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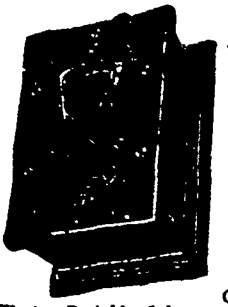

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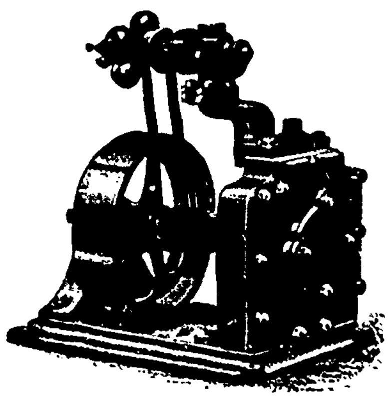

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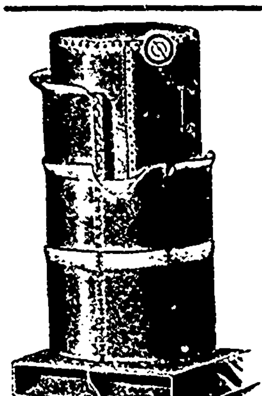

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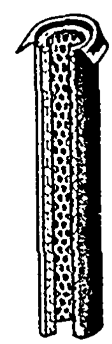

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CANADIAN

ELECTRICAL NEWS

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STEAM ENGINEERING JOURNAL.

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THE FIRE AT THE TORONTO ELECTRIC LIGHT COMPANY'S WORKS.

ON Thursday morning, Jan. 21st, a most disastrous fire occurred at the works of the Toronto Electric Light Company, which resulted in the total destruction of the arc lighting plant. The building, which was a frame iron-clad structure, was the first building erected on the site some ten years ago. At that time it was considered quite a building, and amply large enough for the work for many years to come, but the rapid extension of the business of incandescent lighting and motor power necessitated other and larger buildings, notably the one completed but a few weeks before the fire—an entirely fire-proof structure, containing two one-thousand horse

VIEWS OF THE TORONTO ELECTRIC LIGHT COMPANY'S PREMISES, PREVIOUS TO THE RECENT FIRE.

power engines and 500 k. w. generators. The burned building was used exclusively for arc lighting, with sufficient power generators and alternating current machines to take the night load after midnight, when the plant in the western building was shut down.

The building contained sixty-two dynamos, of all sizes from 25 to 125 lights capacity each, and 4 pairs of horizontal Brown-Corliss engines of 500 horse power each, and 6 lines of shafting 62 feet long. The building was fairly well supplied with fire-extinguishing apparatus, including 4 sets of hose and nozzles, 15 extinguishers and innumerable pails kept well filled with water. It was thought that the continuous presence of workmen, during the entire day and night, together with these appliances, were a sufficient safeguard against any danger of loss by fire. Events proved differently, however.

The final cause of the catastrophe is somewhat difficult to arrive at. It appears that at about 4 o'clock in the morning, when all machinery was of course in operation, fire was discovered under one of the dynamos on the ground floor near one of the lines of shafting. According to orders in such an event, the engines were stopped, and the hands, together with the watchman whose duty it was to look after these matters, put out the blaze by using the extinguishers. After it was all out, and the wet belts taken from the dynamos in the vicinity, the engines were again started. This would probably be some fifteen or twenty minutes after the fire was out. The cause of what followed is now only a matter of conjecture. It appears that the various lighting circuits had only been fairly started when a sheet of flame shot up from the upper floor and appeared to envelop the entire building in that part. So rapid was its spread that, although the men sprang to the engines some of them were never shut down, and the man who remained to do it had to make his exit by a window. Just as many theories as to the cause of this second fire are advanced as there are individuals to express an opinion. The most probable one is that the acid from the extinguishers used may have sprayed upon some of the many wires, penetrated the insulation and even carried the high voltage current over the wet porcelain insulators. Be the cause, however, what it may, the fact remains that at 5 o'clock on the morning of the 21st of January, the Toronto Electric Light Company found themselves without an arc plant.

There are used for city lighting alone about eleven hundred lights, and for commercial use from five to six hundred more. No time was lost; while the fire was yet burning men were at work erecting new poles to carry the wires into other buildings, and the manager of the company put himself into communication by telephone and telegraph with every place at which it was likely that dynamos could be obtained. The response by the companies appealed to was both prompt and effective. The General Electric Co. had some dynamos of various kinds in stock, and they worked with a will. A car was loaded and shipped special from Peterboro'. At 4 o'clock p. m.—within seven or eight hours of the fire it was backed into the siding of the Electric Light Company's works in Toronto. Two more cars were shipped and arrived a few hours afterwards. On receipt of a telegram from Toronto the Royal Electric Co. of Montreal put gangs of men to work to take out dynamos from their lighting stations, and even the machine used by them for testing lamps in their factory was included. These were loaded upon cars and attached to the night express, reaching Toronto next morning. Within six hours of the fire a number of the latest type of Brush machines, of 125 lights capacity, were purchased and shipped from Cleveland and Lynn.

The result of this work was that the city was at no time without light. The company had a few small dynamos in their power station. These, with what reinforcements could be got in operation the first night, provided about 300 lights. This was sufficient for the centre of the city, and by using alternate lights in the outside districts the ground was fairly covered. The second night, with the exception of the extreme northwest section, a stranger would not have noticed anything unusual, and the succeeding five nights the number was added to until, within one week of the fire, the entire number was again in operation. Two dynamos were placed in the power house of the Toronto Railway Co. and a number in the incandescent light station of the Toronto Electric Light Co. at Terauley street the remainder on the engines at Scott street and the Esplanade, that were used for driving power generators.

When the weight of the machinery required for this work is taken into consideration, as well as the intricate and delicate adjustments required, and the disorganization of the circuits caused by the loss of the distributing switchboard, it will be seen that the work done was an achievement of no ordinary magnitude. Within 36 hours of the fire the employees of the company handled and placed in position close upon one hundred tons of machinery.

In speaking of the fire Manager Wright was most enthusiastic in his expressions of appreciation of the manner in which the companies concerned came to his assistance, and of the untiring and devoted energy of his employees.

The Toronto Electric Light Company intend to replace the burned building with an entirely up-to-date fire-proof structure, so that a recurrence of the disaster will be rendered an impossibility. The engraving we present shows the works of the company as they were before the fire. The engine in the upper left hand corner is one of those just installed in the new power house for driving power generators. The building shown to the left foreground of the picture is the one destroyed. A steam derrick has been erected in the ruins to handle the heavy machinery and get the ground cleared for the new works at the earliest possible moment.

THE CHAMBLY POWER WORKS.

THE works for the utilization of the water power at Chambly, Que., are making satisfactory progress. A concrete dam is nearing completion, which will make possible the development of 20,000 h. p., delivered to shafts in eight units, besides two units for exciters. The generators will be direct coupled to water wheels, and each unit of generator will be 2650 h.p. capacity. These generators are now in process of construction at the Royal Electric Company's works at Montreal. They are to be two-phase "S.K.C." inductor type alternating current, generating current direct from the machines at an impressed E. M. F. of 12,000 volts. There are a number of novel features connected with the working out of the enterprise—one being the high electromotive force of the generators and another the capacity of the machines.

CHEMISTRY IN THE BOILER ROOM.

PART II.

By WM. THOMPSON, Montreal West.

BEFORE we proceed to the study of what takes place during combustion, it it necessary that we should briefly consider certain substances called "elements." An element is a substance that cannot by any means known to chemistry be reduced to a simpler substance. Iron, for instance, is an element—so is silver, carbon, oxygen, hydrogen, and many other substances which it is not necessary for me here to mention. In addition to the substances called elements, we have other substances called "compounds." A compound is a substance made up of two or more elements, held in mechanical or chemical combination, and can by certain processes be reduced to its simpler elements. For instance, water is a compound of the elements hydrogen and oxygen; coal is a compound of carbon, nitrogen, hydrogen and certain other elements; air is a compound of the elements nitrogen and oxygen.

Substances are said to be held in mechanical combination when the elements composing the compound are able to be separated or distinguished by mechanical means, and differs from a state of chemical combination inasmuch as the elements composing the compound are simply side by side. For instance, the elements iron and sulphur can be ground together in the finest possible atoms imaginable, still they form only a mechanical compound, as both the iron and sulphur retain their original properties and can be separated one from the other by simple mechanical means, and they have not really combined one with the other. But if you heat the substance they enter into chemical combination one with the other—the iron loses its properties as iron; the sulphur loses its properties as sulphur, and they can only be decomposed again by chemical means. The iron is no longer visible as iron, and the sulphur is no longer visible as sulphur—the two elements have combined together to form a new substance, a compound of iron and sulphur, known in chemistry as iron sulphide. Just so long as they were held in mechanical combination they remained iron and sulphur, each retaining its own peculiar properties, but when they were brought into chemical combination by means of heat the properties belonging to both the iron and sulphur disappeared, and a new substance was formed, with entirely new and different properties.

As the reader is no doubt aware, there are a great many different grades of coal, and generally divided into two distinct classes, known as anthracite (hard) and bituminous (soft), both of which are largely used for the production of power.

For our purpose we will take a sample of Welsh coal, the analysis being as follows: Carbon, 85%; hydrogen, 5%; nitrogen, 1%; sulphur, 1%; oxygen, 3%; and incombustible matter, called ash, 5%. This sample of coal then is a chemical compound containing these various elements in different proportions, and before it can be changed into any other substance, decomposition must take place.

Atmospheric air is composed of nitrogen and oxygen in mechanical combination in the proportion of 4 parts of nitrogen to 1 part of oxygen by volume, and by weight, 77 of nitrogen to 23 of oxygen.

To enter into the philosophy of chemistry in this article is not my intention, but to make the matter clear it will be necessary to discuss the properties of each element and also the properties of the different compounds when in combination with each other. We have the following elements to deal with, only two of which are solids, as follows: carbon, solid; hydrogen, gas; nitrogen, gas; oxygen, gas; sulphur, solid. The reader already knows that the bringing into combination of the atmospheric air with heated coal, causes the coal to burn and give out heat. This is, however, far from being the mechanical operation so often imagined. What really does take place is that the oxygen of the air enters into chemical combination with heated coal, and this very act of combination gives out the light and heat so often noticed. When chemical combination between substances has taken place, new substances are formed, just as when iron and sulphur are chemically combined iron sulphide is formed. Let us now review briefly the properties of each element when dealt with separately. To do this properly requires a certain amount of laboratory training, so that each element may be separately dealt with, and its various properties discovered. A description of experiments to be carried out is much too long for this article, so we will simply state well-known facts relating to each element in question.

CARBON is an element that occurs extensively in nature in many forms. The form in which we get it in the present instance is the well known substance "coke." Carbon has strong affinity for oxygen, and combines with it in two proportions under certain conditions.

HYDROGEN is a colorless, inodorous, tasteless gas, of a very light nature, being 14½ times lighter than air. It is combustible, but does not support combustion. It will combine with oxygen to form water, in the proportion of 2 parts hydrogen to 1 of oxygen by volume, or 1 part hydrogen to 8 parts of oxygen by weight.

NITROGEN, as already stated, forms four-fifths the volume of the air. It neither burns nor supports combustion, and acts as a diluting agent with oxygen. It has been said it is simply in mechanical combination in the air with oxygen; that is, the atoms of each are simply side by side, each retaining its own peculiar properties.

OXYGEN is in present instance our most important element, and a proper understanding of its power to combine with carbon forms the most important part of an engineer's education. Pure oxygen is a strong supporter of combustion, and combines readily with many elements, in each case giving off light and heat. With carbon it forms two highly important compounds, known as carbon dioxide and carbon monoxide—carbon dioxide being the result of perfect combustion and carbon monoxide the result of imperfect combustion. While oxygen supports combustion, it is not combustible itself, all its properties being practically the reverse of hydrogen.

Nature has provided that the elements will only combine together under certain conditions and in certain well-defined quantities, and it is the understanding of these conditions and quantities that makes the study of chemistry of any value to us. If carbon and oxygen simply united in any proportion, and when in combination each was destroyed, then we should require no knowledge of chemistry, but every fireman knows he must get so much air from the atmosphere, must kindle a fire before it will burn, and must maintain a current of air through his fires, and that the intensity of his air current enables him to burn a given quantity of coal in a given time. This simply goes to prove that there are conditions as to what oxygen shall be supplied, and governing the temperature at which the two elements will combine. For instance, just so long as iron and sulphur remained together at a low temperature no change took place, but as soon as a given quantity of heat had been imparted to the substance combination took place; and if we test carefully we shall find there is a certain fixed quantity of heat required, and that a certain temperature must be reached before chemical combination sets in, and that in every case these two elements require the same number of heat units and same temperature to be reached—enabling us to determine exactly what is required to change iron and sulphur into iron sulphide.

The same thing can be said regarding coal. Just so long as the compound remains at a given low temperature, decomposition and combination with oxygen will not take place. You can pass all the air you like over coal in its normal condition and you will get neither light nor heat, but heat the coal to a sufficiently high temperature and combination at once sets in, and decomposition of the compound of coal takes place. This is well illustrated in the manufacture of gas. A coal compound, chosen for its richness in gaseous elements, is placed in a closed retort, secure from admission of air, and a fire built underneath to heat the coal, which is decomposed, all the gases being liberated, the carbon and solids only remaining—proving that a compound of coal can be decomposed into its elements by heat, and that the element carbon is of such a nature that it will not pass into a gaseous state by the application of heat alone, as did the other elements contained in the coal. I want to impress my readers with the importance of this natural law, as it is of vital importance to engineers. I have said hydrogen combines with oxygen to form water, but only on certain defined conditions and in given quantities. Hydrogen and oxygen can be mixed together in exact quantities, and they will still remain in mechanical combination, but the moment they are heated up to a given point chemical combination sets in with such rapidity that an explosion occurs, and instead of the two gases we formerly had we have a liquid called pure water—very much smaller in volume but equal in weight to the weight of the gases before combination took place. Then we have a fixed point of combination and also a fixed quantity. If in the mechanical compound of the two gases we had an excess of hydrogen or oxygen the excess of either gas will remain behind in an uncombined state, showing that hydrogen will only combine with oxygen to form water in one fixed proportion, and hence excess of either of the elements can be considered as so much waste.

What I want to make clear is the important fact that carbon and oxygen will combine together in two different proportions and form two gases with entirely different properties, in each case giving out both light and heat, but in proportions that simply astonish the engineer, and the power to understand this fact is our most important duty.

(To be Continued.)

KINKS WITH THE STEAM ENGINE INDICATOR.

The indicator, while it is primarily intended for indicating the performance of an engine, can be utilized for a number of other purposes and will frequently serve to assist an engineer out of a predicament. This article will be devoted to some of the special employments to which the instrument may be put.

There is a convenient method for measuring the speed of an engine by the use of the indicator which may be exceedingly useful in case the speed counter is not at hand, as is often the case, and the speed of the engine is high.

The indicator being connected to the engine at either end of the cylinder, the procedure is as follows: Disconnect the cord from the reducing rig and take it in the hand as shown in Fig. 1. At a given instant press

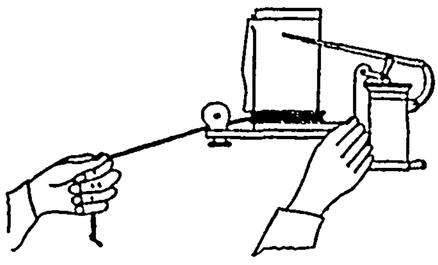

Fig. 1.—Measuring Speed of Engine.

the pencil motion against the drum, at the same time drawing out the cord with the hand, releasing the pencil motion after a certain definite time has elapsed. A record such as is shown in Fig. 2 will be produced. It is obvious that the number of crests to the jagged record indicate the number of revolutions that have taken place in the interval, and from this the speed of the engine can be calculated.

The engineer who has handled an indicator but little sometimes finds it difficult to appreciate the fact that it may be used with advantage in scores of other places about the plant than the engine. Oftentimes many a "freak" card may be explained by taking a diagram with the indicator tapped into the pipe connecting the two cylinders. Where a receiver is used, this application of the indicator would show little or nothing, as the pressure in such a receptable is quite constant. In the steam pipe before it enters the engine the indicator has been used to demonstrate the necessity for a steam reservoir or cushion. A Bourdon gauge attached to a

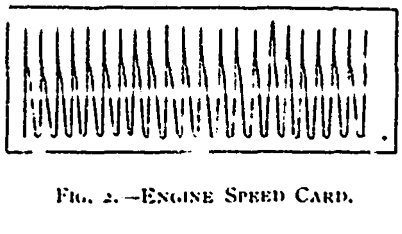

Fig. 2.—Engine Speed Card.

shaking steam pipe will be as much effected by mechanical jar as by variable pressure, but by means of the indicator the momentary drop of pressure on admission, or the sudden use at cut-off due to the inertia of the steam, can be shown and measured, and judgment can be passed as to whether or not a reservoir will lessen these evils. Indicators can be used on steam pumps, applied to either the steam or water cylinder, on gas engines or any appliance where there is a variable pressure to be measured. Care must be always taken to anticipate the pressure nearly enough to use a spring of proper scale. The pressure can be recorded with reference to any mechanical event by using a suitable reducing motion connected to the mechanism with reference to which the record is to be taken.

Governor cards indicate almost as much about the regulation of an engine as do the ordinary cards about the events of the stroke. Fig. 3 shows such a card. The method of obtaining it is as follows: Load the engine with some power consuming device that can be thrown off either instantly or gradually, as may be preferred. A dynamo is very suitable for this purpose. Have the indicators ready, the drums oscillating and the pencil movement in motion. Let there be two men, one to operate the indicators and the other to manipulate the engine load. At a given instant let the load be suddenly varied and at the same time press the pencil motions of the indicators against their drums, having previously taken the record with the original load. Hold the pencil motion on until the engine seems to have attained a steady speed and the record similar to that of Fig. 3 will result.

The card thus taken is significant of many things. On it there are two cards which are made quite plain by frequent retracing. One lies within the other. These are the initial and final load cards. The number of complete cards between these two, or rather, other than these two, is the number of complete revolutions that the engine made before it succeeded in readjusting itself to the new load. On a good engine this number is very small.

The card serve to show also how the engine accomplished its speed control, whether by legitimate control of the cut-off or by varying some of the other events also, the latter always being more or less objectionable.

Fig. 3.—Engine Regulating Card.

A governor card losses its value as such if the load is gradually varied, for the intermediate cards will then indicate a gradual and proper control of the steam distribution to fit the gradually increasing or diminishing load, as the case may be.

If, however, there are but two loads, a maximum initial load and a minimum final one, any card between the two indicative of these loads is one of transition and taken while the engine was regulating.

The necessity of being able to take cards at a given instant has been shown in the foregoing, and this need would be more apparent in a test on a multiple expansion engine with two indicators on each cylinder. Without such simultaneous record, the result would lose much of its value and the cards would certainly not be comparative. This simultaneous action can be conveniently accomplished by the use of the electro-magnet. An electro-magnet can be so placed on each indicator that when the former receives current it will press the pencil motion against the drum, and on the breaking of the circuit the pencil motion can readily be caused to fly back by means of a spring. Connecting the magnets of all the indicators in series, they will form a circuit of high resistance and should be worked by a number of cells in series or by a 110 volt electric light current.

Ordinary magnets, such as are used on electric bells, will answer excellently, and five or six of them in series will offer enough resistance so that an electric light current can be used with safety. If there are only one or two magnets they should be protected from excessive currents by placing them in series with one or more incandescent lamps connected in multiple, or else a battery should be used. A switch or push button gives appropriate control. The application of these magnets will be different with different makes of indicators, and it would take too much space to describe them all. A little ingenuity will always solve the problem. It may be necessary to fasten a metal strap to some part of the pencil motion support in order to enable the magnet to actuate it. Such electro-magnetic mechanisms are sold with some indicators as a regular part of their equipment. -American Electrician.

BY THE WAY.

Mr. T. L. Willson, of acetylene gas fame, has been taking an active part in the discussions at Hamilton relative to the utilization in Canada of the power of Niagara. Among many other things he is credited with having said that it cost him upwards of $300,000 to make available 1000 horse power on the Welland Canal, and for this amount 60 h.p. could be made available at Niagara. Some acetylene or other kind of gas appears to have found its way under Mr. Willson's hat.

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The individual who in Canada is caught in the act of tapping an electric wire or a gas main is promptly called upon to show cause why he should not be sent to jail. It is different in Germany. The Superior Court of that country recently decided that electricity, not being a movable object, could not be stolen. In pursuance of this peculiar method of reasoning, a man who had tapped the mains of an electrical company to get current with which to operate his motors, was acquitted of a charge of wrong-doing.

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The number and capacity of electrical manufacturing establishments in Canada, have so increased as to sometimes cause me to wonder how it is found possible to sell so large a quantity of electrical goods in a country with a comparatively small population. The fact, however, that these manufactories are constantly busy and that several of them have found it necessary to enlarge their facilities, is proof of the existence of a steady growth of demand. There is also the additional evidence before us that last year electrical goods to the value of nearly a quarter of a million dollars were exported to Canada from the United States.

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Prof. Henry A. Rowland, of the Johns Hopkins University, is said to have brought to commercial perfection a multiplex printing telegraph, by means of which an operator can transmit a telegram written upon a typewriter and have it reproduced in typewritten form at the receiving end. In addition to the typewriting part of the invention, Dr. Rowland, with his new machine, can send over the same wire five or six different messages at the same time in one direction, which, in duplex, makes ten or twelve messages that can be transmitted on the same wire at the same time. Thus, with five operators at each end of a line, sending each an average of thirty words a minute, three hundred words can be transmitted each minute. The current of electricity transmitting the message can be relayed, and in this manner the invention can be operated for great distances.

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The remarkable statement was made to me the other day, by a gentleman who has had a thorough training and wide experience in mechanical matters, that for twenty years the city of Toronto spent twice the amount of money which was necessary for coal for the city waterworks pumping station. It may be remembered that only within the last three or four years, and since the introduction of the Hawley down draught furnace, has soft coal been used at this station. Prior to that time hard coal was employed, costing all the way from $3.75 to $5.00 per ton. The gentleman to whom I have referred makes the claim that the credit which has been given by the City Engineer to the down draught apparatus, for the large saving effected in cost of fuel, is one to which it is not entitled, inasmuch as soft coal might have been used during the years above mentioned, apart from the use of any such special device. My informant states that he has always used soft coal on ordinary furnace grates and without any artificial draught, the sole requirement being that the fireman must attend strictly to business and feed the fuel frequently and keep the grates clear of ash. "Once, during a strike at the coal mines," said he, "we were obliged for a time to burn hard coal, and it almost ruined us; yet the city, as previously stated, used nothing else for nearly a quarter of a century."

MONTMORENCY ELECTRIC POWER CO.

The Montmorency Electric Power Co., Quebec, have decided to make extensive improvements in their generating station at Montmorency, and also in their substation in Quebec, and with this object have contracted for machines of more modern type and of larger capacity than those they are now operating. The entire arc lighting plant, including water power equipment, will be discarded, the intention being to put in water wheels of larger capacity and better adapted to the conditions. In making the alterations to the arc lighting plant it is the intention to install new arc machines, recently purchased, of the Brush type, in the sub-station in Quebec, each machine being of 125 lights capacity. Two of these machines will be coupled to one synchronous motor of 200 kilowatt capacity, of the Stanley type, manufactured by the Royal Electric Co., of Montreal. Two of these motors will be installed, each motor driving two machines. The above changes are expected to be completed about the middle of May, when the company will be able to lay claim to having one of the most modern plants in existence. In the advertisement pages of this number the company offer for sale the material which they have been compelled by the proposed changes to discard.

The amount of capital invested in electric mining machinery in the United States, says the New York Times, is estimated to be over $100,000,000, while that invested in stationary electric motors, used for the operation of machinery of all kinds and in all manner of shops, is over $60,000,000. The number of electric motors in use is not definitely known, but is believed by those best able to judge to be over 500,000.

ANSWERS TO ELECTRICAL PROBLEMS.

1. What is the three-wire system?

ANS. A system of running incandescent lamps with a smaller outlay for copper than the regular multiple-arc system, which is credited to the inventive ability of Thomas A. Edison. It consists of two multiple-arc circuits side by side, and the middle wires combined in one, that is, the positive of one circuit and the negative of the other are represented by one wire. This requires two dynamos in series, and when all the lamps are burning we virtually have a multiple series circuit with two lamps in series across a 200-volt circuit, for the dynamos being in series we have 200 volts between the outside wires and two 100-volt lamps in series, thus obtaining the advantages of a higher voltage with only 100 volts between the lamp terminals, and allowing a smaller wire to be used. If, however, we turn out lamp number one, the current through lamp number two goes down the middle wire and back to the dynamo through number one. The middle wire is called the neutral or balancing wire, and takes the unbalanced current when there are more lamps burning on one side than the other, and as the burning lamps are practically never all on one side, the neutral wire can be smaller than the others, but in practice this is very rarely done except in very large plants. Should all the burning lamps be on one side the dynamo on that side does all the work, the other running idle, but as the other lamps are turned on it goes to work in proportion to the number switched in.

2. How are dynamos run in series?

ANS. Putting in series is placing the positive brush of one dynamo (or positive wire of a battery) in connection with the negative of the next machine, and in this way we add voltage or pressure, something we cannot do with steam pressure, and which comes under the head of difference of potential.

3. What is meant by ampere turns?

ANS.—One ampere passing once around a piece of iron, or in other words, making one turn around the iron, is called an ampere turn. So if we wind 200 coils around a magnet (or just an open coil, i. e., no iron in centre, called a core) and send 200 amperes through we have 2 x 200 equals 400 ampere turns. The same effect is produced by 800 turns and ½ an ampere, or 40 turns and 10 amperes, just as volts x amperes makes watts, and many combinations produce the same result.

4. What are the main portions of a dynamo?

ANS. It may be said that a dynamo consists, first of a magnetic circuit, which is completed by a body of iron which carries copper conductors and revolves across or in the magnetic current at one point. Take, for example, a plain horse shoe magnet and revolve a disk of iron between its poles, the disk being covered with insulated wire. The magnetic lines flow, or find a path, through the disk, and the revolving wire "cuts" or passes through the lines, and electric currents are set upon the wire. In practice the permanent horse shoe magnet gives way to electro-magnets, on account of greater strength of magnetism. The armature core is made up of pieces of soft sheet iron on which is wound insulated wire for conducting the current to the brushes.

5. How are dynamos calculated for different service?

ANS.—As a start we may say that one volt is produced by the armature wire "cutting" or passing through 100,000,000 magnetic lines per second. For example, we have an armature with the length of wire on each side 10 inches, and having 500 turns of wire on the armature. This revolves in a field of 100 square inches area, and the magnetism is 20,000 lines per square inch. Then there are 100 x 20,000 lines equals 2,000,000 lines in the field. Now, 500 turns of wire will cut 500 times as many lines per second as one turn would, and be equivalent to 2,000,000 x 500 equals 1,000,000,000, which, divided by 100,000,000 equals 10 volts for each turn per second, and running 25 turns per second, or (60 x 25 equals 1,500) 1,500 per minute will give 10 x 25 equals 250 volts pressure from such a machine. The magnetism is calculated from the ampere turns and the quality of the iron, and is not so certain as the voltage unless you know the quality of the iron. This calculation involves too much mathematics for us at this time.

6. What is alternating current and what is direct current?

ANS.—The power is the current as generated in an armature without connection, and consists of waves which go both above and below a medium line, or, as we usually say, it goes "first in one direction, then back again." The direct current is corrected from this by collecting all the waves at their points and taking them off along the line to their work. In passing from one pole piece to another the direction of current is reversed in the wires, and it is while the wire is in the so-called neutral space between the poles that the current should be taken off, that is, after it has gathered all the electricity from the lines cut, they are conducted away before their direction is reversed.

7. Of what use are the carbon points that are used in the Westinghouse circuit breaker, or do they form part of the carrying circuit?

ANS. The carbon contact points and plates in the Westinghouse circuit is of great value and forms a very ingenious arrangement for preventing injurious sparking when the circuit is broken. The carbons remain in contact after the metal contacts are broken, and so carry the current instead of the metal, and thus relieve the metal of any spark, and as the spark does not hurt the carbon materially, it does no harm at that point, although the carbon points can be very readily renewed. This saves the metallic portions of the switch from discoloration and also prevents the unsightly marks on the marble switchboard which are apt to be made with the ordinary switch. The carbons carry the whole current only after the metallic contact is broken.

8. Of what use is a rheostat in the connections of a dynamo?

ANS. The rheostat is placed in the field circuit and is used to regulate the magnetism of the field by allowing more or less current to flow around the field magnets. If the speed should drop a little you can cut out a little resistance, allowing more current to flow, getting more magnetism, and this produces a higher voltage. Also, when the load is suddenly increased or gets up to nearly the limit of the machine, the voltage is apt to drop a little unless it is compounded, and the rheostat allows you to vary the field strength and consequently the voltage.

9. What is meant by "burning out a cross on the line?"

ANS.—This is something that is seldom done in practice now, but consists in sending enough current through line wire to melt the wire which forms the cross or connection from one wire to the other. Assume that the two wires of an arc circuit are side by side and a small bare telephone wire drops across both wires and makes connection through a break in the insulation of each. Now, if we send enough current through to melt the small wire, the cross or connecting wire, and then relieve the cross. This is not recommended as modern practice, however, and removing the wire is the more modern way of keeping a line clear.

10. I have a shunt wound dynamo which I wish to run as motor, how shall I connect it to have it run the same way as at present, as I do not want to change the brushes?

ANS.—Connect it exactly the same as at present, for if the current flows in the same direction through the armature, the current will flow through the field in the opposite direction and thus make the poles different from the dynamo. Study this out, as it makes a good study and will help you with other problems.

11. How does decreasing the voltage increase the amperage?

ANS.—Transforming does not alter the total amount of electricity (volts) except what is lost in the transformation, and as the pressure (voltage) decreases the quantity must increase to keep this value constant, just as using a crowbar in prying a huge stone or heavy weight we move our arm (the pressure) through a long distance to accomplish a very small rise to the weight, but the total work is the same in each case. In the case of the transformer the voltage multiplied by the amperage of the secondary equals the voltage multiplied by the amperage of the primary (less the loss in the transformer). In the case of the crowbar the distance the weight was raised multiplied by the weight raised equals the distance the long end moves multiplied by the power applied less the loss in friction.

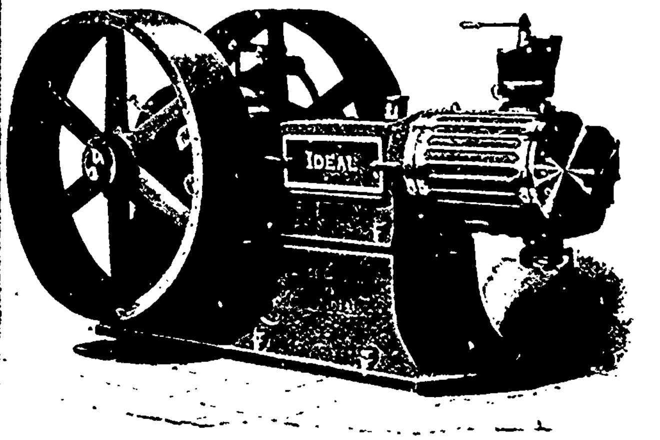
12. What is induction?

ANS.—In the case of electricity it is the current caused or "induced" by the passage (or variation) of current in another wire without actual contact. The transformer is entirely dependent on the induction principle, as there is no contact whatever between the primary and secondary coils. Some of the later alternating dynamos and motors work on the same plan and have no actual contact, but transfer current from the stationary portions to the moving ones solely by induction. The secondary current is said to be induced by the primary, and is often called the induced current.—The Tradesman.

The Canadian General Electric Company have closed a contract with the Toronto Electric Light Company for an additional 450 kilowatt generator to be installed in their new power house. This machine will be a duplicate of that already supplied by them to the same company, in satisfactory operation for some weeks past, being of the belt-driven type and running at a speed of 300 revolutions per minute.

THE "IDEAL" STEAM ENGINE.

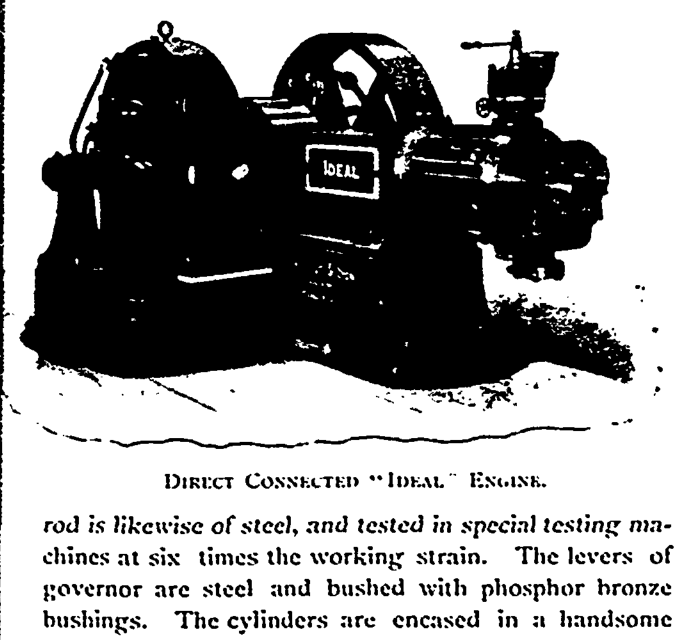
THE three cuts which appear on this page illustrate the "Ideal" steam engine, which is manufactured in Canada exclusively by the Goldie & McCulloch Company, of Galt, Ont. It is an automatic self-oiling engine, and is built for direct connection to slow and medium speed dynamos, for electric lighting and street railway service. The manufacturers claim that it is especially adapted for direct connection because of its range of speeds, quiet running, absolute regulation,



SINGLE CYLINDER "IDEAL" ENGINE.

perfect balance, compactness and absolute lubrication, insuring cleanliness and reliability.

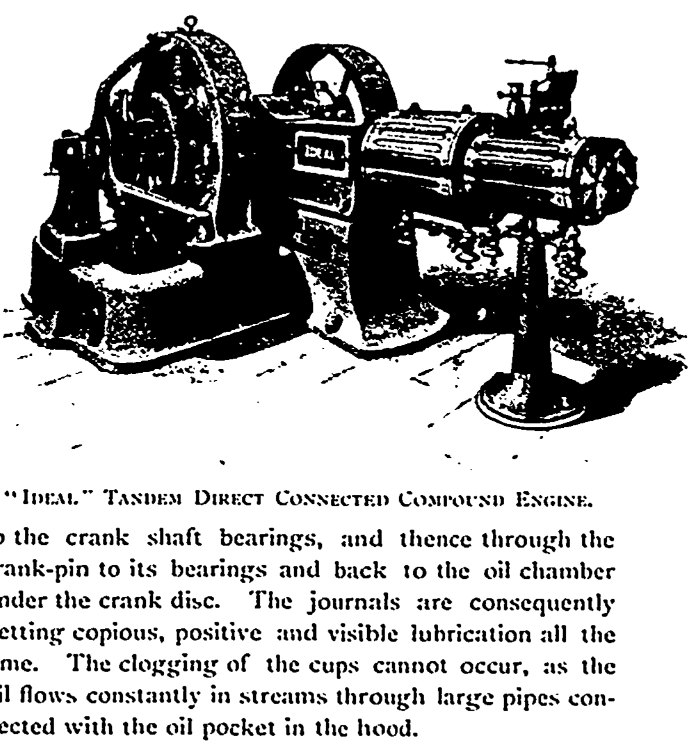
The details of construction are as follows: Cylinders cast of hard, close-grained charcoal iron, finished smooth and receive a high polish. The steam chest is lined with a pair of hard bushings with bridges across the ports, and fitted with the well-known piston type of valve, which is ground to its seat and perfectly balanced. The crank shafts are of larger diameter than usually found in practice, the shaft and disc being cast of gun metal in one solid piece, with open hearth steel center; the crank pin is of tool steel, ground to gauge, and pressed into the discs under hydraulic pressure, ranging from 25 to 50 tons pressure; the cross head is of steel, fitted with bronze slides and removable hardened steel wrist pin; the piston rod is steel and is secured to cross head by thread and massive jam nut; the connecting



DIRECT CONNECTED "IDEAL" ENGINE.

rod is likewise of steel, and tested in special testing machines at six times the working strain. The levers of governor are steel and bushed with phosphor bronze bushings. The cylinders are encased in a handsome paneled iron jacket, with raised surface polished; space between cylinder and jacket filled with non-conducting material. The automatic cut-off governor is simple; the range of cut-off is wide and enables the engine to carry a load largely in excess of rating, as the point of *cut-off is automatically extended to three-fourths stroke* when an increased load requires it. This is considered an important feature in electric railway work, for should the load be unexpectedly increased 50 per cent. for a few hours during the run, as is frequently the case, the engine readily meets this extra requirement. The bearings are cushioned on a film of clear oil.

This engine has a unique system of automatic lubrication. The crank disc is covered by a light hood, fitted absolutely oil tight to the top of the engine frame, but without bolts or fastenings of any description; it is therefore readily removed. The crosshead and guides are likewise fully enclosed, but a side plate for obtaining ready access thereto is also fitted oil tight and held in position only by two cam handles, a quarter turn of which releases it. The engine is consequently more accessible than the ordinary center crank engine, having oil-fenders attached in the usual way; yet no oil can get to the belts or floor. The enclosure is dust-proof, no oil is wasted, the crank-disc dips only about one inch into the oil and none of the parts are submerged. The motion of the discs delivers it by centrifugal force into the pocket extending across the inside of the hood and through a pipe attached to the hood into the oil pocket, through which the oil is carried down in streams



"IDEAL" TANDEM DIRECT CONNECTED COMPOUND ENGINE.

to the crank shaft bearings, and thence through the crank-pin to its bearings and back to the oil chamber under the crank disc. The journals are consequently getting copious, positive and visible lubrication all the time. The clogging of the cups cannot occur, as the oil flows constantly in streams through large pipes connected with the oil pocket in the hood.

The "Ideal" engine, both simple and compound, is noted for quiet running, being entirely free from vibration. The one used at the World's Fair at Chicago for running the electric generators which operated the electric cranes and movable sidewalks, made the phenomenal run of 743 hours, with but one application of oil and without a single stop. Some of its advantantages are that steam is used quickly; it occupies less room; is impossible to run away, for should any part of the generator break the engine will stop; power is applied without the use of speeding-up devices; and ease with which generators can be placed direct on the shaft.

The manufacturers will be pleased to furnish further particulars to interested persons.

The town of Barrie, Ont., are considering the question of controlling their electric light plant.

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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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Electrical Conventions. THE Executive Committee of the National Electric Light Association of the United States has chosen Niagara Falls as the place of the next annual convention. The Canadian Electrical Association have already decided to hold their next meeting at the Falls during the month of June.

Cheaper than Gas. THE Toronto Electric Light Co. announce a reduction in the price of lighting for residence purposes only, of 33⅓ per cent. The reduction is put in the form of discount for prompt payment. The discount, which was formerly 40 per cent. is now 60 per cent. This reduction appears to place the cost of electric light a shade below that of gas, even at the low charge of 90 cents per thousand feet, the figure at which it is supplied in Toronto. At 90 cents per thousand feet the cost per hour of the gas consumed by a five-foot burner would be about 4½-tenths of a cent, while the cost of operating a 16 c. p. incandescent lamp under the new tariff would be only 4-tenths of a cent.

Fire Risk in Central Stations. THE recent destructive fire in the Toronto Electric Light Company's premises, should cause the minds of owners and managers of electric stations to revert to our recent remarks on the subject of "Central Stations as Fire Risks." In view of the danger incident to the use of high currents, and the disposition of the insurance companies to put electric stations in the category of most hazardous risks, and charge accordingly, every owner and manager of a central station should be able to see the wisdom of adopting every possible protective device. In the first place the building in which the electrical machinery is installed should be made as nearly fire-proof as possible. New buildings which are specially put up for the purpose should in every case be built entirely of fire-proof materials. Secondly, there should be supplied the most efficient form of lightning arresters and other protective devices. Thirdly, employees should be compelled to keep the premises in as perfect a condition of cleanliness as possible. We heard of a case not long ago in which a large and valuable plant had a narrow escape from destruction by fire due to a dirty lightning arrester, a switchboard reeking with all the different varieties of oily, greasy filth which accumulate in a slovenly power house and a loose wire.

Niagara Falls Power.

CONSIDERABLE public opposition is being manifested to the application of the Canadian Niagara Power Co. for an extension of time in which to fulfil their agreement with the Ontario government for the construction of works on the Canadian side for the utilization of the power of Niagara Falls. The wonderful development which has taken place during the last five years on the American side, culminating in the successful transmission of electric power to Buffalo, has opened the eyes of our people to the value of the exclusive privilege granted several years ago by the Ontario government to the Niagara Power Co. It is very properly felt that the construction of the necessary works for the utilization of the power of the Falls on the Canadian side, is of far greater importance to this country than the payment of $25,000 per year by the company to the government for the retention of the monopoly which they at present enjoy. At the time the agreement was made with the company, the commercial practicability of the generation and transmission of electric power on so large a scale as exists at Niagara to-day had not been demonstrated. When the plans of the Cataract Construction Co. were announced, the gravest doubts were entertained even by persons best competent to comprehend the situation and estimate the chances of the success of the enterprise. Under these circumstances it was reasonably considered that the Ontario government had made a satisfactory bargain. In the light of what has since been accomplished, it is felt that the bargain is not a good enough one to be continued on the same terms. Canada wants a share of the manufacturing industries which are likely to be attracted to Niagara Falls. A prominent Toronto manufacturer makes the statement in the public press that certain New York manufacturing concerns are prepared to erect large factories on the Canadian side of the river as soon as the power shall have been made available. We understand that it is not the desire of the Canadian Niagara Power Company—which is another name for the Cataract Construction Co.—to begin construction work in Canada until such time as they shall have disposed of well-nigh all the power which their present works on the American side will generate. This point may not be reached for several years. Are Canadian interests to lie dormant during this period? It is for the Ontario government to decide. If, as has been stated, Canadians are prepared, in the event of the American company being deprived of their present monopoly, to construct the works, now is the time for a bona fide offer to be made to the government. If the government should deem it wise to grant any extension of time to the American company, such extension should be a short one, and the company should be required to give therefor a quid pro quo either in the shape of cash, or what would be preferable, a surrender of some of the exclusive privileges which were granted to them.

Electrical Engineering in Canada.

OUR recent enquiries as to the prospects for electrical engineers in Canada has elicited many interesting and valuable opinions from persons whose knowledge and experience certainly gives weight to their ideas; and, as might be expected, there were replies optimistic and pessimistic. Still, however, it seems to us, the subject is not exhausted. Electrical engineers may properly be sub-divided into three classes: laboratory experts, constructive engineers, and operating engineers; and each of these classes require special knowledge and experience. We are, of course, not taking into consideration the large number of telephone and telegraph engineers, whose province it is to deal with apparatus and problems very different from those handled by engineers dealing with lighting and power currents. The laboratory expert is purely an electrical specialist, not necessarily educated in mechanics or any other branch of engineering. For such, there seems to be a very limited field of usefulness in Canada. The constructive, however, and the operating engineer have a very different and in many respects a far more extended horizon which will become even wider and more wide as the public arrives at a better idea of what the use of electricity requires. For both a very thorough knowledge of mechanical and of civil engineering is required, in so far as those branches include steam engine practice and railway construction. The constructing electrical engineer who does not include within the range of his professional knowledge the principles of engine and machine design which are absolutely necessary in the efficient planning of a complete plant; or those principles of track construction (rails, their proper weights, sections, etc., and road-bed) without which a railway becomes a mere tram road, is really failing in his responsibilities; while the operating electrician who is not thoroughly versed in the principles of steam generation and utilization, as well as in electrical matters, is really shutting his eyes to the main feature of his duties. Hitherto it has not so much been that the public does not appreciate knowledge in its employes; but the employes themselves have not understood their duties, and while claiming to be electrical engineers, electricians and so on, have been no more than mechanics, with a smattering of dynamo tender's knowledge. It is at least a reasonable guess, that in Toronto there are many score young doctors and lawyers who have not the faintest prospect of ever earning $75 a month, who might have done certainly as well as superintendents of electrical plants; and although Josh Billings once advised "It ain't safe to prophecy unless you know," still we presume to say that in future few engineering enterprises, whether light, power, railway, mining or electrolytic, will be undertaken without the assistance of an electrical engineer; and that the lighting plant of 1,000 light capacity that is not either directly or indirectly in charge of a properly educated electrician will be a rarity, and losing money. Let electrical engineers shew what they can do, instead of wailing that there is no prospect, and the public are sharp enough to know a good thing when they see it.

CORRESPONDENCE

THE DUTY ON ELECTRICAL MACHINERY.

To the Editor of the CANADIAN ELECTRICAL NEWS.

SIR,—It was with great interest that I observed, recently, a hint thrown out by the tariff commissioners, that the duty on electrical machinery might be at least reduced if not quite abolished. I cannot help thinking that such a course would be greatly in the interests of the Canadian public, who at the present are paying a considerable sum every year to support an industry that has no real "raison d'etre." Nor can I think that the larger and more reputable manufacturers would have any well-founded arguments or objections against it. One manufacturing company exploiting a very favorably known make of dynamo, finds itself obliged to import a considerable portion of it, the necessary materials, etc., not being obtainable in the Dominion. On these imported portions a large duty is levied, which obliges the company to charge a higher price without in any way benefitting thereby. Speaking in the most general terms, there seems to be no good reason why the electrical manufacturing industry should be protected in Canada. It is entirely an imported industry, and to a large extent supported by American capital. While we have several very excellent colleges giving electrical courses and degrees—still the science of practical electricity is by no means one of Canadian growth, and as a matter of fact we simply follow where Europe and the United States lead. My notion of protective tariff is that it is intended to foster and carefully nurse into vigorous, self-supporting strength, industries which, by developing and consuming the natural resources of a country, may be of permanent benefit to the community, and help a nation's advancement. Taking the whole Dominion, I find that the establishments manufacturing electrical machinery can be numbered on the fingers of one hand, and of these probably there is not a solitary one that does not copy some American patent, or that can truly be said to represent a thoroughly Canadian industry. Do five manufacturing companies, mostly small, constitute an industry? and yet these five are protected, to the prejudices of the whole country, by a 25% duty. Take carbons—there is one carbon factory in Canada; there are, we may truly say, hundreds of purchasers; these hundreds have to pay 25% more than they otherwise would in order that one may live. Has any improvement in carbons, in incandescent lamps, in transformers, in dynamos—in any electrical apparatus—originated in Canada? Are we originators, or imitators? most certainly the latter, and the question is inevitable, "Why protect an imitation, that cannot be said to represent an industry, and which is in the hands of a very few?" Moreover, it has been demonstrated to a certainty in several recent cases, that this protective tariff DOES NOT PROTECT. In at least four instances within the last very few months, to my certain knowledge, machines built in the States have been sold right in the Dominion; the figures, including freight, customs dues, etc., etc., being considerably less—some hundreds of dollars less—than the same size of machine manufactured by Canadian manufacturing companies was being quoted at. The principle of "the greatest good to the greatest number" should point out that if American manufacturers can manufacture so cheaply that they can sell their goods in Canada, paying 25% duty, and even then undersell Canadian manufacturers, the electrical manufacturing industry in Canada is not worth protecting, and is simply an unjust imposition on hundreds of citizens who are heavily taxed that a few individuals may live.

Yours truly,

JUSTICE.

THE COST OF ELECTRIC POWER.

TORONTO, Feb. 2nd, 1897.

To the Editor of the CANADIAN ELECTRICAL NEWS.

SIR,—You, and no doubt, all the readers of your valuable journal, are at the present time interested in the development and transmission of power by electricity, especially over long distances. No doubt the different electrical manufacturing companies in Canada have figured on developing certain powers, and for the benefit and education of the electrical public in general, I would ask you to publish the enclosed clipping from one of the Hamilton daily papers of a very recent date, which no doubt will furnish food for reflection to the electrical engineers and also show them the errors in cost in figuring on power transmissions in the past.

"Mr. Willson said it had cost him as much to develop his 100 horse power at Merritton as it would cost him to develop 60,000 horse power at the falls, or about $320,000. So far as he was personally concerned he was interested because with electric power he could produce carbide so much cheaper than at present. The demand for carbide was larger than the supply could possibly be under the present circumstances, the cost of producing 1,000 tons in a year being $19.31½ per ton. He had orders booked for New York for 11,000 tons at $80 per ton, and a few days ago he shipped thirty tons of carbide.

"He estimated the total expense of developing 60,000 horse power on the Canadian side of the falls at about $320,000, or $533⅓ per electric horse power for twenty-four hours every day in the year.

"To get 10,000 electrical horse power to Hamilton would cost about $45,326, requiring a capital of $321,150. This would mean a cost of only $4.58 per horse power, but at the first cost it would probably run near $10.

"Mr. Willson said he believed if electrical power were brought to this city, as it could be brought if the American monopoly were not allowed to continue, Hamilton could control the world in the matter of manufacturing. This would be especially the case if natural gas were utilized with the powers at the fall. No country in the world could produce goods as cheaply as this city could with this electrical energy that the legislature was asked to give away for a paltry and unpatriotic consideration.

"In reply to a question he said Buffalo paid about $25 per electrical horse power at present, and he presumed it would cost this city that much to get it from the Canadian Niagara Power Company. He thought the legislature should hold the valuable electrical power, and lease it by the year, charging $1 per horse power for it, instead of allowing it to be monopolized by an American company. The government could make the headrace and establish the developing apparatus at a cost of about a million and a half dollars, without injury to the beauty of the park or the diminution of the water at Niagara."

A TRAVELLER.

WIRE ROPE DRIVING.

The transmission of power by means of a wire rope is apparently a very simple matter, but several laws must be obeyed or the transmission will give trouble from the start. First, the rope should run in the right direction, so as to pull through its bottom fold, letting the top rope lie slack, thereby hugging the pulleys through a considerable arc. The rope should also be driven at as high a speed as possible. The higher the speed the greater the pull upon the rope to a certain extent, but where the speed is high the pull can be less. Just imagine a rope running at 1,200 feet per minute and pulling fifty pounds. If the speed be got up to 600 feet per minute, the rope to do the same work must pull 100 pounds. This makes a much tighter rope necessary, brings more strain upon the rope, the pulleys and the shafting, and more than counteracts the gain in rope life which may be caused by slow velocity.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

NOTE.—Secretaries of Associations are requested to forward matter for publication in this Department not later than the 25th of each month.

TORONTO NO. 1 AT HOME.

THE annual assembly of Toronto No. 1 was held in Engineers' Hall, 61 Victoria street, on Wednesday evening, February 3rd. Over 200 engineers and their friends, many of whom were ladies, gathered in the hall, which had been decorated for the occasion. Mr. J. Fox, president of the Association, performed the duties of chairman, and on the platform with him were Messrs. C. Mosely, vice-president, and S. Thompson, chairman of the special committee. The first part of the entertainment took the form of a concert, a novel and rather pleasing feature of which was the display of juvenile talent. The programme consisted of songs by Miss Dillon and Mrs. Coutts-Bain; readings by Miss Leverty; comic duetts by Messrs. Parker and Daly; club swinging by Mr. Thos. Eversfield; violin solo by Miss Simpson; duetts by the Misses Leverty; musical selection by Master Willie Huggett, and a selection by Messrs. Hordern and Collins. Mr. Harding played the accompaniments, and each artist was well received. Then followed what might be said to be the event of the evening—a clever exhibition of hypnotism by Mr. John Main. The wonderful feats performed proved to the satisfaction of the audience that the subjects were fully under Mr. Main's control, and established beyond a doubt his reputation as a hypnotizer, besides providing much amusement for the audience.

After refreshments had been served, a couple of hours was spent in dancing by those who felt thus inclined. The entertainment passed off most successfully, to the credit of the following committee: S. Thompson, chairman; A. Storer, J. Huggett, M. Mose, W. J. Webb, J. Fox, A. M. Wickens, G. Thompson and T. Eversfield.

OTTAWA NO. 7.

Ottawa No. 7 have elected the following officers for 1897: President, Frank Robert; vice-president, Albert Gaul; recording secretary, T. G. Johnson; financial secretary, Sidney Barnes; treasurer, William Hill; conductor, Thos. Butterworth; door-keeper, Allan Clark; auditors, Thos. Wensley, Frank Merritt and F. G. Johnson. The Association numbers forty members, and is in a satisfactory financial position.

BROCKVILLE NO. 15.

Sir,—On the first evening of last month, Brockville No. 15 was favored with a visit by Bro. F. Donaldson, of the Boiler Inspection and Insurance Co. of Canada, who gave us a very interesting and encouraging talk on the prosperity of the Order of the C. A. S. E. He congratulated the members of the Association on the apparent lively interest they manifested in working out some very difficult problems on the blackboard, which was received with applause. Some suitable remarks were also made by Past-President Bro. Chapman before the meeting closed.

JAMES AIKINS, Rec.-Sec'y.

WOULD NOT BE WITHOUT IT.

Mr. Ed. Bailey, of Ottawa, in renewing his subscription to the ELECTRICAL NEWS for 1897, writes: "It has afforded me some very valuable information during the past year, and I would not be without it for a great deal."

HEAT AND BOILER EXPLOSIONS.*

THE subject of the paper to be read before you is Heat, and its action during the explosion of boilers.

I will first briefly outline the views held as to what heat is, by both ancient and modern philosophers. Following the modern ideas, the mechanical equivalent of heat will be considered. Then the behaviour of water when subjected to heat, and under the usual atmospheric conditions, and further when confined, as in a boiler, where, under ordinary conditions, the water may be subjected to a pressure greater than the atmospheric. In preparing this paper I have endeavored to use only such facts that you can experimentally prove to be true. In calculations, the simple rules of arithmetic are sufficient for our purpose, and technical terms will be avoided as much as possible. If I use the word "theory" it is in the sense of being a generalization of facts, and the word "energy" in its mechanical definition must be used; there is no equivalent for it in our language. Energy means "capacity for performing work," and according to this definition may be either at rest or in motion, or, as the books say, either potential or kinetic, or, what is the same thing, either possible or actual.

As an illustration of how the term energy is used, and which must appear in this paper, especially when a boiler explosion comes in order. At noon you shut down your engine. The steam may then be 50 or 60 by gauge; notwithstanding this pressure the whole system is at rest; there is no visible motion. It cannot be denied that there is a capacity for performing work still in the boiler. It is possible, and is therefore called "potential" energy. Open the throttle valve; motion of the engine takes place, and a part of the potential energy stored in the boiler becomes kinetic or actual, as stroke after stroke is made by the engine.

It is natural for the human mind to assign some cause for every effect observed. The common belief of the ancients was that heat was a material substance that permeated the small spaces between the minute particles or atoms of matter, and they called it caloric, a name retained at the present time, but with a somewhat changed meaning. There never was the least direct evidence to support this belief. It was one of the results of a pernicious fallacy then believed, that there was a double system of natural laws, one theoretical, the other practical. The philosopher made this theory as he called it, and then twisted the facts to an agreement with it. Under such a system no scientific advance could be made.

This was the received opinion about heat for over 2,000 years. Yet during this time a writer occasionally appeared that doubted it, and considered heat to be simply a mood or condition of matter. But, true to the theoretical ideas of that time, no proofs were advanced. About one hundred years ago, Benjamin Thompson, afterwards known as Count Rumford, took the question in hand. He was a native of Concord, in Massachusetts, and for his loyalty to King George during the American revolutionary war, he was obliged to leave his country. After some years he turned up as superintendent of a military arsenal in Germany, where his attention was directed to the great amount of heat generated during the boring of brass cannon. He experimented and measured. The question was in the hands of a master. The results were made public in a paper read before the Royal Society on January 25th, 1798. The scientific men in all countries have accepted his conclusions. It is said this was the most important paper ever read before this learned society. It established what is now called the mechanical theory of heat. Reasoning on his experiments, he came to conclusions that have been accepted as final, that heat is not an igneus fluid, but a form of atomic or molecular motion, and if a motion, there must be a mechanical equivalent at work.

We all know what a hot journal is, and at least some of the causes. We all know that heat is generated and the temper taken out of a chisel or drill if sharpened on a dry grindstone. Lay a small bar of iron on an anvil and strike it a smart blow with a sledge. Where impact took place it is found to be sensibly warmer than at any other part of the rod, and a second blow on the same place makes it warmer still, in fact it can easily be made red hot. Those who have witnessed tests of armor-plates for warships tell us that when the projectile struck the plate there was a brilliant flash of light, and on examining the hole made in the plate it was found that the metal had been fused. To come down to a small matter, although there is no great or

* Paper by Capt. James Wright, read before Montreal No. 1, C.A.S.E., January 21st, 1897.

small in nature, when I was a boy going to school in Scotland, amongst the equipment to stocks and stores found in every boy's pouch, there was sure to be a good sized brass button. Brass buttons were then fashionable on male attire, so they were easily got. By rubbing this button on a desk or form heat was generated, and, if then applied to the neck of the boy that sat next to him or in front of him, would give him a start. Often the master's tawse supplemented this affair, and I have seen battles fought on the play green to settle the little matter. In doing this trick, the boy was unconscious that he was illustrating one of Nature's great truths, the conservation of energy by the transformation of work into heat. But he was well aware that the longer he rubbed and the greater the pressure he put on the button the hotter it became.

Following the reading of Count Rumford's paper, it became an important problem to establish the correct relationship between heat and mechanical work. During the early part of the present century many tried but failed. At last, about the year 1840, the question was independently taken up by Joule, an Englishman, and Mayer, a German, of whom it has been said Joule worked the theory out, and Mayer thought it out, and both gave it the solidity of demonstrated truth. This great question took this form: What weight lifted one foot high is equivalent to the warming of one pound of water 1° F.? As it was then and is now, the unit of heat is the amount required to raise one pound of water one degree in temperature. Joule worked or experimented for seven years in the basement of a storehouse in Manchester that was noted for the uniformity of its temperature throughout the year. At first his results were widely different, but as his experience increased, they became closer. At last, in 1849, after applying all the precautions suggested by seven years' experience, the result of 110 experiments made on water, mercury and cast iron, was that the mechanical equivalent of the unit of heat,was the lifting of 772 pounds one foot high, or what is the same thing, the lifting of one pound 772 feet high.

Mayer adopted an entirely different course. The data from which he calculated the mechanical equivalent of heat was obtained from the increased amount of combustible consumed in heating air which expanded against the atmosphere and perfomred work, above that consumed in heating the same weight of air to the same temperature in a closed vessel which resisted expansion, and no mechanical work done. Mayer perceived that the difference in the combustible consumed, or more properly the heat utilized in producing the same thermal effect on equal weights of air, and under the above different conditions, was the heat equivalent of the work done; and from this he calculated that the mechanical equivalent of the heat that would raise the temperature of one pound of water one degree F. was the lifting of 771.4 pounds one foot high, or about ten ounces less than Joule's equivalent. This extraordinary coincidence removes any doubt of its accuracy, and it is rightly considered the greatest scientific discovery of the century.

It is an acknowledged truth in modern science and confirmed by all experience, that energy or the capacity for performing work cannot be annihilated. The amount in the universe, possible and actual, remains the same under every change which may arise. But it changes its form of action. Under certain conditions it appears as heat or light; under others as mechanical, electrical or chemical energy, besides many other forms. Still conservation is the law which binds the whole together. We have a good example of this in the street railway system in this city. There is a pile of coal and a supply of water at one end of the system, a hundred or more moving cars at the other, with a wire connection between. The method of doing this is foreign to the subject of this paper, the main purpose of which is to trace the causes which lead to a boiler explosion, and the destructive effects which accompany or follow it, without any hypothetical suppositions about unknown forces which cannot be proved to be present. In fact, it will be seen that when a boiler explodes it is simply obeying the usual laws under which it acts when supplying steam to an engine, or to heat a building.

Following up the lines laid down at the beginning of this paper, the effect of heat upon water under the usual atmospheric conditions now comes in order. In this country we are acquainted with water in the form of a solid, a liquid, and steam. It is generally said that water freezes at 32° and boils at 212°. The last figure is not quite correct at all times, it depends upon the atmospheric pressure which varies from day to day. But it would be inconvenient to be talking in fractions all the time, or having to read a barometer before making an assertion. It has been agreed upon that under the ordinary atmospheric conditions these figures be accepted.

On a day when the temperature is below 32°, put a thermometer in a pail of warm water, and set it outdoors in an exposed position; then observe its gradual fall in temperature. Repeat this as often as you please; vary the conditions; let the temperature of the atmosphere be zero, or 10, 20 or 30 degrees below. You will find that water in the liquid form never falls below 32°. At this point there is a halt, and only after becoming a solid, or ice, does the temperature fall below 32° Again, put a thermometer into a quantity of water in a pot, and put it over a fire in a stove. Now observe what takes place. The temperature rises until 212 is reached. Here again a halt takes place. The water boils, steam is formed. Hold the thermometer in the steam; its temperature is also 212°, and as long as any liquid water remains in the pot, its temperature never rises above 212°. It makes no difference what the temperature of your source of heat may be, the result is the same. From this it is evident that the range of temperature in which water can exist in the liquid form, while under the common atmospheric conditions, lies between 32° and 212°. It has been said by the highest authority that water is the most wonderful substance in nature.

So far our experiments have been made in a pail or pot. Unimportant as they may appear, yet in view of what follows in this paper, I beg leave to call your special attention, again and again to the fact, that the highest temperature at which water can exist in a liquid form while under atmospheric pressure is 212°. This fact astonished even James Watt, which shows the state of experimental knowledge at that time. One hundred and thirty years ago he was working as a mechanic in Glasgow College. In the course of events, a model of a Newcomen pumping engine was put into his hands for repair. As a common mechanic, he did the work. Afterwards he tested it, and was amazed at the enormous quantity of steam it used. In his efforts to discover the cause of this he found that he could not raise the temperature of water in an open vessel above 212°. He was enlightened on this subject by Dr. Black, one of the professors. Dr. Black had previously discovered the same thing, put it in a scientific form, and was then teaching the principles of latent heat to his classes that all matter in passing from the solid to the liquid form, or from a liquid to a vapor, absorbed an amount of heat that was not sensible to a thermometer, and was hence called latent, but could be proved to exist by a reversal of the process. After this consultation Watt returned to his shop in the college and contrived a means of making special and quantitative experiments on latent heat. He decided that the latent heat of steam at a sensible temperature of 212° was 945. Or, in other words, that the latent heat, set free by one pound of steam at atmospheric pressure, in passing to the state of water at 212° also, would raise the temperature of 945 pounds of water one degree. Considering the then imperfect means at Watt's disposal of solving this question, it is wonderfully close to the now accepted figure of 966. It is well known that Watt, in tracing the causes which led to the wastefulness of the little model, invented the separate condenser, the first of that brilliant series resulting in the steam engine, and effecting in a peaceable manner, the greatest revolution that ever took place on earth. To sum up the above thermal results. Under atmospheric pressure, water in the liquid form can only exist between the temperatures 32° and 212°. In the solid form, or ice, the temperature can fall below 32°. In the form of steam the temperature can be raised above 212°, in which case it is said to be superheated.

Next in order comes the thermal behavior of water, when subjected to a pressure greater than the atmospheric, as we see in a boiler. This part of the enquiry will lead us directly, and at once, to the origin of the mighty force at work during the explosion of a boiler. For clearness and precision of statement, in the line I propose to pursue, I have considered it best to select some boiler for reference. Any one would answer the purpose; but I happen to have in my possession the drawings of a common horizontal tubular boiler, with all the calculations required for our present purpose. This boiler is 66 inches in diameter and 14 feet long, with fifty-nine 3½ inch tubes. The calculations are based on a working pressure of 100 pounds by gauge, and at a time when there was 4½ inches of water over the top row of tubes. Under these conditions there is 181 cubic feet of water in the boiler, and 97 cubic feet of steam room. As was stated in the beginning of this paper, I will endeavor to use only those facts that you can experimentally prove. Take this boiler when empty and drill a hole in the water space and another in the steam space.

Tap the holes and screw in boiler thermometers. These are nothing but common thermometers designed for this purpose. When in place the bulb is in the interior of the boiler; the stem and the graduation is outside, where it can be read. After this is done put in a proper charge of water; put the safety valve in place, and hang the weight at a point where it will balance an internal pressure of 100 by gauge. Then start the fire. At first the two thermometers may not read alike, the conditions are different; but they soon read the same. It will now be observed that the temperature of the water gradually rises. As it approaches 200°, there is a noise in the boiler. This is the same action as the singing of a tea kettle, only on a larger scale. Presently the water thermometer reads 212. The boiler is now comparatively quiet. In a short time the finger of the gauge reads 5. At this time the reading of both thermometers is 228°, or 16 above the highest possible temperature under atmospheric pressure alone. Now carefully note the pressure and corresponding temperature as steam is getting up. With gauge at 30, both thermometers read 274°; with gauge at 60, both thermometers read 307°, with gauge at 100, both thermometers read 338°. These are the boiling points, or temperature of ebullition corresponding to the given pressure, and prove that as the pressure increases the boiling point rises. And also that under all circumstances, at least as long as the steam is in contact with the water from which it was generated, the temperature of the steam and the water is the same. These results are immutable. The water contained in the accumulator in the Board of Trade building, when subjected to an air pressure of 100 pounds per square inch, would not boil until a temperature of 338° was reached.

In following up the line of argument pursued in this paper it is convenient to know what is fairly the weight of water, and what is the weight of steam contained in this boiler. Under usual working conditions, when the water is 4½ inches above the upper row of tubes, and steam at 100 by gauge, we found the water space to be 181 cubic feet. This volume of water, at a temperature of 338°, weighs 10,140 pounds, and the 97 cubic feet of steam, that being the steam space in the boiler, weighs only 25½ pounds. In this case the weight of water in the boiler is 397 times the weight of the steam. Numerical results sometimes surprise us, but we must accept facts as we find them.

Preliminary and other preparations being made, we now confront the main question, the explosion of a boiler and how it is effected. If our selected boiler with 10,140 pounds of water in it at a temperature of 338° was suddenly relieved from a large amount of its internal pressure of 100 pounds per square inch, what would take place? The conditions under which water formerly existed as a liquid in the boiler are gone, and it will of necessity lower its temperature in conformity with the decrease in pressure. In falling to atmospheric conditions, as it must come to this in all explosions, each pound of water drops 126° in temperature, and in 10,140 pounds of water, 1,227,640 heat units would be liberated. Now, what becomes of this heat? Energy is indestructible. It may take other forms, but cannot be annihilated. This heat is utilized in the formation of steam. There is nothing hypothetical in this. It can experimentally be proved to be true, and we see it every day. When water comes from the try-cock of a boiler under pressure, as soon as it is subjected to atmospheric conditions, it generates steam, and a large volume, too, compared with the small quantity of water. But the same thing is seen to better advantage, and can be studied at the out board end of a blow-off pipe during the operation of blowing off a boiler. Look at the great volume of steam formed after exposure to the atmosphere, when nothing but water under pressure came from the boiler. It is a fact that during the operation of blowing off a boiler, and an explosion, the same process is gone through, the difference in the effects being due to the difference in the time it was done.

The weight of steam made under the condition of a sudden fall in pressure can be computed between any named pressures or temperatures. In the present case I prefer to take it from the working to the atmospheric temperatures, or from 338° to 212°, and also using the former data.

Temperature of water previous to explosion	338
Temperature after explosion	212°
Heat rejected per pound of water	126 units
Total heat or steam at 212°	1178°
Original temperature of water	338
Units of heat required to form one pound of steam	840 units

This amount of heat is furnished by 6⅔ pounds of water in falling from 338 to 212°, or one pound of steam is under the circumstances formed in every 7⅔ pounds of water. Dividing the 10,140 pounds of water in the boiler by 7⅔ we obtain 1,322 pounds of water converted into steam by the sudden loss of 100 pounds pressure per square inch in the boiler. This is astounding. We found only 25½ pounds of steam in the boiler when in working order, and now during an explosion 1,322 pounds is accounted for. Most of you must think that I am in error here. If so I cannot detect it. On the principle of the conservation of energy, I tested it in this manner. Previous to the explosion there was 10,140 pounds of water in the boiler at a temperature of 338°; total units of heat in the water, 3,427,320. After explosion there was 8,818 pounds of water at a temperature of 212°, and 1,322 pounds of steam at a sensible temperature of 212°, but a total heat of 1,178°.

Units of heat in 8,818 pounds of water at a temperature of 212°	1,860,416
Units of heat in 1,322 pounds of steam under atmospheric conditions	1,557,316
Total....	3,416,732

In working this out, I paid no attention to the fractions in the table. Yet the difference in the heat units before and after explosion is only 588 in these large amounts. The conservation of energy here holds good, and obtaining this result, I had no hesitation in laying it before you. I have intentionally omitted saying anything about the 25½ pounds of steam that was in the working boiler. Its effect on the results is comparatively insignificant, and for simplicity, I said nothing about it. Also, I wish to observe, that in making the last calculation, it was based alone on the actual transformation of heat energy, from the sensible to the latent form, which then took place in the boiler after a sudden loss of internal pressure.

This loss of internal pressure generally results from a failure of the boiler to resist the stress it was subjected to. In other words it was not strong enough. A rent, rupture or collapse takes place. An opening is made. If small the boiler may peaceably discharge its contents; but if large enough to permit an immediate and material fall in the pressure, enormous forces are liberated, an explosion follows, and all in strict conformity with natural laws, which are observed every day in a boiler house.

It may be thought that my method of calculation is obscure, in finding that 1,322 pounds of water at a temperature of 338° would change its liquid form into steam at atmospheric pressure, when the boiler pressure of 100 pounds by guage was lost. I will put it in another form. As already stated there is 10,140 pounds of water in the boiler at a temperature of 338°. In falling to a temperature of 212°, or atmospheric conditions there is 1,277,640 of heat units liberated, which is taken up as latent heat by a part of the water becoming steam. The latent heat of one pound of steam at atmospheric pressure is 966 heat units. Dividing the total heat units liberated, viz., 1,277,640 by 966, we again obtain the same number 1,322, which is the pounds of water evaporated from, and at 212° by 1,277,640 units of heat. All such questions admit of an approximate solution in a practical manner. The fireless locomotive is an example, where water, in falling from a temperature of 400 to 260° furnishes steam to do the work for a limited time.

I must now come to a close. My purpose in writing this paper to be read before you, was to trace the origin of the forces at work during the explosion of a boiler, and go no further. We have seen the changes which must take place in the thermal conditions of the water in a boiler in following a sudden fall of pressure from 100 by gauge to atmospheric pressure. At the same time, the total units of heat remains the same notwithstanding the change of form in energy. But this is not all. What would be the result when the pressure has fallen from 100 to 80? Over 160 pounds of water would be converted into steam, an amount more than six times the weight of steam in the boiler under working conditions. This seems to prove that an explosion may, under certain conditions, instantly follow a rupture or failure of the boiler, although there are authenticated cases where it did not, and several seconds intervened between the failure of the boiler and explosion, as witness that case in a Denver hotel the year before last.

The engineers of 60 or 80 years ago were much perplexed in accounting for explosions. They theorized, as it was then called, and talked nonsense about explosive gases, invisible lightning, and the miraculous ability of red hot plates to make steam. But in one thing they were correct. They observed that under the same pressure, the destructive effects of explosions was in proportion to the weight of water in the boiler.

Don't attempt to run a shaft in a box that is too large or too small, as you will waste time and fail to secure good results.

THE LATE E. CARL BREITHAUPT.

In common with his many friends in the electrical fraternity, we are called upon to express our deep regret and sorrow at the untimely death of the late Mr. E. Carl Breithaupt, of Berlin. Most of our readers are already familiar with the tragic particulars of his death. In his capacity as manager of the Berlin Gas Works, he was supervising the emptying into tanks of several barrels of coal oil, which it was the intention to use as a temporary substitute for the crude oil usually employed in the manufacture of gas, when it is supposed the gas rising from the tank came in contact with the flame in a lantern which Mr. Breithaupt was carrying, causing an explosion which resulted in his death and the death of the electrician. The latter was killed instantly, but Mr. Breithaupt lived for six or seven hours, during which time he recovered consciousness, and was able to bid good-bye to his sorrowing relatives.

By this lamentable occurrence the light of a useful life has been extinguished, and the shadow of a great sorrow has been cast upon many hearts. The large attendance and many tokens of esteem which marked the obsequies, were but an index of the high regard in which the deceased was held by all who had the honor of his acquaintance.

The Late E. Carl Breithaupt.

The late Mr. Breithaupt was cut down in early manhood, being only 30 years of age. Deceased was the fourth son of the late Louis Breithaupt, mayor of Berlin in 1880, and was also a brother of the present mayor, Mr. J. L. Breithaupt. He was a native of the town in which his death occurred, and there received his early education. Subsequently he attended the Northwestern College at Napierville, Ill., and Johns Hopkins University at Baltimore. At the latter institution he took a thorough course in electricity, and graduated as an electrical engineer. About six years ago he returned to Berlin, assumed the management of the gas works, and also began practice as a consulting electrical engineer.

He had recently purchased a controlling interest in the Berlin and Waterloo Street Railway, of which he also undertook the management. Under his direction it was reconstructed and transformed into an electric road. During the past few months handsome new cars and other modern equipment had been added, and the power station was about to be extended with the view of putting the line in the best possible shape for business next season.

The deceased was a past president of the Berlin Board of Trade, a member of the Toronto Board of Trade, and actively interested in the advancement by every means of the welfare of the community in which he lived.

In the death of Mr. Breithaupt the Canadian Electrical Association has sustained a very serious loss. From the earliest days of the Association he had manifested the greatest interest in its welfare, and by every means in his power advanced its prosperity. In addition to rendering valuable counsel and assistance as a member of the Executive Committee, he prepared and presented several valuable papers, and as Chairman of the Committee on Statistics performed valuable service. At the last annual convention he was elected second Vice-President, and had his life been spared, would in due time have been given the highest position in the gift of the Association, for which his genial nature and conspicuous ability so well qualified him.

MONTREAL TELEGRAPH COMPANY.

The fiftieth annual report of the directors of the Montreal Telegraph Company was presented at the annual meeting held in Montreal on the 14th January. Since the first dividend to the shareholders, on the 14th January, 1848, dividends averaging over 9 per cent. per annum have been paid semi-annually, without intermission till 1881, besides which bonuses on several occasions, ranging from 10 per cent. to 25 per cent., have also been paid. From the formation of the Western Union Telegraph Company in 1866, the closest and most friendly relations have always been maintained between the two companies. On the 17th of August, 1881, accepting the proposal of the late Dr. Green, President of the Western Union Telegraph Co., to still further harmonize the great telegraph interests of the United States and Canada, the arrangement was consummated and the conditions embodied in the agreement of that date, by which, for a period of 97 years from the 1st July, 1881, dividends to the shareholders of the Montreal Telegraph Company at the rate of 8 per cent. per annum are guaranteed by the Western Union Telegraph Company. By the terms of the agreement, and in virtue of this guarantee, the company continues the payment of quarterly dividends begun, under such favorable auspices, in October, 1881, over fifteen years ago.

The company continues free from debt or obligation of any kind, and has assets of $2,259,415.

The Chateauguay & Northern (Montreal Island Belt Line) Railway have ordered additional G. E. 1000 equipments from the Canadian General Electric Company.

LEGAL.

We herewith print the full text of the decision of the Montreal courts in the action brought by the Bell Telephone Co. to restrain the city and the city surveyor of Montreal from interfering with the company for the purpose of preventing them from laying underground conduits in the streets of that city.

"The court, having heard the parties by their respective counsel on the grounds of this action; and after having examined the procedure, the exhibits produced and the proof adduced, and having deliberated :—

"Whereas the company defendant declares :—

"1st. That in virtue of the powers granted to it by its charter it placed certain pipes or conduits underground in certain streets of the city defendant, comprising, amongst others, Notre Dame street, from St. John street to Gosford street and from this latter street to Craig street.

"2nd. That on the 22nd April, 1896, said company notified the city by letter that it intended to place conduits in the following streets for the operation of its telephone wires, namely: In Notre Dame street east and west of St. John street and in the streets going in northerly and southerly direction of this street, and also in St. Peter, St. Alexander, St. Charles Borrommee and St. Catherine streets, and, to this end, it would be necessary to make excavations in these streets.

"3rd. That the plaintiff requested the City Council to name the inspector (or other official of the city) to oversee and direct such works, and that on the 17th May, 1896, the sub-committee of the road department of said city recommended that the request of the company be granted and it be permitted to place its conduits underground in Notre Dame, McGill, St. Peter, St. John, St. Sacrament, Craig, and other streets.

"4th. That on the 22nd July, 1896, plaintiff was notified by the city inspector (by letter) that the City Council had, by resolution to that effect, authorized the excavations in the streets of the city for the placing of said conduits therein, demanding a deposit of fifteen thousand dollars ($15,000) as a guarantee that these said streets thus opened would be put back in their normal condition, which deposit was made.

"5th. That plaintiff placed conduits in Notre Dame street, from St. John street east to Gosford street, in Gosford to Craig, in Hospital and St. Francois, Place d'Armes and others.

"6th. That on the 8th September, 1896, said Council passed a resolution giving instructions to the city inspector to stop the work which was being done by plaintiff on said streets, Notre Dame, and from St. Sulpice to Gosford and in all the streets where the works of the plaintiff was being carried on, to take up said conduits and replace the streets in the same condition as they were before and to prevent (by force, if necessary) all works and encroachments on all streets and public places being done without permission of the City Council.

"7th. That the inspector of the city notified plaintiff that it intended immediately to take up from Notre Dame street (between St. Sulpice and Gosford) and from the latter street, all the conduits and other material which had been placed there by the plaintiff, and that said removal mentioned had been commenced.

"8th. That, acting as aforesaid, the Council exceeded its powers, and acted without authority, and that, for the reasons mentioned above, the plaintiff demands that writ of injunction taken out for the protection of its rights be granted.

"Whereas defendant has contested said writ, denying to the plaintiff the right to act as it has done, and denying the powers it invoked, &c., &c.

"Considering that it is shown by the proof, exhibits and documents on record that plaintiff before proceeding with said works (stopped and interrupted by defendant) had conformed to the rules and formalities the latter could demand by the terms, as well of its act of incorporation as by that of plaintiff.

"Considering that plaintiff has proved the allegations (essential) of its request, and specially according to the terms of the charter it had the right to put its conduits and place its telephone wires underground in the streets, roads, public places, &c., in the city of Montreal for the purpose of its business and of its act of incorporation, and that it conformed to all that was required before the exercise of its rights and the execution of its said works.

"Considering that it is proved that defendant made efforts to deprive the plaintiff of its rights, and that, in fact, it interrupted and prevented plaintiff from carrying out its works and paralized its action in the exercise of said rights and powers, and this by force and violence.

"Considering that plaintiff established its right to a writ of injunction in the particular case, and that the defendants have not justified the position taken by it, in its defence.

"Maintains the present writ of injunction and conjoins in consequence the defendant and said P. W. St. George to immediately cease to intervene in plaintiff's work and forbids them or their representatives to take up or alter in any manner the works commenced by plaintiff in said streets or places above mentioned and indicated, and to interrupt the works to be done in the said places and streets in question designated and indicated in the said request drawn up with the object of placing its wires according to its rights under terms of charter of said plaintiff. Costs of present writ of injunction and of contestation, distraits to Bethune & Bethune, advocates of said plaintiff, the whole subject to disposition and penalties provided by law in such matters."

TRADE NOTES.

The Montreal Street Railway Company have placed an order with the Canadian General Electric Company for 60 additional motors of their C. G. E. 1000 type.

The Canadian General Electric Co. are building two 600 horse power direct current railway generators, to be direct connected to synchronous motors in the Quebec sub-station of the Montmorency Company. They will deliver current at standard railway pressure for the new Quebec District Railway Company's system, the power to drive the synchronous motors being generated at Montmorency Falls.

The W. A. Johnson Electric Co'y, 34 York St., Toronto, have secured the contract for the electric generators and engines for the new Foresters' Temple Building, Bay St., Toronto. This is one of the largest office buildings in Canada, being nine storeys high, and the construction throughout is most modern. The electric plant consists of 3 direct current 50 kilowatt 125 volt generators, "Walker" type. These will be direct connected to 3 Ideal automatic engines, made by the Goldie & McCulloch Co. The Temple Building is the first large office building in Ontario to put in its own electric plant. This contract was awarded after keen competition.

The Canadian General Electric Company have closed a contract with Mr. Louis Simpson, general manager of the Montreal Cotton Co.'s mills at Valleyfield, ror a second 450 kilowatt three-phase generator to be used in furnishing power to drive alternating motors throughout the mills. This will make the Valleyfield power house the largest for the supply of power by alternating currents up to the present in operation in Canada, the total capacity of the two three-phase generators being 1200 horse power, and of the induction motors in use about 1000 horse power.

WAGNER TRANSFORMERS TRIUMPHANT.

On September 15 the Lachine Rapids Hydraulic & Land Company of Montreal submitted specifications for transformers to the prominent manufacturers of electrical transformers both in the United States and abroad.

Its electrical engineer is Cary T. Hutchinson, and the principal points of the specifications were that at the maximum load the 30-kilowatt transformer should have an efficiency of 97 per cent.; not less than 96 per cent. from half to quarter load, not less than 80 per cent. at one-tenth load; total drop at full load, 2 per cent.; the insulation to be guaranteed to withstand successfully a test of 25,000 volts alternating current, continued as long as desired and repeated at arbitrary intervals. The tests required to ascertain the efficiency of the transformers were to be made in the factory of the maker, under the supervision of Mr. Hutchinson. The Wagner Company not only tendered a bid on these specifications as submitted by the Lachine Rapids people, but furnished in addition specifications of a more efficient transformer, showing that at one-tenth load an efficiency of 92 per cent. would be guaranteed, 12 per cent. better as compared with 80 per cent.; and at 100 per cent. load, 97 6-10 per cent.; while at 1¼ and ¼ load an efficiency of 97 5-10 per cent. was guaranteed, with a regulation of 1½ per cent. As the amount of the order was upward of 900 kilowatt capacity, the $10,000 contract secured by the Wagner Company is also taken to show that upon equal specifications its transformers are the cheapest. The company guarantees "the sufficiency and proper working of the said transformers for a period of two years from the erection thereof, and to repair any damage thereto or defects therein save and except damage resulting from lightning and mechanical injury, and in the event of any of the said transformers being found defective during the said term, the said contractors will replace the same with others of the quality, size and efficiency herembefore stipulated. —Electricity, N. Y.

The above contract also covered all future extensions required by the Lachine Co'y, involving about 9,000 K. W.

This sale was made by Mr. W. A. Johnson, of the W. A. Johnson Electric Co., Toronto, Canadian representatives for Wagner transformers. Many of these transformers are already in use in other Canadian cities.

QUESTIONS AND ANSWERS.

JAMES MCPHERSON writes : "Could any of my brother engineers tell me if an injector will force cold water just up eight feet, then along 18 feet, then through a Wainright circular coil heater and back again same way to boiler front? Our heater is at the back of the boiler. We have no feed pump so the heater is useless, and would like very much to be able to use it. Over in the foundry we have a small Blake pump which gets its water under a varying head from 20 to 40 lbs. ; it has to pump it a distance of 80 feet and then up about 90 feet into big fire tanks. The pump works quite freely but pounds awfully bad in the water end. What should I do to overcome this?"

ALFRED THORNTON, Quebec, writes: "My elevator compression tanks give me lots of trouble, or rather the losing of water from the tanks. There are no leaks in the tanks as a matter of course, and all glands, etc., on the elevator gearing are as they should be. Yet I can never get as much water kept in the glass as ought to be. If I choke off the air from the pump then you should hear her knock. I have heard some elevator pumps scrunt and scrap a very great deal in the steam cylinder when they were going dead slow, and although it doesn't occur in mine, yet I would like to be able to give a pointer to those who suffer."

MOONLIGHT SCHEDULE FOR FEBRUARY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1	P M 5 40	A M. 6 10	12.30
2	" 6.00	" 6.10	12.10
3	" 6.30	" 6.10	11.40
4	" 7.20	" 6.10	10.50
5	" 8.20	" 6.10	9.50
6	" 9.30	" 6.10	8.40
7	" 10.30	" 6.10	7.40
8	" 11.30	" 6.10	6.40
9	"	" 6.00	5.10
10	A.M. 12.50	....	
11	" 2.00	" 6.00	4.00
12	" 2.50	" 6.00	3.10
13	" 3.40	" 6.00	2.20
14	No light.	No light.	....
15	No light.	No light.	....
16	No light.	No light.	....
17	No light.	No light.	....
18	P. M. 6.00	P. M. 9.10	3.10
19	" 6.00	" 9.10	3.10
20	" 6.00	" 10.30	4.30
21	" 6.00	" 11.40	5.40
22	" 6.00	A. M. 12.50	6.50
23	" 6.00	" 2.10	8.10
24	" 6.00	" 3.20	9.20
25	" 6.10	" 4.20	10.10
26	" 6.10	" 5.20	11.10
27	" 6.10	" 5.20	11.10
28	" 6.10	" 5.40	11.30
....	....	....	....
....	....	....	....
		Total,	179.30

Four-fifths of the steam engines now working in the world have been constructed during the last 25 years. France has 79,590 stationary and locomotive boilers, 1,850 boat boilers, and 7,000 locomotives. Germany has 59,000 land boilers, 1,700 ship boilers, and 10,000 locomotives. Austria has 12,000 boilers and 2,800 locomotives. The working steam engines of the United States represent 7,500,000 horse power; of England, 7,000,000 horse power; Germany, 4,500,000 horse power; France, 3,000,000 horse power; Austria, 1,500,000 horse power. This estimate does not include locomotives, whose number in the world is 105,000, representing a total of 3,000,000 horse power. The world's steam engines, however, aggregate more than 26,000,000 horse power, equivalent approximately to the work of 1,000,000,000 men.

SPARKS.

The city of Fredericton, N. B., will put in a fire alarm system, to cost $5,000.

A local company at Parrsboro, N. S., intends putting in an electric light plant in the spring.

The city of Hamilton received $12,704.66 from street railway receipts last year, against $13,249.19 in 1895.

The mayor of Port Arthur, Ont., urges that the street railway power plant be sufficiently increased to light the town with electricity.

In the whole of Great Britain there are but sixty-seven miles of electric street railway, or thirteen miles less than in the city of Toronto.

E. P. Plante and E. Pratte have registered a partnership in Montreal to carry on business as electricians under the style of Plante & Pratte.

The Sandusky Electric Railway Company, of Sandusky, Ohio, has gone into the hands of a receiver. The indebtedness of the company is $120,000.

It is reported that certain Quebec gentlemen are considering the utilization of the water powers in the vicinity of Parry Sound, Ont., for supplying power, light, etc.

The Westinghouse Manufacturing Co., of Hamilton, has been incorporated, with a capital of $500,000. Hon. J. M. Gibson and Dr. Archibald Malloch are interested in the company.

The Cataract Power Company is said to have closed contracts for supplying electric power to the largest users in Hamilton for a term of five years. The plant is expected to be in operation by June next.

Mr. W. K. Knowles, a director of the Callender Telephone Exchange Company, of Brantford, Ont., has written to the City Council of Toronto requesting permission to tender for the telephone franchise.

At the headquarters of the Great Northwestern Telegraph Co., in Toronto, there are employed 90 operators, 50 messengers and 6 linemen. The Company have 35 city branch offices and 1,800 offices in connection with their entire system.

On the ground that various requirements of the Municipal Act had not been complied with the Courts recently quashed a by-law of the town of Listowel, Ont., providing for the creation of a debt for the purpose of lighting the town by electricity.

The Valley Telephone Co., of Annapolis, N. S., intend making extensions in their circuit next spring. A line will be run from Annapolis to Bridgetown, via Round Hill, and from Clementsport to Clementsvale, and thence to Bear River.

The Auburn Power Company, of Peterboro, Ont., has been incorporated by the Ontario Government, the capital stock being $99,000. The promoters are James Kendry, John Carnegie, R. M. Dennistown, W. H. Meldrum and Margaret Meldrum.

Incorporation is asked by the London Electric Motor Co., to manufacture electrical machinery. The head-office is at London, Ont., the promoters being S. R. Break, W. H. Wortman, C. E. A. Carr, S. Potter, E.E., A. Gorman, T. J. Cahill and W. Barton. Capital, $45,000.

A demonstration of the application of X rays to surgery was recently given by Mr. O. Higman, head of the Electric Inspection Department at Ottawa, in the presence of a number of the physicians of that city. A Tesla high frequency and high potential coil was used to excite the Crookes tube.

A company at Rossland, in which Mr. W. S. Norman is interested, are bringing electric power from a branch of the Columbia river, 12 miles away. They will generate 1,500 horse power, or sufficient for the 21 machinery plants at the camp, besides supplying light and power to Trail and Rossland.

The contracts for the equipment of the electric railway at Quebec have been given. The cars will be built by the Ottawa Car Company, the trucks by the Taylor Electric Truck Co., of Troy, N. Y., and the electrical apparatus by Ahearn & Soper, of Ottawa. The cars will be 18 feet long and will be supplied with 12 incandescent lights.

The Hull Electric Co. and the Ottawa Electric Light Company have begun cutting prices. The former company reduced their figures for lighting from 15½ to 12½ cents a light per week. Now the Ottawa Electric Light Company have done the same. The competition is so keen between the companies that a further reduction may take place, and the consumers are rejoicing.

SPARKS.

Stouffville, Ont., is moving in the direction of securing electric lights.

Steps will probably be taken by the ratepayers of Dundas, Ont., to secure electric street lighting.

The Citizens' Telephone and Electric Company, of Rat Portage, Ont., propose putting in an electric plant for supplying power.

The town of Millbrook, Ont., is reported to have dispensed with its electric light service, owing to the poor light supplied.

Mr. John Moodie, of Bell's Corners, has made a proposition to the County of Carleton to construct an electric railway from Richmond to Bell's Corners, and to supply light and power. A bonus of $10,000 is asked.

James Halliday, electrician for the Kingston street railway, has invented a new fender for street cars. It consists of a strong wire netting woven across a framework of one and a half inch iron tubing. A canvas background protects the draw-bar and bumper.

Application has been made to the Ontario Legislature for letters patent incorporating the Seine River, Foley and Fort Frances Telegraph and Telephone Co. The objects of the company are stated to be the building of telegraph and telephone lines through the Seine River gold fields to Fort Frances.

In the United States there is invested in motors $500,000,000, in electric mining apparatus $100,000,000, in electric railways $700,000,000, in electric lighting $500,000,000, in the electric elevator industry $15,000,000. This is exclusive of the value of establishments that manufacture the machinery and apparatus.

A meeting of the provisional board of directors of the Huron and Ontario Electric Railway was held in Toronto last month, at which the promoters in New York presented a request for further details regarding water powers and grades. When these are furnished it is thought the contract for the construction of the road will be signed.

The officers of the Canadian Marine Engineers' Association for the ensuing year are as follows:—Hon. president, O. P. St. John; president, E. J. O'Dell; first vice-president, Frank Limpert; secretary, S. A. Mills; treasurer, D. L. Foley; inside guard, J. R. Young; auditors, F. E. Smith and J. H. Ellis; councillors, R. McLaren, W. B. Stevens, James Currie, R. Childs and E. Abbey.

A meeting of the Board of Directors of the Packard Electric Company was held at St. Catharines, Ont., on January 23rd, at which the following officers were elected: President, J. W. Packard; Vice-President and Treasurer, W. D. Packard; Secretary and Manager, E. E. Carey; Directors, J. W. Packard, W. D. Packard, E. E. Carey, G. A. Powell, G. B. Morley, P. J. Crowley.

The report of the directors of the Ottawa Electric Railway Company is a most encouraging one. The number of passengers carried last year was 5,583,235, the gross receipts were $212,105, and the net profits $67,745. Four quarterly dividends of two per cent. each were declared. It is stated that the mileage of the company is greater than that of any other city in Canada according to population.

The following, relating to the street car fender, appears in a Guelph exchange: "Thursday afternoon a lady on Woolwich street, who is going to leave the city for a few days, came out and, stopping the car, asked the conductor if he would please get the motorman to help her husband out with a trunk. On being told the company would not carry trunks, she replied 'Oh my, how stupid, I thought that was a patent baggage carrier you had hitched on.'"

A company of eastern capitalists has been formed at Rossland, B. C., to build an electric railway between that point and Spokane, a distance of 160 miles. Application is now being made to the Washington Legislature for a charter to build that part of the projected road south of the boundary line. The power for the road will be obtained from the falls of the Kettle river, which is 110 miles from Spokane. It is unlikely that the Rossland branch will be constructed this year.

The Grand Trunk Railway Company are said to be considering the lighting of their cars by electricity. In England, one or two of the railways light their cars by electricity in a novel way. The system consists in providing each car with a small dynamo placed beneath it and worked directly by a belt passing over the axle. When in motion the car supplies sufficient power to drive the dynamo and at the same time to store electric energy in an accumulator ready to supply light when the train is standing.

In obedience to the decision of the Judicial Committee of the Privy Council in the matter of duty on street rails, an order-in-Council has been passed sanctioning the refunding of the duties paid on steel rails for street railways from 1887 to March 27, 1894, when the present law came into force. The whole amount of claims against the Customs Department under this head is some $138,000, of which $50,000 was by the judgment awarded the Toronto Street Railway, and $50,000 is claimed by Messrs. Ross & Mackenzie for the Montreal Street Railway. The customs officials at Ottawa are engaged in investigating the claims.

The Canadian Niagara Power Company held a meeting at Niagara Falls, Ont., on the 13th ultimo. There were present Colonel Albert D. Shaw, of Toronto, president of the company; Mr. Francis Lynde Stetson, of New York, vice-president; Mr. William B. Rankine, of New York, secretary and treasurer; and Mr. C. J. Holman, of Toronto, one of the directors. The old officers were re-elected. The company desires an extension of its lease for four years, in regard to developing the power, and had an important conference with Mr. John W. Langmuir, president of the Park Commission, in regard to this matter.

The Owen Sound Electric Illuminating & Mfg. Co. have just added to the plant of their power house on river Sydenham, 2½ miles from the town, a 50 k.w. S.K.C. generator, and are now busy equipping several business houses with incandescent and arc lights from this dynamo. It is also intended in the near future to run a day circuit for power. The pressure on the primary mains is 2,000 volts, and on the secondary mains 104 volts. The lamps are 3¼ watts to the candle power. The station is now equipped with two Royal 40-light arc dynamos (using a current of 9.6 amperes), and the above-named 50 k.w. S.K.C. generator. The two arc machines have been running for about 11 years, during which time they have had no trouble whatever with them.

An English scientific expert has reported upon the distribution of telephones in different countries in Europe, on which is based an article in the Literary Digest, N. Y. It is surprising to find the system most extended in Norway, Luxemburg, Switzerland and Denmark. Norway has a telephone to every 144 inhabitants, while Great Britain has only one to every 636, France one to 1,432, Austria one to 1,640, Italy one to 2,530, and in Russia there is only one instrument for every 13,102 of inhabitants. In Luxemburg the price of a telephone is $16, which covers everything, the consequence of this cheapness being that the whole of the Grand Duchy has a telephone service. In other parts of Europe a system has been established for bringing the villages into a circuit of telephones, a development along the lines of which there will ere long be great advances made in Canada.

The Sherbrooke Gas and Water Co., of Sherbrooke, Que., are remodelling their entire electric lighting plant and water power. They have purchased from the Royal Electric Co. one 180 k.w. and one 60 k.w. "S.K.C." generators. This, in addition to the 60 k.w. "S.K.C." generator purchased from the same company about a year ago, will make up the electric equipment for both light and power. It is their intention to use the smaller units for lighting purposes during the hours of light load, and the large machine for power purposes only, during the day time; but during the lap hours, that is, from five to seven o'clock in the afternoon, when the lights and power are both on, the three machines will be working together on the same circuit. It is also their intention to change their entire transformer equipment, replacing them with those of a higher efficiency.

A despatch from London, Eng., says: A new electric locomotive of large dimensions, calculated to draw trains of double the weight of those attached to ordinary engines at a rate of sixty-two miles an hour, has been tried with success on the Western Railroad of France line. The first experiments of this kind were made in 1893 between Havre and Beuzeville with an electric locomotive which behaved well throughout the trial trip. Owing to the success of this machine, the company's engineers constructed two larger locomotives, and it is one of these which has just been tested. It is 57 feet long and 1,350 horse power. In spite of their size, they wear out the rails less than ordinary locomotives, as the weight is distributed on eight axles instead of four or five. They are safer than the others, owing to their elastic character, which enables them to make curves with security at full speed. Great things are, in fact, expected from these contrivances, which, when perfected, are expected to do 100 to 115 miles an hour.

ELECTRIC RAILWAY DEPARTMENT.

MR. F. L. WANKLYN.

With considerable enterprise Toronto capitalists have, during the past year, taken definite action towards securing control of the street railway franchises of several cities in England, with the object, evidently, of electrifying the systems. Foremost among these

Mr. F. L. Wanklyn.

capitalists has been Mr. Wm. Mackenzie, president of the Toronto Street Railway, who has made several trips across the Atlantic in that connection. So much of his time has been thus devoted that it became necessary to relieve him of some of his duties in Canada, and the appointment of a manager for the Toronto Street Railway was decided upon by the company. The person to receive this appointment is Mr. Frederick L. Wanklyn, of Montreal, whose portrait we present.

The new manager is an engineer of large experience, and has an intimate knowledge of street railways, having spent several years supervising the construction of such in Lombardy. He was born in Buenos Ayres not quite 38 years ago, and educated at Marlborough College, England. He served a regular pupilage under the late Charles Sacre, M. Inst. C. E., Chief Engineer of the Manchester, Sheffield and Lincolnshire Railway, at the Gorton Works, Manchester. His first appointment was that of resident engineer of the Tramways and General Works Company on their lines in Lombardy, Italy. Subsequently he became general manager and engineer of the Lombardy Road Railways Company, with headquarters at Milan.

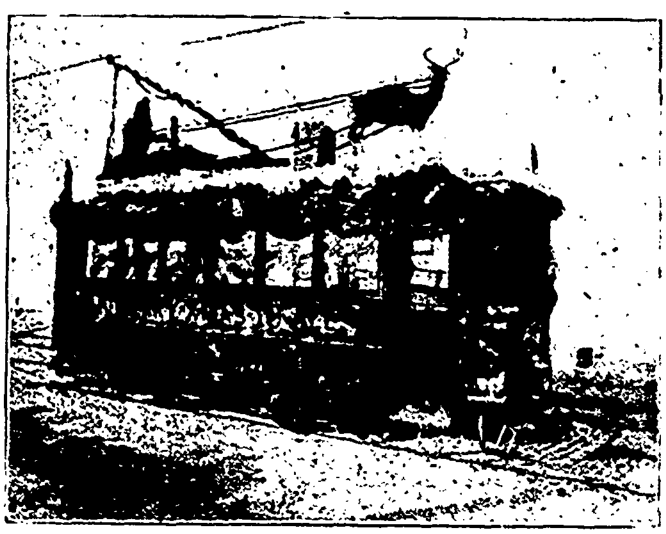
Upon coming to Canada he was appointed to the position of assistant mechanical superintendent of the Grand Trunk Railway, under Mr. Herbert Wallis, M. Inst. C. E., and subsequently was given charge of the extensive works of the company at Point St. Charles, in Montreal. Since the change in the administration he has filled the position of master mechanic. During the conversion of the Montreal street railway, and the erection of the new power-house, he acted as consulting mechanical engineer to the company. He is a member of the Canadian Society of Civil Engineers and an associate member of the Institute of Civil Engineers, England.

Before leaving Montreal, the employees of the Grand Trunk Railway shops presented Mr. Wanklyn with a handsome illuminated address, expressive of the good feeling which existed between them. He was also presented with a gold-headed cane by the employees of the rolling mills.

Those who are best acquainted with the new manager consider the step a wise one on the part of the company, and we have no doubt that proof of his ability will be forthcoming in still further improvements to an already prosperous road. Mr. Wanklyn has been elected as a member of the Board of Directors.

SANTA CLAUS ON A TROLLEY CAR.

An illustration appears herewith of the trolley car from which Santa Claus gladdened the hearts of the children of Ottawa by the distribution of Christmas fruit and candies, which was referred to in our last issue. Mr. Warren Y. Soper, of the firm of Ahearn & Soper, caused letters to appear in the daily papers, signed "Santa Claus," which stated that he would visit Ottawa on the day before Christmas and make a daylight tour through the streets on top of an electric car. A time table was furnished indicating at what time he would reach certain points, and before that time the streets were thronged with men, women and children. When the car appeared it was covered with snow and ice, indicating its recent arrival from the far north. On the front vestibule were the figures "1896," and on the rear "1897." The interior of the car was filled with toys of every description, and Santa Claus was on top driving his reindeer, with a basket of toys on his back. The motorman and conductor were costumed as Icelanders, and an Eskimo played on a cornet during the trip. As the car proceeded, Santa Claus distributed the oranges, etc., assisted by several persons inside the car.



A Christmas Car.

Some four thousand oranges were placed at the disposal of the children, the scrambling for which created no little amusement.

IMPROVING WITH EVERY NUMBER.

Mr. E. F. G. Fletcher, Gravenhurst, Ont., in remitting his subscription to the Electrical News, writes: "Your paper is improving with every number, and I consider it far ahead of any other electrical paper I take."

TORONTO STREET RAILWAY.

The annual meeting of the shareholders of the Toronto Street Railway Company was held on the 20th of January last. The report of the directors showed the net profits of the year to be $282,086.47. From these profits two dividends at the rate of 1¾ per cent. each were declared, amounting to $210,000, leaving, after the deduction of an allowance for pavement charges amounting to $60,000, the sum of $12,026.47 to be carried forward. The gross earnings for the year ending December 31, 1896, showed a slight increase over the previous year. During the past year the operating expenses exceeded the previous year by $17,845.55. This increase occurred almost altogether in electrical equipments, a large proportion of which was due to the accumulation of water upon the tracks of the company during the spring weather. By the decision of the Privy Council the Government refunded the company the amounts collected as duty on the rails used in the construction of its system. This amount ($56,000) was carried to the credit of capital account. The president, having found that his business in England prevented his giving the company's affairs sufficient attention, determined to appoint a manager, and the board, after careful consideration, have selected F. L. Wanklyn, of Montreal.

The company built in its own shops during the year, twenty open motor cars. The following statement of operating expenses was presented :

	1896.	1895.
Gross earnings	$997,273.28	$992,800.80
Operating expenses	507,760.31	489,814.76
Net earnings	$489,512.97	$502,886.04
Passengers carried	23,537,911	23,355,228
Transfers	7,354,895	7,257,572

Percentage of operating expenses to earnings, in 1896, 50.9 ; in 1895, 49.3.

The assets were reported to be $9,780,914, made up as follows : Equipment and real estate, including suburban lines, $9,536,912 ; stores in hand, $23,404 ; accounts receivable, $34,359 ; cash in bank, $186,237. After the adoption of the report the meeting adjourned, and at a special meeting of the shareholders a by-law was passed authorizing the directors to increase their number two new directors. The new directors were not elected, however, as due notice has to be given before the election. Mr. F. L. Wanklyn, the new manager, will likely be elected to the Board of Directors.

The old Board was re-elected as follows :—William Mackenzie, J. Ross, Hon. Geo. A. Cox, W. D. Matthews and James Gunn. At a subsequent meeting of the directors Mr. Mackenzie was elected president, and Mr. Ross vice-president.

HAMILTON, GRIMSBY AND BEAMSVILLE RAILWAY.

The annual meeting of the Hamilton, Grimsby and Beamsville Railway was held at Hamilton on the 25th of January, the president, Mr. T. W. Lester, occupying the chair. The report for the year showed the total receipts were $35,277.91, and the expenditure charged to current account $24,121.87, leaving a net revenue of $11,156.04. This is equal to about 9¾ per cent. on the capital stock. It was pointed out that a considerable percentage of the amount nominally expended for repairs was really for new construction, or to make good the alleged faulty work in the original construct[illegible]. The president reported that the Beamsville extension had cost about $40,000. The directors recommended that a dividend at the rate of 7 per cent. be paid upon the stock of the company. This would take about $8,000, leaving $3,155 to be carried to the reserve in other words, to be applied to the reduction of the floating liabilities of the company. A comparative statement of the receipts for the years 1895 and 1896 was as follows: 1895, $34,084.99; 1896, $35,277.91. The number of passengers carried last year was 243,394, as compared with 236,656 the previous year, the average each day being 666 in 1896 and 648 in 1895. The passenger fares in 1896 amounted to $29,695.35, as against $29,525.71 in 1895. The total miles travelled last year were 196,006, a slight increase over the previous year.

There was a strong fight for office between the Myles and the Lester factions, which resulted in the overthrow of the latter. The following were the directors elected.

Messrs. C. J. Myles, A. H. Myles, W. J. Harris, R. Ramsay, R. S. Martin, L. Bauer and John Gage. At a subsequent meeting C. J. Myles was elected president, Wm. Harris, vice-president, R. S. Martin, treasurer, A. J. Nelles, manager and secretary, and H. J. Brown, electrician. Mr. Adam Rutherford, the former secretary, has been asked to resign.

LONDON STREET RAILWAY.

At the annual meeting of the London Street Railway Company, held on January 13th, the directors present were :—H. A. Everett, president ; E. W. Moore, vice-president ; C. W. Wason, of Cleveland ; H. S. Holt, of Montreal, and Thomas H. Smallman, of London. Mr. C. E. A. Carr, the manager, acted as secretary.

The reports of the past year's operations were presented, and were considered highly satisfactory. Over 2,500,000 passengers were carried in the twelve months, and operations were conducted for 57½ per cent. of the gross receipts.

Mr. Charles Currie resigned his position as secretary-treasurer, owing to his removal to Lima, Ohio, where he assumes the management of the Everett line. The old board was re-elected, and Manager Carr was appointed to act as secretary-treasurer and manager.

STREET RAILWAY ACCIDENTS.

The Court of Appeals of Maryland held, in the case of The Baltimore Traction Company vs. Helms, that where one deliberately walks out from behind a street car from which he has alighted, and attempts to cross a public street without using his powers of observation, and is injured by an approaching car, which injury could have been avoided by the use of the most ordinary care, he will not be allowed to recover. The court said it did not intend to lay down the same rule of conduct as always applicable to the crossing of tracks of steam and street railways, and added : "The legal duties and correlative rights in the two cases are not the same, and what might be negligence in the one case would in the other, under some circumstances, be held to be but the exercise of a legal right. It is not necessary in this case to formulate any general rule as to the degree of care required of persons crossing highways in cities, for, as we have seen, the plaintiff failed to exercise any care whatever, and seeks to avoid the legal effect of his own misconduct by relying upon the negligence of the defendant."

PERSONAL.

W. J. Hands, recently engineer of the Electric Light and Water Co., Gananoque, Ont., has been appointed engineer at Upper Canada College, Deer Park, Toronto.

Mr. Ross McKenzie, formerly of the Niagara Falls Park and River Railway, will, it is said, succeed Mr. George Campbell as manager of the Winnipeg road.

Messrs. A. M. Wickens and J. J. Main have been elected on the Technical School Board of Toronto to represent the Canadian Association of Stationary Engineers.

Mr. A. J. Durley has received the appointment of assistant professor of Mechanical Engineering in the Faculty of Applied Science at McGill University, Montreal.

Mr. James Ross, Vice-President of the Montreal Street Railway, accompanied by Mr. Grenville Cunningham, Managing Director of the company, took their departure from New York a fortnight ago en route to England on a business trip of some weeks.

The many friends of Mr. A. E. Edkins, Registrar of the Ontario Association of Stationary Engineers, will be pleased to learn that he is rapidly recovering from his recent severe illness, and that his entire convalescence is now only a matter of time. Mr. Edkins literally passed through the valley of the shadow of death, having been at one time considered by his physicians to be entirely beyond hope of recovery. A kind of Providence, assisted by a splendid physical constitution, have, however, pulled him through the ordeal, and we trust that for many years to come he may be spared to his family and friends.

PUBLICATIONS.

A very handsome calendar has been issued by the Boiler Inspection and Insurance Co. It is said to be the first issued in Ontario from steel plates engraved by Canadian artists.

The Wm. Hamilton Mfg. Co., of Peterboro, Ont., have sent us copies of their new catalogues containing illustrations and descriptions of their "Payne" automatic Corliss engine, steam boilers and other machinery. Included in the contents of these catalogues are several valuable tables of calculations relating to the operation of steam engines. A copy of these catalogues will be sent to any address on application.

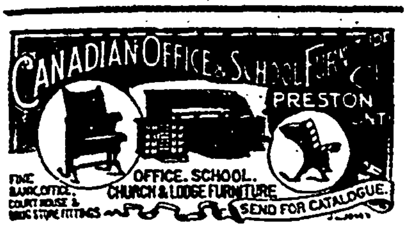
MR. GEO. W. EPPS, in remitting his subscription, remarks that the ELECTRICAL NEWS is thoroughly up-to-date in every respect.

SPARKS.

The new plant so far ordered by the Toronto Electric Light Company to replace that destroyed in their recent fire consists of 8 Brush arc machines of the latest type, having a capacity of 125 2,000 c.p. lamps each.

The recent fire at the power house of the Toronto Electric Light Co. was the occasion of an exceedingly prompt piece of shipping work from the factories of the Canadian General Electric Co. at Peterboro. A telephone message from Mr. J. J. Wright reached Mr. Stephens, general superintendent of the works, at 7.45 in the morning, and at 8.30 a car-load of arc apparatus, including a 125-light Brush machine, was on its way to Toronto, where it arrived in time to be put in service the same night.

Application is being made to the Ontario Legislature by Alexander H. Edwards, of Carleton Place; John B. Riley, of Plattsburg, N. Y., United States Consul General at Ottawa; Thomas Henry, of Montreal, and James Fowler, of Arnprior, for an Act to incorporate the Lanark County Electric Railway Company, with power to construct a line of railway from the town of Perth to the village of Lanark, and to extend the same to Olivers Ferry and Smiths Falls on the south, and to Almonte and Carleton Place on the north.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