B, C and D. R of A = 100 ohms; B = 75 ohms; C = 50 ohms, and D = 25 ohms, what will be the ratio of current passing through the circuit which will pass through each conductor.

According to Rule 1 the current passing through each of the conductors A, B, C and D will be inversely proportionate to its resistance.

$$\therefore \text{As } A : B : C : D :: \tfrac{1}{100} : \tfrac{1}{75} : \tfrac{1}{50} : \tfrac{1}{25}$$

Or to simplify:

As A : D 100 : 25
B : D :: 75 : 25
C : D :: 50 : 25

That is, that the ratio which current passing through conductor A bears to current passing through conductor D is the same as the ratio that the resistance of conductor A bears to R of conductor D, and so on for all the other conductors.

Example 7: Supposing the current passing through terminals of generator, and consequently through circuit, to be 50 amperes, what amount of current will pass through each of the branches, A, B, C and D, in foregoing problem.

To determine the amount of current that will pass through parallel circuits of different resistances, take the resistance of each branch in ohms as a denominator, having 1 as a numerator. Reduce the fractions to a common denominator and add together the new numerators. Take the sum of the numerators as a new common denominator, and the single numerators as new numerators, and new fractions will express proportional currents passing through portions of circuit as units of one.

$$\text{Then } \tfrac{1}{100}\ \tfrac{1}{75}\ \tfrac{1}{50}\ \tfrac{1}{25} \quad \frac{3 \cdot 4 \cdot 6 \cdot 12}{300}$$

And sum of numerators equals 25, using this as per rule $\frac{3 \cdot 4 \cdot 6 \cdot 12}{25}$

$\therefore$ current passing through branches expressed in units of one must equal: $A = \frac{3}{25}$; $B = \frac{4}{25}$; $C = \frac{6}{25}$; $D = \frac{12}{25}$.

Total current passing through circuit is given as 50 amperes.

Then current passing through A = $\frac{3}{25} \times 50 = 6$ amp.
" " " " B = $\frac{4}{25} \times 50 = 8$ amp.
" " " " C = $\frac{6}{25} \times 50 = 12$ amp.
" " " " D = $\frac{12}{25} \times 50 = 24$ amp.

It will be observed in Fig. 2 that current passing through circuit first passes through conductor E^1, and when parallel branches are reached four paths are provided for its passage, when it again unites on conductor E^{11}.

It is quite evident that the more paths there are provided for the passage of the current the less resistance will be offered. This brings up a problem as to resistance offered by the parallel branches of a circuit as compared with a single conductor.

It is quite clear that we cannot summarize or add the resistances of each parallel branch together. If branch A had only been provided, then resistance of A would have been the resistance of that portion of the line, but addition of other branches clearly reduces resistance of each branch to flow of current by providing another path for its passage.

In divided circuits the resistance of the combined branches is expressed by the reciprocal of the sum of the reciprocals of the resistances.

Example 8: Find the resistance of the combined branches, A, B, C and D, as set forth in foregoing examples.

The reciprocal of resistance is conductance expressed usually as Mhos, a derivate of the word Ohms.

The reciprocal or conductance of the four branches then is:

$$\tfrac{1}{100} + \tfrac{1}{75} + \tfrac{1}{50} + \tfrac{1}{25} = \tfrac{25}{300} \text{ or } \tfrac{1}{12} \text{ Mhos.}$$

The resistance of the combined branches is as 5 : 60 = 12 ohms.

Application of Rule 3 to this problem proves that the E M F on each of branches is equal 600 volts.

R of A = 100 ohms and C = 6 amps. E M F 600 volts.
R of B = 75 " " = 8 " " " 600 "
R of C = 50 " " = 12 " " " 600 "
R of D = 25 " " = 24 " " " 600 "

And combined resistance of A, B, C, D = 12 ohms combined. C = 50 amps. E M F 600 volts.

Perhaps a clearer method of arriving at the combined resistance of parallel circuits is to use the formula

$$R = \frac{R \times R^1}{R + R^1}$$

Which is based on the principle that the combined resistance of two parallel circuits can be found by multiplying their resistances together and dividing the product by the sum of their resistance.

By this method, combining A and B we get $\frac{100 \times 75}{100 + 75} = 42.8$ ohms.

Combining C and D we get $\frac{50 \times 25}{50 + 25} = 16.7$ ohms.

Then combining these two products we get $\frac{42.8 \times 16.7}{42.8 + 16.7} = 12$ ohms combined R of branches A, B, C and D.

If the whole of the branch circuits were of uniform resistance, then formula could be very much simplified by using formula

$$R = \frac{R}{N}$$

When the resistance of one branch is divided by the number of branches the quotient will be the combined resistance of all the branches.

Example 9: What would be the combined resistance of four parallel branches each having a resistance of 100 ohms?

$\frac{100}{4} = 25$ ohms.

STRENGTH OF STAYS AND FLAT SURFACES.

We require here to find area and number of stays required, area of surface supported by one stay, and the pressure that may be allowed against any flat surface.

The greatest stress per square inch of section of an iron stay

allowed is 6000 lbs. Then calling this the T. S. (tensile strength) of our formula, the total stress on a stay may be found by the following formula:

$$\text{Stress (S)} = a \times T\,S$$

Example: Find the stress allowable on a direct stay 1¼ inches in diameter when the stress allowable equals 6000 pounds per square inch section.

$S = a \times T\,S = 1.25^2 \times .7854 = 1.2271$ square inches of section.

$1.2271 \times 6000 = 7362.6$ total stress allowable on stay.

Example, the stays of a boiler are 1¼" in diameter and placed 12 inches apart, what should be the working pressure of the boiler if the stress allowable per square inch section of stay is 6000 pounds.

Rule: First find the stress the stay is capable of supporting, then divide the result by the area held up by each stay and the quotient with the pressure allowable on the boiler.

$1.25^2 \times .7854 = 1.2271$ square inches section of stay.

$1.2271 \times 6000 = 7362.6$ total stress allowable on stay.

Since the stays are 12 inches apart or 12 inches from centre to centre of stay, each stay must support a section of plate equal to 12 inches squared.

Then $12 \times 12 = 144$ square inches area, supported by each stay.

Then $7362 \div 144 = 51.1$ pounds pressure allowable on the boiler.

Rule to find required diameter of stay: Area of section in square inches held up by each stay multiplied by pressure on boiler divided by stress allowable per sectional inch on stay equals required area of stay.

$$\sqrt[2]{\text{area} \div .7854} = \text{diameter.}$$

Example: Find the required diameter of a direct stay when allowable stress on stay is 6000 pounds per square inch of section and stays are 15 inches apart with boiler pressure at 75 pounds per square inch.

$15 \times 15 = 225$ square inches of surface supported by stay.

$225 \times 75 = 16{,}875$ pounds stress on each stay.

$16{,}875 \div 6000 = 2.81$ square inches required area of stay.

$\sqrt[2]{2.81 \div .7854} = 1.9$ diameter of stay required.

Example: the stays of a boiler are 1½ inches in diameter and capable of sustaining a stress of 8,835 pounds, what distance must they be pitched apart to sustain a working pressure of 60 pounds to the square inch?

Rule: $\frac{8835}{60}$ = area of section, and square root of area of section equals pitch or distance from centre to centre of stays.

$8835 \div 60 = 147.2$ area of section to be supported in square inches.

$\sqrt[2]{147} = 12.125$ length of each side of section of plate, or required pitch of stay = 12⅛ inches.

Proof: $12.125^2 \times 60 = 8{,}820$.

[Note.—This result would have been exact had fractional parts of an inch been worked out.]

We now have rules for three of the most important determinations relating to stays:

1st. Determining the total weight or stress that a stay is capable of supporting.

2nd. Determining the required diameter of a stay when total weight to be sustained is known.

3rd. Determining the area of surface a stay of given dimensions is capable of supporting under known conditions.

To practical operating engineers these questions are of great importance; I will therefore repeat the examples under conditions which they may be expected to be met with in ordinary practice.

Example: The stays on a flat surface are 12 inches apart centre to centre, and through corrosion, have eaten away to 1 inch in diameter. The pressure per square inch on the boiler is 60 pounds, what is the strain per square inch section of stay, and to what pressure should the strain be reduced to give a stress of 5,000 pounds per square inch section of stay.

$12 \times 12 = 144$ square inches held up by each stay.

$144 \times 60 = 8640$. pounds held up by each stay.

$1^2 \times .7854 = .7854$ square inches sectional area of stay.

Then stress per square inch section of stay equals:

$$8640 \div .7854 = 11{,}000$$

This is clearly sufficient to break the stay and render the boiler unsafe.

$5000 \times .7854 = 3927$ pounds weight that stay is capable of sustaining.

$3927 \div 144 = 27.27$ pounds safe working pressure.

And therefore to comply with conditions named that strain on stay must not exceed 5000 pounds per square inch of section, boiler pressure must not be allowed to exceed 27.27 pounds per square inch.

Example: The stays of a boiler are 10 inches apart, and one of them breaks, throwing more stress on the four surrounding stays. The stays are 1⅛ inch in diameter, and the boiler pressure is 50 pounds per square inch, what extra stress will be placed per square inch of section of stays if area supported by each has been increased by ⅓, and what must the boiler pressure be reduced to so that stress per square inch section of stay shall not exceed original stress.

Stress held by each stay equals—

$$10 \times 10 = 100 \times 50 = 5000 \text{ pounds.}$$

Sectional area of stay equals

$1.125 \times 1.125 \times .7854 = .994$ square inches, stress per square inch of section before the break $= 5000 \div .994 = 5030$ pounds.

Then stress per square inch of section after the break—

$5030 + ⅓$ of 5030, or $5030 + 1676.66 = 6706.66$ pounds.

Stays before break supported $10 \times 10 = 100$ square inches of surface, and after the break they are called upon to support ⅓ more, or 133.33 square inches.

Original stress per square inch section of stay $= 5030 \div 133.33 = 37.7$ pounds per square inch, to which point pressure must be reduced so that original stress on stays may be maintained.

Example: What is the total pressure on the flat bottom of a boiler 18 feet 6 inches long by 6 feet wide, the pressure of the steam being 30 pounds per square inch, and the depth of water 10 feet 5 inches. Find also the required number of stays 1½ inches in diameter, and what diameter they must be pitched apart when the stress per square inch of section of stay shall not exceed 6000 pounds.

Take a column of water 1 foot high and 1 square inch in area as weighing .434 pounds.

10 feet 5 inches equals 10.416 feet.

$\therefore 10.416 \times .434 = 4.51$ pounds pressure per square inch through weight of water.

Then $4.51 + 30 = 34.51$ total pressure per square inch on bottom of boiler. The boiler is 18' 6" by 6' $= 18.5 \times 6 = 113$ sq. feet area.

$113 \times 144 = 16272$ area of boiler in square inches.

$16272 \times 34.51 = 561{,}546.72$ pounds total weight bottom of boiler is called upon to support.

Area of stay equals $1.5^2 \times .7854 = 1.767$ square inches.

$1.767 \times 6000 = 10602$ pounds weight that one stay is capable of holding up.

$561{,}546.72 \div 10602 = 53$ nearly number of stays required.

Or we might say since each stay is capable of supporting 10602 pounds, $10602 \div 34.51 = 307$ square inches area of plate each stay can support.

16272 total area of boiler $\div 307 = 53$ number of stays required.

$\sqrt{307} = 17.5214$ inches distance from centre to centre of stay.

The Acetylene Lighting Company has been formed at London, Ont., to manufacture apparatus for the production of acetylene gas.

The Canadian General Electric Company are supplying a 1,000 light direct-connected, incandescent lighting plant to the Gutta Percha & Rubber Mfg. Co. This installation will be, when finished, one of the most complete in the country. The machine is of the steel frame, ventilated armature type, direct-connected to an "Ideal" engine, running at the slow speed of 280 revolutions per minute. The great saving in space, durability and high efficiency, obtained by the use of these direct-connected units, has led to their almost exclusive adoption as the standard machine where it is desired to obtain the best and most economical conditions in operating an isolated incandescent lighting plant.

The Colonial Lighting Syndicate is said to be endeavoring to secure control of electric light, gas and street railway systems in Ontario. A recent issue of the Belleville intelligencer says: The proprietor of this paper has been in regular communication for many months with a Toronto firm acting in the syndicate's interests, and we are given to understand that if the negotiations go through, it is the intention of the syndicate to extend the road to Tweed, using heavy rails that will enable the C. P. R. to haul their cars to and from that village, a contract for that purpose to be entered into with the railway company. We also understand that Sir William Van Horne has agreed to give a certain sum of money towards the enterprise. The street railway is also to be run to Trenton. The object of the syndicate is to secure a number of similar enterprises in Canada, operating these under one system, which it is now doing in Ceylon, where the representative now in Canada has been for twelve years.

ELECTRIC RAILWAY DEPARTMENT.

THE WEST INDIA ELECTRIC COMPANY.

REFERENCE has been made in previous issues of this journal to the formation of a company, composed chiefly of Canadian capitalists, to build an electric railway at Kingston, Jamaica. The directors of the company, which will be known as the West India Electric Company, Limited, are: F. S. Pearson, of New York; Hon. Senator L. J. Forget, W. B. Chapman, William McLennan and C. E. L. Porteous, of Montreal, and E. A. Haggart, of Jamaica, the latter representing the Board in the island. Some of these gentlemen have just returned from Jamaica to Montreal, and report the undertaking as progressing favorably. The old street car system has been taken over and contracts awarded for the building of the new road, which will be about twenty-five miles in length, with possible extensions, and will cost in the vicinity of half a million dollars. It is also probable that electric lighting will be taken up.

Recently the new directors reduced the fares one-half, and the first day's earnings are said to have shown an increase of 30 per cent.

The company are fortunate in having secured as their

MR. HENRY HOLGATE, C.E.
Manager West India Electric Company.

manager Mr. Henry Holgate, in whom for nearly three years has been vested the management of the Montreal Park and Island Railway. Mr. Holgate was born at Milton, Ont., in the year 1863. After serving his apprenticeship in railway work, he became chief engineer of the combined Northern and Great Northern Railways, which were merged into the Grand Trunk in February, 1888. Four years later he resigned to accept a position as engineer with the Central Bridge and Engineering Company, of Peterboro', and in June, 1894, removed to Montreal and became engineer for the Royal Electric Company, superintending the building of their new factory. At that time the directors of the Royal Electric Company were interested in the Montreal Park and Island Railway, and Mr. Holgate was transferred to the management of this road in June, 1895, in which capacity he has since continued.

Mr. Holgate's extended railway and general engineering experience should prove of great benefit to him in his new field. We are pleased to present his portrait herewith.

LEGAL.

LONDON STREET RAILWAY CO. VS. CITY OF LONDON.—The Board of Judges rendered their decision last month in the appeal case of the London Street Railway Company against an assessment on rails, poles, wires and cars, the judgment upholding the assessment. In order to simplify matters, the appeal was argued in two sections: 1st, against the assessment of $80,000 on rails, poles and wires as real estate; and 2nd, against the assessment of $50,000 on the cars as personal chattels of the company. Judge Hughes and Judge Elliott entirely agreed in upholding the Court of Revision in both instances, Judge Finkle holding the cars to be non-assessable. Judge Hughes, in his judgment, pointed out that the statutes under which the company operated curtailed the common-law right of the public to the use of the road by giving an exclusive occupancy for the time being of their cars, rails, poles, wires, etc. He therefore held that it was the public and not the company which enjoyed merely an easement of the street, and quoted Chancellor Rose's decision in the case of the Consumers' Gas Co. vs. Toronto, in support of this contention. This decision of the Supreme Court, he thought, exhausted everything that could well be said on the subject, and settled the law in the main features of the present case. His judgment in part was as follows: "I therefore think the appellants, as respects this subject of appeal, must be dismissed, and the decision of the Court of Revision in respect thereof upheld and affirmed, with costs to be paid by the appellants of the company. As to the cost of construction, I must believe that there was no real intention of placing a separate or enhanced tax upon the costs; of placing the other subject of assessment, i.e., realty, beyond what they are worth if so placed, for I cannot understand that if in the valuation of this property the assessment commissioner or the Court of Revision ever intended to place a tax upon property beyond the intrinsic value when assessed. How, for instance, can a bridge be assessed at the value of the cost of its construction supposing the contractor who built it received a great deal more or a great deal less than it is worth, or because he so slighted his work that it is not nearly so safe or efficient for the purposes that it was intended or contracted for? In respect to the assessment of the cars of the appellants company, I regard them as movable chattels, which are not attached to the freehold or the wires, poles, or machinery of the railway, much less the rails upon which they are propelled. The propelling power, electricity, by no means fastens them to the freehold. . . . And therefore, in the absence of proof which would bring the chattels of the railway company within some one of the exceptions provided by the Assessment Act, that they are otherwise assessable, I would uphold and affirm the Court of Revision in respect thereof, and dismiss the appeal on all parts with costs to be paid by the company." In his judgment, Judge Elliott recited at length the contentions, and asked if there was any substantial difference between gas pipes and rails on the street with regard to the occupancy of the soil. The decision of the Supreme Court in the case of the Consumers Company vs. Toronto held that there was not. The judge went on to quote extensively to show that there was no reasonable distinction between the two cases, and wound up the first part with the brief line: "I therefore conclude that the objection is not tenable." Regarding the second point, the judge held that the cars differed from the rails, poles and wires, which if separated from the main building would render the whole inoperative, and he went on to say, and therefore thought the cars assessable as personalty at $50,000. Judge Finkle also held that the case of the Consumers' Gas Company was not distinguishable from the case in point, and gave judgment accordingly. "As to the cars," said he, "I am unable to satisfy myself that the cars are realty. . . . I feel that the ars care not a class of property liable to assessment, and decline to ratify the assessment of the Court of Revision, and direct that the assessment as to street cars shall be stricken out, and that the costs in this particular class shall be paid by the city of London."

SPARKS.

John Campbell, of St. Thomas, Ont., is installing a 100-light dynamo in his mill.

The telephone cable between Quebec and Levis was carried away by the ice recently.

The Canadian General Electric Company have installed an isolated plant for Messrs. A. & J. Clarke, Bullocks Corners, Ont.

The village of Huntingdon, Que., has purchased the electric light plant from the Stadacona Water, Light & Power Company.

Manager Leather, of the Hamilton Radial Electric Railway, says the line will be extended to Bronte by May 1. The road has been built into Burlington.

The British Columbia Iron Works Company, of Vancouver, have placed an order for a 10-kilowatt, direct connected, steel frame, incandescent lighting generator with the Canadian General Electric Company.

The Shipton Electric Co., of Danville, Que., have decided to proceed with the extension of their power plant this winter, and have made a contract with the Jenckes Machine Co., of Sherbrooke, for one of their Crocker turbines, horizontally set, with penstock and draft tube complete.

The proposition to build an electric railway from Amherstburg to Windsor came up at a recent meeting of the Amherstburg Council. It was stated that a Mr. Jacobson was willing to build the road on the same terms as the Windsor, Amherstburg & Lake Erie Railway, whose by-law was defeated.

The Dominion Wire Company, of Montreal, have elected officers as follows: James Cooper, president; C. W. Vollmann, vice-president; J. C. McCormick, managing director; F. W. Fairman, assistant managing director; H. Horsfall, works superintendent; Albert Hannah, secretary-treasurer.

Mr. Frank Jaynes, general superintendent of the Western Union Telegraph Company, states that his company are preparing to extend their line to Victoria and Vancouver, B.C. The route likely to be adopted is the one followed by the C. P. R. cable, a land line being built from Anacortes to the Terminal City.

The electric lighting system was recently inaugurated at Magog, Que., and is said to be very satisfactory. For private lighting the following rates are charged for 16 c.p. lights: Private dwellings—3 lights, $3.25 per annum each; 4 to 5, $3 each; 6 to 9, $2.50 each; 10 to 19, $2.25 each; 20 and over, $2 each. Stores—3 lights, $4 per annum each; 4 to 5, $3.25 each; 6 to 9, $3 each; 10 to 19, $2.50 each; 20 and over, $2.20 each.

David Russell, of Montreal, John Joyce, of Boston, William Straham, and others, will apply to the Quebec Legislature for incorporation as the Shawenegan Water & Power Company, with power to acquire and develop water powers on the Saint Maurice and Shawenegan rivers; for general powers for the development of power, generation of electricity, the sale and leasing of the same, and the manufacture of calcium carbide, acetylene gas, electric light and other products.

At the Toronto Technical School 171 pupils have succeeded in taking certificates during the past year, and four have been awarded diplomas. Those winning diplomas are as follows: J. Chalkley, trigonometry, applied mechanics, perspective, graphic statics, descriptive geometry, and building construction; Walter Inglehart, applied mechanics, steam engine, electricity, machine drawing, and machine construction; E. W. Adams, trigonometry, applied mechanics, steam engine, sound, light, graphic statics, and euclid; R. H. Chalkley, trigonometry, applied mechanics, algebra, euclid, perspective, graphic statics, descriptive geometry, and building construction.

The Standard Light and Power Co. has absorbed the Temple Electric Co., situated on Chenneville street, Montreal, which supplies electricity to a large number of business firms. The deal was practically arranged a month ago, but the directors of the Temple Company only recently met and gave a formal consent to the sale, which makes the Standard Company one of the most important electrical concerns in Canada. The Lachine Rapids Hydraulic & Land Company will in future furnish the power to the Standard Company under a contract just made, and which means the turning over of many thousands of dollars. The Lachine Company has also brought to a successful consummation its efforts to supply power to the Imperial Electric Co. for five years.

SPARKS.

Taylor, Telfer & Co. are successors to the electrical supply business of C. W. Henderson, Bleury street, Montreal.

The Royal Electric Company have taken over the electric light plant at Aurora, Ont., from the Metropolitan Lighting Company.

The Canadian General Electric Company are installing a 100-light incandescent plant for the Tillson Company, Limited, of Tilsonburg, Ont.

The St. Lawrence Sugar Refinery Company, of Montreal, have placed an order for two 45-kilowatt incandescent lighting dynamos with the Canadian General Electric Company.

The car barn of the Port Arthur Electric Street Railway, including rolling stock, was burned to the ground on December 15th. The railway and plant is owned by the town.

The street car system at Moncton, N.B., has not been a financial success, and the directors of the company have decided to discontinue the service during the winter months.

The Edwardsburg Starch Co., of Cardinal, Ont., are installing a 1,000-light incandescent plant. The Canadian General Electric Company have the contract for the complete installation.

Mr. J. B. McWilliams, of Peterboro', Ont., is said to have interested English capitalists in the water power of the Otonabee river, and as a result a company may be formed to develop the power.

The British Columbia Electric Railway Company is now experimenting with two kinds of fenders on their cars in Victoria, and the one found most satisfactory will be adopted for the cars of the entire system.

The Auburn Power Company, of Peterboro', Ont., have placed an order with the Wm. Hamilton Mfg. Co., of that town, for two new water wheels. These wheels will enable the company to double their electrical output.

It is proposed to hold a "Pan-American" exhibition in 1899. The site proposed is Cayuga Island, containing about 175 acres on the Niagara river, a few miles above the Falls. In view of the vast amount of power in the vicinity, it has been suggested to the promoters that electricity should predominate in the exhibition, including the restaurants, where the products of electrical cooking will be obtainable in a variety of forms.

TRADE NOTES.

The Canadian General Electric Company are supplying a 350-light incandescent plant for the new Booth elevator at Parry Sound.

The Windsor Plaster Co., Windsor, N. S., are lighting their works by electricity, and have given the order for the electrical equipment to the Royal Electric Co.

The Kent Mills Company, of Chatham, Ont., have purchased an incandescent lighting generator from the Canadian General Electric Company.

The Dominion Paper Mills, of Kingsey Falls, Que., are installing an electric lighting plant in their new mills, and have placed the contract with the Royal Electric Co.

The Thompson Electric Co., of Hamilton, have recently sold a 35-light arc plant, complete, to the corporation of Parrsboro, Nova Scotia, and a plant of same capacity to the Port Dover Electric Light Co.

The Virginia Mines at Rossland have passed the preliminary stage, and will now enter the list of shippers. An order for a large hoisting plant, with boilers, has been placed with the Rossland branch of the Jenckes Machine Co., of Sherbrooke, and is now on the way from the east.

Attention is called to the announcement in the advertisement pages of this number that the name of the Kay Electric Manufacturing Co., of Hamilton, has been changed to the Hamilton Electric Manufacturing Co. The business of the company will be continued under the new name at the same address as before.

The Weeks-Eldred Co., of Toronto, have removed from the Board of Trade to No. 80 Canada Life Building, where they have very convenient offices. This company recently placed one of their Jones underfeed mechanical stokers in the Windsor Hotel, Montreal, and the value thereof may be estimated from the fact that it is said to have effected a saving of $150 per week.

The W. A. Johnson Electric Company recently sold a 100-light arc dynamo to the Citizens Telephone and Electric Company, of Rat Portage, Ont. This is claimed to be the largest arc machine yet manufactured for sale in Canada. A letter from the company states that the dynamo is very satisfactory, a noticeable feature being the absence of undue sparking at the brushes.

The Canadian General Electric Company have recently closed a contract with the Bushnell Oil Company, of Sarnia, for a 25-kilowatt, direct connected, steel frame, incandescent lighting generator, coupled to an Ideal engine. This installation will embody all the latest improvements in direct connected practice, which the Bushnell Company, from their connection with the Standard Oil Company of the United States, have learned to value through their experience there.

CANADIAN GENERAL ELECTRIC CO.

(LIMITED)

Head Office:
65 Front St. W.,
TORONTO

Factories:
PETERBOROUGH, ONT.

Branch Offices:

MONTREAL
HALIFAX
WINNIPEG
VANCOUVER
NELSON, B.C.

NEW LONG-BURNING ATLERNATING ARC LAMP

A MONEY MAKER