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CANADIAN

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AND

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GENERATION AND TRANSMISSION OF ELECTRICITY FROM WATER POWER.

THE work of utilizing the great water powers of the far west is going on rapidly. Within the past months two electrical plants for the transmission of power from water falls over long distances have been installed. That at Sacramento, Cal., has proved the feasibility of economically transmitting the power of a fall to a distance of nearly twenty five miles. That at Portland, Ore., is still more important and presented many new electrical problems. Those have been successfully solved and the thriving city of Portland is now benefiting by a service of electricity from a water fall more than twelve miles away. This installation was made by the Portland General Electric Company, of which Mr. F. P. Morey is President. The company constructed to allow of the passage of vessels past the falls into the navigable waters above, extending seventy-five miles inland.

To construct this canal, the State of Oregon contributed about $20,000, the balance being supplied by the Portland Company.

The station building is of concrete, stone, iron and brick and when finished will have a length parallel with the river of 364 feet. The water is taken from the canal, led through an extensive hydraulic installation and discharged into the river below on the other side. The water wheel plant is from the works of the Stillwell-Bierce & Smith Vaile Co., of Dayton, O., and consists at the present time of three units, each consisting of a pair of vertical cylinder gate improved Victor turbine wheels, 42 inches and 60 inches in diameter respectively. The larger wheel is an auxiliary to be brought into service only at periods

FIG. 1.—INTERIOR OF STATION SHOWING THREE 3-PHASE GENERATORS AND TWO DIRECT CONNECTED EXCITERS.

owns the entire water power of the falls on the Willamette River at Oregon City, twelve miles above Portland, which, with a head of forty feet, has a minimum capacity estimated at 50,000 h. p. Part of the power has already been utilized by numerous factories and mills erected near by, and in addition to these an electric station erected some years ago has supplied current for lighting the streets and dwellings of Portland and for operating an electric street railway between Oregon and Milwaukee, seven miles away, the direct current and high frequency alternating systems being used.

In order to take advantage of the power of the falls the Portland General Electric Company has constructed the first part of an extensive station on the west side of the Willamette river opposite the City of Oregon. The part constructed is one quarter only of the building, which is being put up in sections. Twenty sections will complete the building; five are already built and foundations are now being made for the remainder. The ultimate generating capacity of the station will be 12,800 horse power. In addition to the land covered by the station, the Company has purchased about 1,600 acres in the vicinity. It also controls the canal and locks on the west side of the river, of excessive high water, which the records show occur about once in every five years. The smaller wheel runs at a speed of 200 revolutions per minute and the larger at 100 revolutions per minute. Both turbines are set at the same level and each carries a pulley, that of the sixty inch wheel being fixed to the generator shaft. When the large wheel is in operation the two pulleys are belted together, the smaller wheel is disconnected and the large wheel drives the generator at a uniform speed of 200 revolutions. When the smaller turbine is operated alone the belt lies upon a shelf surrounding the pulleys.

The weight of the vertical shaft with the armature is about 33,500 pounds, and to carry this a system of extra bearings is introduced one of the ring thrust type and the other a hydraulic oil bearing, both supplementing the ring bearings on the armature shaft. They are enclosed with cases filled with oil delivered by hydraulic pressure, and are surrounded by water jackets.

The length of the generator shaft is 29 feet, and 8"-¼ in diameter. It is not a continuation of the shaft of the wheel but is coupled to it by means of a disc coupling, which allows of a certain free movement up and down of the generator shaft. The shaft of the 60 inch wheel runs from the coupling to a bearing set in the floor of the station. Both wheels in each section are controlled by hand wheels and both are regulated by the same governor. The belt tightener is also controlled from either floor by a hand wheel.

The water is admitted to the penstocks from the upper canal by means of a head gate operated from a platform on the canal side of the station. Each penstock is ten feet in diameter and is constructed of riveted steel plates. Each wheel has its own flume, the water passing first through the large flume of the larger wheel to the flume of the smaller wheel, whence it passes

Fig. 2. Bank of Step-Down Transformers.

through a tube into a tail race. In addition to this turbine equipment, an auxiliary power equipment has been furnished, consisting of a set of pumps, including a hydraulic pump for supplying oil to the thrust bearing cylinders and a duplex water pump to circulate the water in the cylinder water jackets. They are operated by two 15-inch horizontal turbines enclosed in the same flume. For the operation of the exciters a further pair of vertical turbine wheels has been installed, each 48 inches in diameter, driving the generators by a similar system to that already described for the operation of the main machines.

The complete power plant will consist of twenty, three-phase generators and two direct current generators, acting as exciters. The total capacity of the station, therefore, will be 12,000 horse power, divided into twenty units, each one independent of the other.

In order to obtain the best results from the power at its disposal, the Company selected the three-phase system of electrical power transmission as developed by the General Electric Co., which has proved so satisfactory in the majority of power transmission installations of varying sizes and varying distances in the United States.

One peculiar feature of the Portland installation is the employment of large blocks of power for street railway service, involving the transformation of the polyphase current sent over the line into direct current for railway circuits. The frequency is 33 cycles per second, selected on account of the large amount of power which is necessary to convert from alternating into direct current. The current is delivered directly to the line without first passing through transformers and when it reaches Portland is transformed down to a potential of 400 volts. For the power service the step-down transformers are connected to rotary converters which will deliver a continuous current of 500 volts for street railway service, as well as for the operation of stationary motors. Induction motors will also be used, directly connected to the secondaries of the step-down transformers when this can be done to advantage.

The five sections of the building already erected are occupied in the following order The first section contains the pumps and the accumulators for the complete station, in each of the three following sections is one three-phase alternating current generator of 450 k. w. or 600 h. p. capacity, and the fifth section contains two 250 k. w., m. p. continuous current generators used as exciters. Each exciter is capable of exciting all of the twenty, three-phase generators, and the second has been set up as a reserve in case of accident to the first. At present, one is furnishing direct current to the street railroads in Oregon City. When the station is complete, the exciter section will be removed from the fifth section, which it occupies at present, and will be placed in the centre section of the building, where the switchboards will also be erected.

The generators are of special design and are set upon the floor of the station, the armatures revolving in a horizontal plane, with one bearing at the floor line and another on top of the armature underneath the collector rings. Each generator has twenty laminated poles. The armatures are a little over seven feet in diameter and are about two feet high. These armatures are constructed to deliver current directly to the line at a working potential of 6,000 volts effective pressure without the intermediation of step-up transformers. On account of this high voltage unusual precautions were necessary to perfect the insulation of the armature coils to avoid leakage to the ground. The armatures are wound with flat wire and each of the coils is divided into sections, each section being separately insulated. The thoroughness with which the feat of delivering the enormous voltage direct from the machines has been accomplished can be judged by the fact that the armatures were subjected to a pressure of 15,000 volts alternating and were both short circuited and open circuited under full excitation without the slightest injury.

The field coils are wound for excitation of 500 volts continuous current, and each has been subjected to a test of 5000 volts alternating. The regulation in these machines has proved singularly good, the increase from no load to full load being comparatively moderate.

From the dynamos the loads are run to floor connectors and pass underneath the floor to the switchboard. The concrete floor is over them and thorough protection guaranteed.

The exciters are set up to allow of the armature revolving in a horizontal plane with one bearing only at the floor line. The construction of these exciters is almost identical with the G. E. m. p. type of railway generator, and each has a capacity of 250 k. w. at 125 revolutions per minute.

The high tension switchboards are built of native marble and the panel method of construction is followed throughout. Each panel carries a double pole main switch for the high potential circuit, and a potential circuit and a double pole double throw switch for the exciting circuits. It also carries a rheostat for the control of the excitation of each machine and a single throw

Fig. 3. Receiving or 3-Phase Side of Rotary Converters.

switch opening the circuit through a set of seven 32 c. p. 110 volts. In addition the board carries a current indicator for each line and one for the exciting circuit, and a potential indicator with station transformer placed at the back. The upper part of each panel consists of a set of plug connections for coupling the machines in parallel or for direct line connections from each generator.

The exciter switchboard consists of two panels of Tennessee marble with a special switching panel between them. By means of this switching panel current for the railway service in Oregon City can be obtained from either exciter, or the two exciters can be coupled in parallel or the outgoing railroad current can be used for excitation purposes and the balance from the exciters can be used for other work. From the generators the current passes directly to the line through the switchboard. The line is 14.3 miles long, a separate circuit being installed for each machine. It passes through an undulating country following the course of the Willamette river as closely as possible.

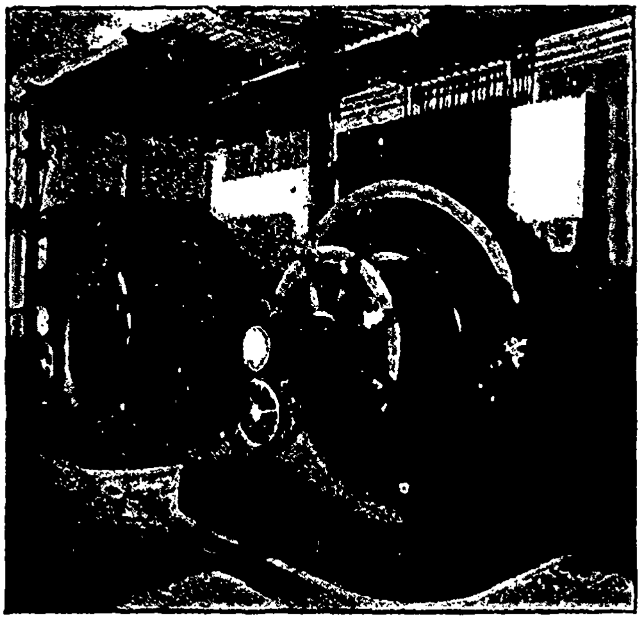


FIG. 4.—DIRECT CURRENT SIDE OF ROTARY CONVERTERS.

The poles upon which the three phase wires are strung, also carry a number of wires for the 5,000 volt continuous arc current from the old transmission station, as well as the wires over which the old system of lighting with high frequency 5,000 volt alternating current is effected. The loss in the long distance transmission line is calculated at full load at about 11 %.

The sub-station to which the high frequency lines are brought, is a two-story building at the corner of Seventh and Alder streets, covering a space of 40 feet by 100 feet. The lower floor is divided into three rooms, one containing the transformers, the second the rotary converters, the other being used for a repair shop, lamp and meter room. The upper story of the building is occupied by the offices. In the transformation room at present are the necessary transformers for the three units already installed—45 transformers in all. The receiving end of each line is connected to a bank of 15 transformers per generator, five being placed between each pair of wires of the three-phase system. The transformers are mounted on an iron rack five transformers high and three wide and foundations are already laid for six additional units. Each set of five transformers is connected to the primaries in series and to the secondaries in parallel, although in the transformation of the three phase current two sets only are necessary. For the large units, with high voltages, however, as employed in the present installation it is desirable to have a large number of transformers banked. The bank therefore is divided into three sets instead of two so that each group may act as a reserve to the other two sides enabling two-thirds of the power of each generator to be delivered even if the transformers on one leg of the circuit have to be disconnected, nor is the balance of the system affected by this change of connection. The transformers regulate at a little over one per cent. variation of the secondaries from no load to full load. The transformers are of the standard General Electric substation type, having numerous air passages between successive bunches of iron lamine and between the coils so that they may be cooled by artificial ventilation. This enables the transformers to be worked at a high output of efficiency and yet remain cool. The distribution of light from the secondaries is effected on the Edison four wire system which also allows of the working of synchronous and induction motors from the lighting mains. The four wire system is worked at 1,000 volts between wires and by means of feeder regulators a variation of 4 in either direction is covered.

As already mentioned the direct current for the railway service is obtained by conversion from the three-phase alternating current. This is effected by means of rotary transformers, a type of machine which the General Electric Company has brought to a high state of perfection. Two of these are at present installed in the sub-station, and space has been left for an additional three. The capacity of each converter is 500 h. p. delivered to the bus bars of the continuous current switchboard. The long distance transmission lines for this railway service, as in the case of the lighting circuits, are connected to the step-down transformers, transforming the current from 6,000 volts on the line to 400 volts at the secondaries. The secondaries are connected to the three collector rings on one side, and the current is thus brought into the armature of the rotary converter. The alternating current at 400 volts is then converted in this machine into direct current at 500 volts at no load and 550 volts at full load delivered from the commutator side. The rotary converters are arranged for self regulation, the voltage on the direct current side compounding with the same regularity as that found in the best direct current dynamos despite the varying losses on the long distance line and the varying armature reaction in the rotary converter. This regulation is entirely independent of the generator which receives constant excitation at all loads. The shaft of the rotary converter is extended twelve inches beyond the bearing of the alternating current side to take a small pulley from which any small machine or an arc dynamo may be driven.

It is a note-worthy fact that in spite of the long transmission line, and the increasing load on the generator, the potential supplied to the railway lines steadily rises as the load is increased.

Each rotary converter has a capacity of 400 k. w. It is an eight pole machine making 500 revolutions. The armature is iron clad, carrying at one side a commutator and at the other three collector rings. From the rotary converters the wires are taken to the power switchboards. Each converter has two panels, one for the three-phase current and one for the continuous current. The alternating current panel carries two double pole switches, one for connection to the converters and transformers and the other to connect the converter to a set of common bus bars. An additional main switch is provided to connect the rotary transformer and the panel itself which carries also a set of fuses, three current indicators and a potential indicator with a transformer reducing the potential from 3½ to 1 The continuous current panel is of the standard direct current railway type with automatic circuit breaker, and a current indicator added for the fields of the rotary transformer. The panels

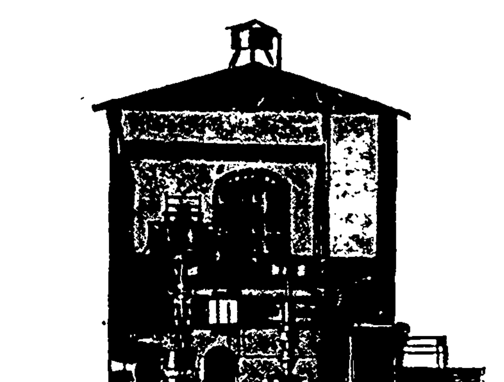


FIG. 5. SECTION THROUGH THE POWER HOUSE.

may be coupled in parallel on both the alternating and continuous current side.

The lighting switchboards in the sub-station consist of one panel for each leg of the three-phase system. The secondaries from the transformers are entirely independent and the panels carry fuses and two 4 pole switches for coupling the feeders directly either to the corresponding transformer unit or to the bus bars and the switches for the operation of the feeder regulators. A current indicator is placed on each side of the four wires and three potential indicators between the four wires. On top of the switchboards are placed the main switches for opening the different feeders, and each panel is provided with ground detectors and lightning arresters.

At present the lighting from the three-phase system is used for large buildings, containing several hundred lights each. They are close to the city station and this distribution can be readily handled at about 400 volts. For the outlying and residential districts the high frequency apparatus with individual transformers will still be employed. Continuous current will be furnished to the railway and to the stationary motors already installed, but new motor installations will be made with the three-phase motors which will be run straight from the three-phase switchboard, in parallel with the rotary transformer.

The direct railway current will be carried to the east side railway station by means of cables under the Willamette river and this distribution will reach as far as Milwaukee, where connection will be made in parallel with the 600 volt service from either station A or station B at Oregon city. The loop from Oregon city to Portland and back will thus be as follows. Beginning at Oregon city with 33 cycle three-phase current at 6,000 volts, 14.3 miles will be traversed as far as Portland; the current will then be transformed to 400 volts alternating, and passing through a rotary converter, issue therefrom at 600 volts continuous, which will be transmitted eight miles to Milwaukee and connect with the continuous current from Oregon city.

This plant when finished will be one of the largest long distance transmission plants in the world. Its satisfactory operation so far shows admirably, not only the effectiveness of the three-phase transmission system for general service, but also its feasibility. This has rendered possible its adaption to the operation of important railway systems through simple apparatus, and to the working of a distributing net work composed in a large part of existing lines.

RELATIVE ADVANTAGES OF THE ONE, TWO AND THREE WIRE SYSTEMS.

Editor ELECTRICAL NEWS.

SIR,—In your October issue I note with extreme pleasure that we poor outsiders are benefitted by being able to read, study and inwardly digest the excellent papers brought before the Canadian Electrical Association at their recent convention. Before going any further allow me to express my deep and sincere appreciation of this benefit, accorded to non-members and members of this useful Association alike. At the outset I wish to say that I want it distinctly understood by your readers that I do not claim to have more than ordinary knowledge—that I am very liable to mistakes, grammatical and otherwise, and ask the indulgence of your readers accordingly.

The paper in which I find myself more especially interested is entitled "Some Modern Alternating Current Apparatus," by H. T. Hartman. Being employed as manager and chief engineer of a small alternating plant in a suburban town, where customers are few and far between, and where primary and secondary mains are required to cover a considerable area, I am more than ordinarily interested in the question of secondary distribution. In the first place, I am desirous of distributing current to customers with as little loss as possible, so as to have every possible unit of current generated at power station turned into cash at regular periods. Secondly, it is essentially important that capital account may be kept as low as possible to secure good and efficient secondary distribution, and at the same time that capital invested be kept within reasonable margin.

I read with a great deal of pleasure the portion of Mr. Hartman's paper applying particularly to secondary distribution by means of the 3-wire system, and at the same time the discussion and remarks on the paper by Mr. Medbury and others. I am particularly interested in Mr. Medbury's remarks, claiming that transformers can be so placed on the 2-wire principle as to distribute current over secondary mains at a less expense for copper wire than by means of the same transformers placed on the 3-wire system. I confess I am somewhat puzzled to know how Mr. Medbury arrives at these results, and why 3-wire secondary distribution is to be condemned, even taking his ideal case as an actual one.

As I understand diagram No. 3, Mr. Medbury proposes, instead of setting a large transformer in the centre of distribution, as in diagram 1, to divide the line into two sections, placing a smaller transformer in centre of either section, thus reducing weight of copper required for secondary by reducing by one-half distance of transmission, and at the same time reducing proportionately the current transmitted. He then points out what appears at a first glance evident, that the close section required for the wires, as per diagram 3, is the same as that for two outside wires on the 3-wire plan, and that the centre or third wire is entirely dispensed with, making it appear that less weight in copper is required for the secondary mains, on the 2-wire plan, as per diagram 3, than on the 3-wire plan, as per diagram 2. I must candidly admit I fail entirely to see how Mr. Medbury arrives at this conclusion. On the other hand, I claim that arranging transformers as per diagram 2 will allow the station manager to distribute twice the amount of current twice the distance than can be done on the 2-wire plan, as per diagram 3, with an expenditure of but 33⅓ % more for copper wire, assuming that the third wire is of same cross section as the two outside wires on the 3-wire system, and that wires of equal cross section are used in each case. This is surely a decided advantage from a purchaser's point of view as it greatly reduces weight of copper required per unit of current supplied, and enables the station manager, as in a case like my own, to serve several customers from one transformer station, enabling the use of larger transformers in place of a number of small ones.

A case in point arises in my own practice. At one point of my system I had eight customers and six prospective ones, so situated that I required at least eight transformers to be set on 2-wire distribution. I speedily found that what with cost and general inefficiency of small transformers, a better system of distribution must be devised. As an experiment I purchased a pair of larger transformers, setting them together in centre of location, and spread secondary wires on 3-wire system over a radius of some 900 feet in each direction, using 52 volts on secondary mains as heretofore on old 2 wire system. By leading one of the outside and centre wires in one direction, and the other outside wire and continuation of centre wire in another direction, tapping off to customers as required, I found this a very efficient method, greatly reducing initial cost and giving equally satisfactory service. In a somewhat similar case I found it necessary to extend outside mains and light some customers a considerable distance from transformers at 104 volts, supplying some customers at 52 volts and others at 104, both from the same set of transformers. So efficient have I found this system of secondary distribution that I am gradually arranging transformer stations at different points on system, so as to eventually have all secondary distribution on the 3-wire system.

Just a word as to meters. I am using the same meters—both Shallenberger and T.-H. Watt Recording—that I formerly used on 2-wire system, with equal results.

Considering Mr. Medbury's great ability, I hesitated before taking up this discussion, and valor may have got the better part of discretion, but I offer as my excuse my great interest in this really interesting question. If I am operating my employer's plant at a disadvantage by adopting the 3-wire system under existing circumstances, then I deserve their condemnation. After studying the question carefully and to the best of my ability, I am unable to see how any arrangement of transformers on the 2-wire system can reduce required weight of copper without seriously increasing the number of transformers and decreasing the efficiency of same, and I have a great big desire for information on this point.

I have the pleasure to remain,

Yours truly,

ENGINEER.

HORSELESS VEHICLES.

While the usefulness of the horse has been to a very great degree impaired by the bicycle and the trolley car, it seems as if his position as a faithful servant of man is to be still further destroyed by the horseless vehicle, about which there is now so much being said and written. It is bad enough to be displaced by the silent steed whose bones are iron and whose muscles are rubber, and to be rejected by the car which sweeps along our streets driven by an unseen force, but when everyone who can afford to keep a carriage, or who has occasion to convey himself or his belongings from place to place, adopts some new fangled mechanical power, then indeed will the glory have departed from one of our hitherto most useful domestic animals. No wonder that it should be proposed in all seriousness to establish canning works where horseflesh might be put up for food, so that if he cannot any longer be useful when alive he may at least do some good when dead by helping to sustain life in others.

If a vehicle can be propelled along a line of rails by steam, or electricity, or gas, why should it not be likewise driven along an asphalted or block paved street, or even over a good country road, (and great progress has been made of late in improving our roads)? Traction engines are not a new thing, but their use has been restricted by their cost and the character of the ways over which they had to travel. With the introduction of new and cheaper methods of propulsion, particularly electricity, it is not to be wondered at that horseless vehicles should be introduced, and it is only a question of time when they shall have become quite an every-day affair on our streets, and when the horse, which has so well served us in the past, shall almost entirely disappear.

In order to test the qualities of horseless vehicles several competitions have been arranged. The first has already taken place, in a race from Paris to Bordeaux and return. There is no country in the world where science and industry are so much encouraged by the awarding of prizes for meritorious work as France, and it is not to be wondered at that the first competition to test the merits of this new system of locomotion should be held in that country. The first prize amounted to the handsome sum of 31,500 francs.

THE CARRIAGE WHICH WON FIRST PRIZE IN THE PARIS ROAD CONTEST.

The French competition was taken part in by no less than twenty-two vehicles, twelve of which arrived at Bordeaux within the time limit set by the rules of the competition. Nine of these covered the distance of nearly 750 miles in less than one hundred hours. Eight of the nine were driven by petroleum or gasoline motors, and one only, and that an old machine built in 1880, by steam. Speed was not the only test, the carriage which came in fourth having won the first prize, its record for the 750 miles being 48 hours and 48 minutes. The fastest carriage was ruled out by the fact that it did not accommodate at least four persons, as required by the rules.

The result of the race seems to show that the lightest vehicle is the best, and this proves the superiority of the essence of petroleum, or gasoline, over electricity or steam as a motive power. It requires only 88 lbs. of gasoline to produce one horse power hour, whereas steam requires at least 66 lbs. of coal, and under the storage battery system more than 220 lbs. is required. Light vehicles also admit of the use of rubber tires. One of the carriages in the competition was equipped with pneumatic tires and though it weighed 2,380 lbs., accomplished the entire distance without accident to the wheels. All the high speed steam carriages met with accidents, which shows that their weight, made necessary by the system, is too great for vehicles for public roads.

Though the petroleum motor showed its superiority over electricity in this contest it by no means follows that the latter will not be the motive power for the self-propelled carriage of the future. The heat produced in any self-propelled carriage, where the power is generated within itself, must always stand in the way of comfort in passenger traffic, an important consideration. It is possible the overhead trolley system may be adapted to road carriages, though they could hardly, in that case, be called self-propelled. We do not doubt that electricians will yet discover some means by which that force can be economically applied to such vehicles.

Following the French competition a similar test is being made on this continent, the Chicago Times-Herald having offered $5,000 in prizes in a race from Milwaukee to Chicago, the date of which has been fixed for November 2nd, and the result of which will be known by the time this paper is in the hands of our readers. Some sixty vehicles have been entered for this competition, the construction of many of them having been stimulated by the prizes offered. The points for the judges to consider are, general utility, speed, cost, economy of operation, general appearance and excellence of design. The London Engineer has also offered prizes aggregating one thousand guineas in a similar competition in England. These competitions will enable American and English inventors to compare the merits of their vehicles with those which took part in the French test.

A parade of English horseless carriages took place at Tunbridge Wells a few days ago. The exhibit included Victorias, landaus and tricycles. As in the French trial the petroleum motor showed its superiority. The essence of petroleum used in these motors is a product having a specific gravity between that of kerosene and gasoline, being about ten per cent. lighter than the former.

So far as the manufacture of horseless vehicles in Canada is concerned, no very definite steps have been taken, but some of our enterprising firms are watching the experiments which are being made elsewhere, and will be ready to place a machine on the market as soon as the times warrant it. Mr. Massey, of the Massey-Harris works in Toronto, who are about to commence the manufacture of bicycles, is credited with the remark that he would have a horseless carriage before the public within a year.

A syndicate of prominent British Columbia business men has however been formed, and is applying for incorporation, with a capital of $500,000, to operate traction engines and carriages on the old Cariboo road, especially between Ashcroft and Barkerville, over two hundred miles of mountain road leading to the mining country. They will carry both passengers and freight. As horse feed has to be taken for long distances into that country the adoption of self propelling vehicles would mean a great saving of expense. Specially wide tires are to be used so as to avoid injury to the roads. Should this company carry out their project, as they talk of doing, at once, their experiment will be watched with much interest.

The Canadian General Electric Co. have sold a three hundred kilowatt monocyclic plant to the Halifax Illuminating Co.

Mr. D. Knechtel, of Hanover, is going to put in an electric light plant at Maple Hill, 2½ miles distant, to supply Hanover with incandescent light. He is negotiating with Mr. Heinburger, the owner of the plant in Hanover, for its purchase. The new plant will be in running order by December 1st.

The Parry Sound Electric Light & Power Co., which was recently organized, have closed a contract with the Canadian General Electric Co. for a monocyclic plant for supplying light and power. The streets are to be lighted with series incandescent lamps, which have given a most satisfactory service in the neighboring town of Bracebridge.

The Hamilton, Grimsby and Beamsville Electric Railway, 18 miles long, has just completed the first year of its history, during which it has carried 220,894 passengers and 15,042 tons of freight. The legislature will be asked to extend the time of completion one year so that the company may obtain the city's bonus of $5,000. The road is only running to Grimsby at present.

THE TORONTO TECHNICAL SCHOOL.

THE Toronto Technical School was established in January, 1892. Its principal promoters were the late ex-*Ald. Gillespie*, who died before it was opened; Dr. J. Orland Orr, the present chairman of the Board, who was the first chairman, the late Mr. I. A. Mills, and Mr. A. M. Wickens.

At first it was thought to be somewhat of an experiment, but the success already achieved has placed it in a more definite position. It is situated on College St., at the head of McCaul St., and directly to the south of the School of Practical Science, in what was formerly Wycliffe College. Permanent quarters have been secured there, and the building so fitted as to be better adapted to the requirements of the school.

It is maintained entirely by the city of Toronto, and is under the control of a Board of Directors composed of seventeen members. Five of these are members of the City Council, five represent the Trades and Labor Council, two the Stationary Engineers, two the Architects, two the Educationists and one the Manufacturers. Regular meetings of the Board are held on the fourth Tuesday in each month during the session, which begins with October and ends with April.

The classes are free to all residents of the city who wish to avail themselves of its privileges. Both sexes are admitted. The course of study to be pursued by any one is optional, and registration and entrance to any class can be made at any time during the session. It is desirable, however, to enter the classes at the opening of the session.

The school has a staff of nine teachers, and the class hours are from 7.45 to 9.45 p.m. each week day evening, excepting Saturdays.

The design of the school is to aid those who have not had the advantage of an education in the early period of life. It is specially intended for the artizans, tradesmen, mechanics, etc., and those who follow the usual occupations of an industrial community.

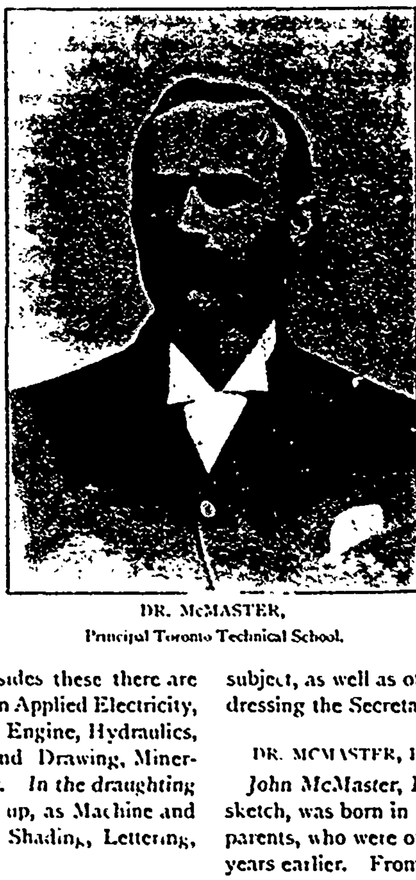
The nature of the work done is very different from that usually taken up by the ordinary commercial colleges or schools. An enumeration of the subjects taught will give some idea of the work it is doing. They are. Arithmetic and Mensuration, Algebra, Euclid, Descriptive Geometry, Perspective Drawing, Mechanics, Chemistry, Practical Chemistry, in each of which there are both junior and senior classes. Besides these there are courses as complete as the time will permit in Applied Electricity, Heat, Hydrostatics, Steam and the Steam Engine, Hydraulics, Light, Sound, Practical Geometry, Freehand Drawing, Mineralogy and Geology, and *Modelling in Clay. In the draughting* room a numerous group of subjects is taken up, as Machine and Architectural Drawing, Industrial Design, Shading, Lettering, Machine Construction, etc.

That the school is doing an important and useful work, and that it is appreciated by the young men of the city, is attested by the fact that the aggregate attendance for last year was 631, while the average nightly attendance for the whole session was 286.

There are no fees for attendance on any of the classes, and each student can take any subject he chooses, or any group of subjects that the time table will permit.

Considerable improvement was made during the holidays by the remodelling of the building and the addition of new class-rooms.

The school is now fairly well provided with apparatus in the more important departments for the practical illustration of the various physical subjects taught. It is intended to make the teaching as practical as possible, and to see that the students know the work and not merely see it done. At the end of the session, or of the work in any subject, examinations are held in the various branches, and certificates are granted to those who succeed. A diploma is also given by the school to those who complete certain definite courses of study. This work, it is thought, will require from three to four years on the part of a *student with average ability and but meagre attainments at his* entrance upon the course.



DR. McMASTER,
Principal Toronto Technical School.

Three new teachers have recently been appointed to the staff, and one of the old teachers, Dr. J. McMaster, selected as principal.

One of the new teachers, Mr. James Milne, of whom we append a short sketch, has been appointed lecturer in the now all important subject of electricity, and he will also lecture on the steam engine. His lectures, covering one of the most important courses in the curriculum, will take up the following topics:—

PRACTICAL ELECTRICITY.—Electrostatics—The Electric Current and its Measurement, Electromotive Force and its Measurement, Ohm's Law, Primary and Secondary Batteries, Electrolysis, Galvanometers, Shunts, Wheatstone Bridge, Locating Faults, the Various Electric Light and Power Systems, including 2, 3 and 5 Wire Systems, Motors, Generators, Armature Winding and Repairs, Transmission of Power, Ampere and Volt Meters, Recording Ampere and Watt-Meters, the Edison Chemical Meter, Testing Efficiency, etc.

HYDRAULICS.—Velocity and Pressure of Water under different heads, Measurement of Flow and Calculation of Water Power, Efficiency of Water Motors, the Capacity and Power of Pumps, Friction in Pipes, Hydraulic Ram, Accumulators, etc.

STEAM AND THE STEAM ENGINE.—Thermal Value of Fuel, the Evaporative Power of Fuel, Transfer of Heat from Furnace to Boiler, Heating Surface, Grate Surface, the Generation of Steam, Motive Power from Steam, Strength of Boilers, Rating of Boilers, the Safety Valve, Action of the Crank and Connecting Rod, the Slide Valve, Comparative Efficiency of the Various Engines, the Indicator, Computation of the H.P., the Theoretical Curve, Measurement of Steam Consumed or Water Used per H. P. from the Diagrams, Testing the Action of the Steam Engine.

We understand that already about 450 have registered for attendance this session. 125 of these will take up electricity under Mr. Milne. The Prospectus of the school, which gives a brief outline of the work done in each subject, as well as other relative information, can be had by addressing the Secretary.

DR. MCMASTER, PRINCIPAL TORONTO TECHNICAL SCHOOL.

John McMaster, B.A., M.D.C.M., the subject of this brief sketch, was born in the county of Simcoe, Ont., in 1857. His parents, who were of Irish lineage, settled in that county a few years earlier. From the age of five till he was twelve, he was as regularly kept at school as the average boy in a newly settled country place can be. At that very early age he learned to plough and became so useful on the farm that he was kept at home, excepting for a few months in the winter. At the age of eighteen it was necessary for him to leave home and to earn a livelihood for himself. At this time his education was very meagre, being confined to reading, writing and arithmetic, at the latter of which he was somewhat expert. As a boy he was very ingenious with his knife, always being mechanically inclined. In spare time, and on wet days, he used to occupy himself making miniature saw-mills, to be driven by a small stream that ran through the farm. Fire-arms made of lead, and bows and arrows of every description, were among his numerous inventions. His desire as a youth was to be an engineer and machinist. In this he never had his father's support, and as he grew older he became more anxious to obtain an education. His first employer owned a small saw-mill and worked a farm besides. John was part of the time engaged in the mill and part on the farm. During this year he bought books and studied

Euclid, History and Short Hand Writing. With the money he earned he resolved to begin his own education. After six months in a public school he passed the entrance to the high school, and very shortly afterwards—three months obtained a second class B certificate. His means being exhausted, he again went to work, and soon secured enough to fit him for teaching. He attended the various training institutions for teachers in this country, and has been engaged in teaching in nearly all the different kinds of schools in the Province. By alternately teaching and studying he was enabled to secure all the different grades of certificates granted by the education department. A degree in arts was the next desideratum. At Toronto University he took a complete honor course in mathematics, graduating in physics in 1886. While there he did not confine himself exclusively to mathematics, but gained a fair knowledge of science, metaphysics and English literature. After graduating he taught mathematics and physics for a few years in different high schools in the province. Not being satisfied with his attainments, he resolved to take up the study of medicine. At Trinity Medical College he took the regular course in medicine, graduating at Trinity University in the spring of 1894. While an undergraduate in medicine he won considerable distinction among his classmates as a student, carrying off his full share of scholarships and prizes.

Before the Technical School began he was engaged as a teacher in the city night schools for several years, and when that institution was commenced in Jan. '92 he was engaged as one of the teachers. Since that time he has remained on the staff, chiefly being engaged in teaching mathematical subjects. The principalship of the school was declared vacant at a Board meeting in August last, and after duly advertising for applications to fill the position, Mr. McMaster was selected from among a number who applied. His duties as principal began at the opening of the school on the 1st of October.

Judging from his active and energetic disposition, and his varied experience in teaching gained in all kinds of schools, as well as his extensive attainments in the various scientific departments of education, we expect an unusual measure of success for this institution.

MR. JAMES MILNE,
Lecturer on Electricity, Toronto Technical School.

MR. JAS. MILNE, LECTURER ON ELECTRICITY.

Mr. Jas. Milne, recently appointed lecturer on Electricity in the Toronto Technical School, was born in Aberdeen, Scotland, on the 29th of January. 1865. He served a five years' apprenticeship in engineering at Mugiemoss Paper Works, Aberdeen, Scotland, taking in pattern-making, fitting, turning and drawing. He attended Gordon's College, Aberdeen, and secured from the Science and Art Department, South Kensington, London, first-class diplomas in Machine Construction and Drawing, Applied Mechanics, Steam and the Steam Engine, Metal Working Tools, (City and Guild, of London, Eng.) &c. Nearly ten years ago he came to Canada. He was for one year in the employ of R. Gardner & Sons, engineers, Montreal, and for three years with M. D. Barr & Co. and the Edison General Electric Co. He then went into business as partner and chief engineer of the Keegans, Mutual Electrical Engineers and Contractors, Montreal. After about three years he withdrew and came to Toronto, where he has been for over three years general superintendent of the Incandescent Light Co., a place he fills with great satisfaction.

The death is announced, in Toronto, of Mr. A. P. Kilganan, of Little Current, Manitoulin Island, government engineer for the district from Collingwood to Sault Ste. Marie. After the government refused to lay a cable to connect Manitoulin Island with the mainland he carried out the work himself, giving the island the only means of communication with the outside world it possesses in the winter. He also established telephone communication all over the island and secured a charter and cleared 70 miles for an electric railway.

NEW ELECTRICAL AND STEAM BOILER PATENTS.

As might be expected, the rapid growth in electrical science and the number of purposes to which electricity is applied in everyday life has called forth the inventive powers of our mechanical geniuses, and the patent office gives evidence of their work. The last issue of the Patent Record bulks up considerably more than usual, largely owing to the number of patents issued for electrical inventions and matters bearing thereon. Some of these no doubt possess merit, but the probability is that most of them will never come into practical use. We append a list of these patents, so that our readers may see what is being done in the way of new electrical patents.

Fare Box—John Maitland Smith, Toronto.

Cypher Combination for Telegraphing—Clement W. Bowman, Ingersoll, and Granville S. Decatur, Hamilton.

Electrical Exchange—The Strowger Automatic Telephone Exchange, assignee of Alex. E. Keith, Frank A. Lundquist, John Erickson and Chas. J. Erickson, Chicago.

Electrical Convertors or Transformers and Enclosing Boxes therefor—Jas. W. Packard, Warren, Ohio.

Conductor's Fare Box—R. R. Mitchell, Montreal.

Electrical Connection—Jas. M. Faulkner, Philadelphia, Penn.

Plate for Secondary Voltaic Batteries—W. A. B. Buckland, 12 Pakenham St., Gray's Inn Road, Middlesex, England.

Current Interrupter—The Canadian General Electric Co., Toronto, assignee of Elihu Thomson, Swampscott, Mass.

Secondary Voltaic Battery—Wm. A Baker, Buckland, Gray's Inn Road, Middlesex, England.

Car Fender—Robt. Bustin, Robt. K Jones, of St. John, N.B., Wesley Vanwark and John R. McConnell, of Fredericton, N.B.

Insulator—L. H. Deslles and F. S Palmer, of Boston, Mass.

Electric Current Transmitter—The Thomson Houston Electric Co., Portland, Maine, assignees of Chas. A. Coffin, Boston, Mass.

Contact Apparatus—The Canadian General Electric Co., Toronto, assignee of Elihu Thomson, Swampscott, Mass.

Electric Circuit Indicator—The Canadian General Electric Co, Toronto, assignee of Elihu Thomson, Swampscott, Mass.

Electric Dental Engine—Wm. E. Wheeler, Geo. W. Johnston and Jas. F. Johnston, of Dayton, Tenn.

Electric Accumulator—Arthur Duffek and Bohumil Holub, Prague, Bohemia.

Car Fender—John F. Ryan, Toronto.

Electric Transmitting Thermometer—Francis N. Denison, Toronto.

Car Fender Attachment—B. E. Charlton, Hamilton.

Electric Head Light—E. A. Edwards, Cincinnati, and Chas. W. Adams, Chicago.

Electric Meter—G. A. J. Telge, Oldenburg, Germany.

Arc Lamp—M. S. Okun, New York.

A number of patents have also been granted in connection with steam boilers. We add a list of these:—

Water Tube Steam Boiler—J. W. Van Dyke, Lima, Ohio.

Steam Trap and Feeder—D. L. Long, Crawfordsville, Indiana.

Feed Water Heater—Walter H. Laurie, Montreal.

Apparatus for Consuming Smoke and Combustible Gases—Louis Hallbauer, Meriden, Conn.

Flue Scraper—Geo. R. Ford, Chicago.

Boiler Cleaner—Geo. R. Ford, Chicago.

Smoke Arrester—Wm. P. Shank, Cairo, Ill.

Steam Generator—S. E. Light, Lebanon, Penn.

Water Heater—Chas. T. Toulmin, New York.

Water Boiler—Ernest Peterson, Blackfriars Road, England.

Mr. R. A. Bush, chief engineer at the Brockville Asylum, accidentally shot himself in the thigh a few days ago. He will recover.

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

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TO the writer, who had occasion recently to visit the Toronto Custom House, it seemed incongruous that side by side with iron doors and shutters, and other safeguards against fire, should be seen in active operation that relic of a past era, the coal oil lamp.

THE sign "To Let" serves to mark the spot in Chicago which two or three years ago was the headquarters of Dr. Wellington Adams, whose proposal to construct an electric railway from Chicago to St. Louis, and operate the same at a speed of 100 miles an hour, was the subject of mild criticism in the ELECTRICAL NEWS at the time The crowds who were to be carried over this road to the World's Fair were compelled to choose another route and put up with a slower pace.

THE most important development in the electrical field of late, is the recent successful test of the electric locomotive built by the Westinghouse Company, for use in hauling freight trains through the Baltimore tunnel of the Baltimore & Ohio railway. The electric locomotive hauled forty-four loaded freight cars, and three steam locomotives up the heavy grade of the tunnel at a speed of 12 miles an hour, the total weight of the train being 1,900 tons. The recent working arrangement made between the Westinghouse Company, of Pittsburgh, and the Baldwin Locomotive Works, of Philadelphia, is considered good evidence that these companies have satisfied themselves of the adaptability of electricity for railway purposes. It it safe to conclude that the working partnership which has been formed between these companies is the result of definite information on this point.

RECENT experiments seem to indicate that the growth of plants may be greatly stimulated by electricity. What wonderful possibilities are here opened up! It may become possible to cause the barren places to blossom like the rose, and the arctic regions, and other parts of the earth now uninhabitable, may be reclaimed and made fit for the habitatión of man.

THE Montreal city council has a rule that parties holding contracts with the city must employ local labor in all their work. In terms of this rule the Street Railway Co. is bound to purchase all its cars from Montreal manufacturers or build them itself. This it has not been doing, and the council now seeks to enforce compliance with the agreement. Was it quite wise to embody such a condition in the contract?

THE St. Clair Tunnel Co. is said to be considering the advisability of using electric locomotives for hauling trains through its tunnel at Sarnia. The heat and escaping steam of the engines at present in use are having an injurious effect upon the tunnel, especially on the asphalt with which the iron is coated. The use of electric locomotives has been successfully tried in a tunnel at Baltimore, and also in mines and underground work at other places, and there appears to be no good reason why they should not be successful in the St. Clair tunnel.

PROF. Geo. Forbes, C.E., has an interesting article in Blackwood's Magazine for September, entitled, "Harnessing Niagara," in which he gives an account of the installation of the great power plant of the Niagara Falls Power Co. Prof. Forbes seems to have had to fight against the preconceived opinions—perhaps the prejudices—of some of those with whom he was associated in the carrying out of that great work, but what he accomplished is there to speak for itself, and it certainly marks him as a great electrical engineer. Had he left out a good part of his article, in which he criticises Americans and American ways, it would have been better. He has certainly brought down upon himself a good deal of hostile comment, and even personal vituperation on the part of a section of the press. Egotism is out of place on the part of a great man, and Prof. Forbes is guilty of it. Nevertheless "Harnessing Niagara" will be read with great interest by those who watch the progress of electrical science.

Mr. George Westinghouse, jr., has recently made the announcement that means have been discovered of producing through the medium of a gas engine of new design, one horse power of energy with a consumption of half a pound of coal. It is a well known fact that with the most economical engines, the amount of coal at present required to produce one horse power ranges from two and one half to six pounds. It can thus be seen what a revolution would follow the introduction of such a discovery as Mr. Westinghouse claims to have made. It would mean the substitution of electricity for steam on railroads, and would solve the question of long distance transmission of electricity for power purposes. It would also mean that electric light could be produced at a sufficiently lower rate than under present conditions to enable it to become a still more formidable competitor of gas and other forms of illuminant. It would be likely to bring electricity into use for heating and other purposes, to which, owing to its cost, it cannot now be applied. The recent application to the Canadian Parliament for a charter for the construction of an electric railway from Montreal to Windsor would seem to show that the developments above referred to are being carefully watched on this side of the line, and that far sighted business men are getting ready to take advantage of the new conditions, which in all probability will be witnessed in the near future.

THE best kind of material for insulators has been and still is a matter of great importance to telegraph companies, more especially perhaps in Canada, where at times the climatic conditions are exceedingly trying. Some years ago the Great North Western Telegraph Company experienced much difficulty with their coast lines in New Brunswick and Nova Scotia. During stormy weather, communication on these lines could not be maintained, and in consequence many complaints were made by vessel owners and others whose interests were affected. After repeated attempts to discover the cause of these interruptions, the difficulty was found to lie with the insulators. A new kind of rubber insulator had been employed in the belief that it would better withstand the climate. It was found, however, that the glazed covering had succumbed to the action of the weather, and that the sulphur employed in the composition had worked out, leaving the insulator porous, and giving opportunity for the salt in the atmosphere to crystallize upon them, and destroy their value. The insulators now used on these lines are made of porcelain, and have proved to be the best adapted to the conditions. Glass insulators are found to answer well throughout Ontario, the only difficulty experienced being that so many of them get broken, especially during the hunting season, when it is a favorite pastime of sportsmen to make a target of them. It is estimated that the renewal of insulators costs the Great North Western Telegraph Company between five and eight thousand dollars every year.

COAL, or fuel generally, is the raw material out of which electric light is manufactured the less used the greater the profit and the quantity used depends on the way it is burned, and on its quality. Everyone has a feed water heater, but very few are aware of the saving effected by raising the temperature of the feed-water 1° Fahrenheit, and still fewer take any means to effect this rise in temperature. In an 100 h.p. plant, running on the average three hours full load every night during the year, the saving effected by raising the temperature of feed-water 1° Fahr. amounts to about 400 lbs. of coal. In winter, when the water is down at freezing point, it is sufficiently obvious that a little intelligent care will save a good round sum. It is doubtful whether, in small stations, the operators know the temperature of their feed, or ever take the trouble to raise it. In places where a condenser is used, it is generally accepted that the higher the vacuum obtained the better will be the general results in point of economy, but this is by no means necessarily so. It is usual to feed the condensed steam back into the boiler, and in that case the higher the temperature of the "water of condensation" the better; but on the other hand, this advantage is obtained at the expense of the vacuum, which itself tends to diminish fuel consumption. So we have the alternative to use plenty of "condensing water" and get a high vacuum and a low temperature of feed water, or to give up some inches of vacuum and gain in the temperature of the hot well. The actually most economical combination must be arrived at in each case by experiments, for, although it is quite possible to give a general expression, showing the relation between feed-water temperature and inches of vacuum, still actual experiment will be more convincing and more intelligible to the average engineer. What is here sought is to suggest to station owners that 27 inches vacuum is not necessarily the highest economy, and that a sacrifice of vacuum might be more than compensated for by the increase in feed water temperature.

As poles are an important item in the equipment of electric light, telegraph and telephone companies, some particulars as to the source of supply in Canada, the lasting qualities of various kinds of woods, and the most suitable method of setting, may be of interest. To begin with, experience has shown that cedar is by far the most lasting material for this purpose. A good cedar pole will endure, under ordinary conditions, for about 25 years, while other kinds of wood, such as spruce, decay in less than half that period. The principal source from which cedar poles are obtained for use in the western part of Ontario, is the county of Victoria, and the neighborhood of Lindsay. In the Ottawa region, there is very little cedar to be had, and the poles for use in this locality are obtained from the neighborhood of Pembroke. In Quebec and the Lower Provinces, cedar is more plentiful, but in some parts where it is not easily obtainable, spruce, which grows in abundance, is substituted. The life of poles is considerably greater in cities, where the pavement protects the wood from the action of the water, than in the country districts, where they are exposed to such action. It has been found that poles deteriorate more quickly in sandy soil than in soil of a heavier kind, such as clay. The life of white cedar poles in the clay soil of Detroit is said to be about 13 years, without protection or treatment of the butts. Norway pine poles have lasted in the same soil about 30 years, but were badly rotted at the surface line. They, however, rot very soon in a sandy soil. The more pitchy ones decay first. Winter cut poles, and those cut in summer with the sap-wood removed, are more lasting than those containing green sap-wood. Experiments with ordinary 4-inch gas pipe, used as trolley poles, and set in concrete up to the surface of the ground, without other coating, developed that they would become corroded through at about 10 inches below the surface in about three years, forming a black deposit. As an illustration of the powerful action of frost, it may be mentioned that in Toronto recently, poles were found to have been uplifted to the extent of eight or ten inches by the action of frost. The experiment is being tried of making the lower end of the poles wedge-shaped instead of square, with the object of lessening the effect of the frost's action. It is hoped that by lessening the amount of resisting surface at the bottom of the pole, the tendency to upheave will be lessened in a corresponding degree.

IT is gratifying to observe that owners and operators of electric light and power houses are beginning to take some little interest in their business, other than the purely commercial one of balancing expenditure against receipts. They are slowly awakening to the fact that electrical and steam machinery, in combination, is all the better for being studied, and that the various wastes and leaks that take place during the process of converting heat into light can be minimized, and may represent a very tidy return on the investment. New installations are being made and new machinery is being purchased, more with a view to cheapness in first cost than with the recognition of the fact that cheap machinery and construction most likely mean expensive operation. Experience gained by costly experiment has proved to many owners that a dynamo is not always a dynamo, no matter how it has been designed and constructed, and that scientific knowledge and practical experience applied in the design of electrical apparatus, will produce a better result than rule of thumb or guess work. The same applies in the operation of an electric power house. The operator who takes the trouble to study his work, to look into his own business, and, in fact, to take an intelligent interest in the undertaking committed to his charge, will always be able to show better results than one who gets light without knowing how, or at what cost, and is satisfied to do so. This latter state of affairs results largely from the want of knowledge, in those using electricity, of the imperfections of their apparatus; of the many directions in which these imperfections result in wastes, and of the manner in which, and the means whereby, these wastes may be at least minimized, if not entirely eliminated. It may safely be assumed that it is the prospect of making money that induces capital to invest in electric lighting enterprises. If this be so, then why not be logical about it, and try and make as much as is possible? Why not be business-like and keep track of expenditures and profits? Why not be sensible and study the business? In electricity, as in every other profession, there are quacks, and there are reputable practitioners; there is good, bad and indifferent machinery and apparatus; and between the indifferent apparatus operated by the quack electrician, and the good machinery intelligently handled by the earnest, thoughtful engineer, there is just the difference between profit and loss. From the coal or wood pile to *the lamp or motor, there are sources of waste in every direction,* and the "electrician" who thinks that managing an electric plant consists in burning fuel, and smoking his pipe until it is time to collect the monthly accounts, is a very expensive man to have around the place.

ONE can to a certain extent sympathize with the owners of small power houses who hesitate before spending a considerable sum of money in order to obtain some prospective advantage, but when saving can be effected merely by a little care and intelligence applied to the operation of an already installed plant, then such an one is merely advertising his own indolence and want of energy, when he says there is no money in electric lighting. A great majority of installations seem to have been made without much regard to efficiency; the machinery bought anywhere, and wiring done anyhow, and the operation managed by anyone; and the consequence is a heterogeneous collection of old type apparatus, which of itself is a necessary source of waste. Prices for electric lighting have had to be reduced in order to make business, and it is generally very difficult to show a favorable result, when operating expenses are kept up by inefficiency, and receipts are lessened by competition. A careful examination into the causes of failure of electric power houses to pay reasonably, will probably lead to two conclusions—that, in the first place, the arrangement of the plant, the wiring system, the kind of machine, the kind, size and distribution of transformers, the relative sizes of engine and dynamo, and so on, are widely different from what experience shows to be the best; and second, that poor as it may be, inexperienced, indolent management fails to operate it to the best advantage. An electric light man quite recently expressed surprise on hearing a transformer spoken of as "chewing up the coal pile," and wondered that it could possibly do so. Now transformers are by no means perfect apparatus; the very best made has a percentage efficiency well below 100, and cannot possibly come up to 100; and between the best and the medium make there is a very appreciable difference. Let electric light men once clearly grasp the fact that transformers *do* waste energy, and they will have gained valuable knowledge. The best claim for transformers in large sizes is about 97 per cent. efficiency at full load. This means that one of these transformers has to be given energy enough for about 103 lamps on the primaries, in order that it may give current for 100 lamps on the secondaries. In a 1000 light plant, therefore, the energy for 30 lamps is "chewed up" by the transformer all the time it is running at full load, and a greater proportion at less loads, and this is the best that has yet been done. This 30 lamp energy goes in heating the transformer iron and copper, in overcoming its resistance, in overcoming the inductive back E.M.F., and in supplying the energy lost through hysteresis. The best transformer costs money—and the chances are that cheap ones have been bought through ignorance of these wastes—and it is evident that the cheap one may really be a very expensive one, because, although any copper and iron will make some kind of transformer, the cheap kinds waste far more in proportion than the expensive ones. Electric light owners would do well to see whether their transformer and wiring system is not responsible for the annual deficit, and whether a little money judiciously spent in replacing old transformers by modern ones would not be the truest economy.

MOONLIGHT SCHEDULE FOR NOVEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1......	A.M. 3.30	A.M. 5.30	2.00
2......	No light.	No light.	....
3.	No light.	No light.	....
4......	No light.	No light.	....
5......	P.M. 5.10	P.M. 7.40	2.30
6......	" 5.10	" 8.40	3.30
7......	" 5.10	" 9.50	4.40
8	" 5.10	" 11.10	6.00
9......	" 5.10	A.M. 12.20	7.10
10......	" 5.10	" 1.00	7.50
11......	" 5.10	" 1.30	8.20
12......	" 5.00	" 2.50	9.50
13......	" 5.00	" 4.00	11.20
14......	" 5.00	" 5.20	12.20
15......	" 5.00	" 6.00	13.00
16......	" 5.00	" 6.00	13.00
17......	" 5.00	" 6.00	13.00
18......	" 5.00	" 6.00	13.00
19......	" 5.00	" 6.00	13.00
20	" 5.00	" 6.00	13.00
21......	" 7.30	" 6.10	10.40
22......	" 9.00	" 6.10	9.10
23......	" 10.20	" 6.10	7.50
24......	" 11.00	" 6.10	7.10
25	" 11.20	" 6.10	6.50
26.	....	" 6.10	} 5.50
27......	A.M. 12.20	....	
28......	" 1.20	" 6.10	4.50
29......	" 2.20	" 6.10	3.50
30......	" 3.20	" 6.10	2.50
		Total,	212.10

THE LEVER SAFETY-VALVE.

GENERAL REMARKS.—We have received so many requests for a rule for calculating the position of the weight on a safety-valve, and the blowing-off pressure when the position of the weight is given, that we have thought it wise to publish such a rule in The Locomotive. It would be easy to give a simple formula for the purpose, but we have considered that the wants of engineers would be best met by explaining the theory of the lever-valve, and showing, as clearly as possible, the reason for each step in the calculation.

OBJECT OF THE SAFETY-VALVE.—The object of the safety-valve, as every one knows, is to prevent the pressure in the boiler from rising to a dangerous point, by providing an outlet through which steam can escape when the pressure reaches a certain limit, which is determined by the strength of the boiler, and by the conditions under which it is to work. The simplest device for attaining this end is the "dead-weight" valve, the principle of which is illustrated in Fig. 2. It consists simply of a plate of iron, laid upon a nozzle, and held down by a weight. The calculation of the blowing-off point of such a valve is very simple. In the valve here shown, for example, the steam acts against a circle two inches in diameter. The area of a two-inch circle is $2 \times 2 \times .7854 = 3.14$ sq in., and the weight tending to hold the cover plate down being 314 lbs., it is evident that the valve will not blow off until the steam pressure reaches 100 lbs. per square inch. Dead-weight valves are used somewhat in England, but they are seldom met with in this country, the commoner form here being that suggested in Fig. 1. It may be well to say that Fig. 1 does not purport to be a good form of valve. We should certainly object to it, if it were placed upon a boiler offered to us for insurance, because no guides are provided for the lever or for the valve stem. These features were intentionally omitted in the engraving, in order that their presence might not draw the attention away from the main points under consideration—the calculation, namely, of the blow-off pressure and of the position of the weight.

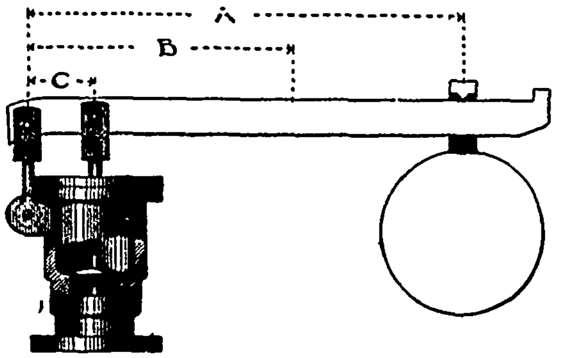


FIG. 1—DIAGRAM OF A LEVER SAFETY-VALVE.

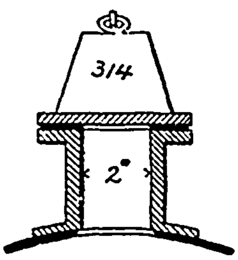


FIG. 2—A "DEAD-WEIGHT" VALVE.

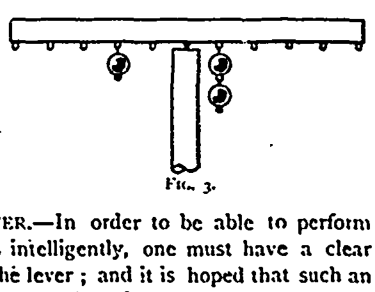


FIG. 3.

THEORY OF THE LEVER.—In order to be able to perform safety-valve calculations intelligently, one must have a clear idea of the principle of the lever; and it is hoped that such an idea may be had from a study of the illustrations that are presented herewith. These represent a lath or other light piece of wood, which is balanced upon a knife edge, and into which, on the under side, a number of small staples are driven at equal distances. A number of balls of lead are also supposed to be provided, all exactly alike, and all being furnished with a hook at the top and a staple at the bottom. Two of these weights, when hung upon the first staple, as shown in Fig. 3, will just balance one weight hung upon the second staple, on the other side of the fulcrum. In the same way, four of them, when hung upon the first staple, as shown in Fig. 4, will just balance one hung upon the fourth staple. Five upon the second staple, as shown in Fig. 5, will just balance two upon the fifth staple; and three upon the fifth staple will just balance five upon the third staple, as shown in Fig. 6. It will be seen that in every one of these cases the lath is balanced, provided the weight upon one side, when multiplied by its distance from the fulcrum, is equal to the weight upon the other side, multiplied by its distance from the fulcrum. *This is the principle of* Archimedes, and it is used in all calculations relating to the lever. *(The reader may find it* a profitable exercise to show that the systems shown in Figs. 7 and 8 *are balanced. A suggestion* is afforded him in Fig. 7, while in Fig. 8 he is left entirely to his own resources. He should find no difficulty in either case, however, if he has grasped the fundamental idea which is contained in the illustrations given above).

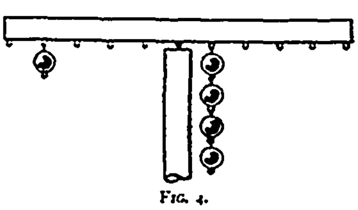


FIG. 4.

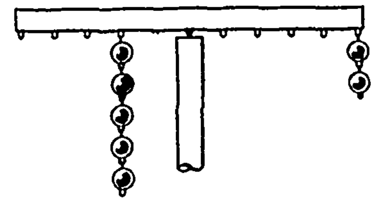


FIG. 5.

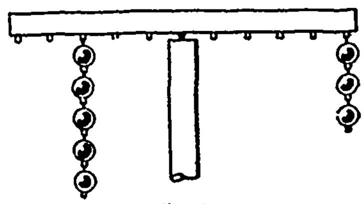


FIG. 6.

APPLICATION TO THE SAFETY-VALVE.—We are now prepared to apply the principle of the lever to the safety-valve, although there is still one point to be cleared up before we can give a complete rule. (The point to which we refer is the influence of the weight of the arm which carries the ball; but for the present moment we shall consider this arm to be devoid of weight, and we shall introduce a correction for it later on.) Fig. 9 is a crude representation of a safety-valve, in which the total steam pressure against the disk of the valve is supposed to be 40 lbs., and the ball is supposed to weigh 10 pounds. If the valve stem is 6" from the fulcrum, the ball will have to be 24" from the fulcrum in order for the valve to blow off at the given pressure—that is, at 40 lbs. This is easily seen, since 6×40 equals 10×24; but if the reader has any doubt about the applicability of Archimedes' rule in this case, he may note that the upward pressure due to the steam can be conceived to be replaced by a 40 lb. weight hung 6" to the left of the fulcrum, as indicated by the dotted circle. The lever will then be equivalent to the one shown in Fig. 10, which is similar in all respects to those shown in Figs. 3 to 8, and to which Archimedes' rule plainly applies. If the blowing-off pressure were not given in Fig. 9, and we were required to *find it from the other data there shown, we should reason as* follows: When the valve is on the point of blowing off, the upward thrust of the valve-stem is just balanced by the downward tendency of the ball; and, therefore, from Archimedes'

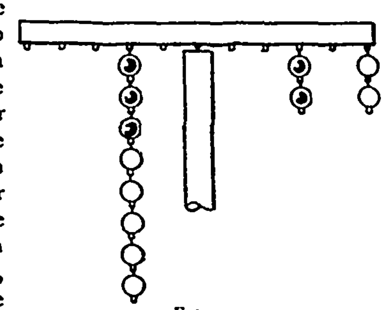


FIG. 7.

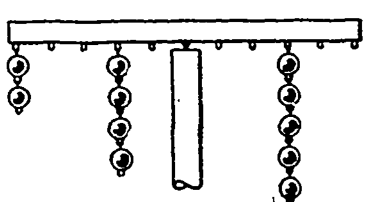


FIG. 8.

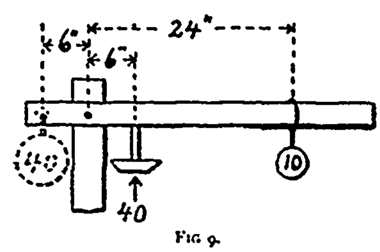


FIG. 9.

principle, 10 x 24 must equal 6 times the thrust of the valve-stem. But 10 x 24 equals 240, and hence 240 is 6 times the thrust of the valve-stem, and 240 ÷ 6 (= 40 lbs.) must be the total pressure exerted on the disk of the valve when it is about to blow off. If the pressure per square inch were desired, we should have to divide 40, the total pressure on the valve disk, by the area of the disk in square inches.

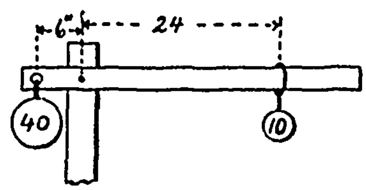


Fig. 10.

THE ARM OF THE VALVE.—In order to take the weight of the valve-arm into account, we shall first make a short digression for illustrating the meaning of the expression "center of gravity." Consider, first, the system shown in Fig. 11, where there is one ball on the first staple and one on the fifth. The one ball on the fifth staple is equivalent to five balls on the first one; so that the two balls on the right hand side of the fulcrum are equivalent to six balls suspended from the first staple. They are therefore balanced by the two balls on the third staple; and, in general, if two balls be hung from any of the staples, they would be exactly balanced by a pair of balls whose distance from the fulcrum was the average of the distances from the first two. Fig. 12 is a further illustration of this fact. Now, referring to Fig. 13, let us conceive the valve-arm to be without weight, except two small and equal pieces of it, whose distances from the fulcrum are respectively 10" and 20". By analogy with the two preceding illustrations, we see that these two little masses would be just balanced by a similar pair of masses, spaced at equal distances; they would be just balanced by four similar masses, hung at a distance from the fulcrum equal to half the length of the arm. While this kind of reasoning is applicable, strictly speaking, only to the case in which the valve-arm is of equal thickness and width throughout, and has no irregularities whatever, we may, in practice, apply it to all valve-arms which are approximately uniform in cross-section; and by extending the conception of Figs. 13 and 15 until the little masses become so numerous as to fill the entire lever, we conclude that a valve-arm of this sort would be balanced by a similar arm suspended (as shown in Fig. 15) at a distance from the fulcrum equal to half the length of the arm itself. This amounts to saying that a uniform valve-arm acts the same as it would if its weight were all concentrated at the middle point of the arm. The point in a body which possesses this property is called the center of gravity of the body. As we have said, the center of gravity of a straight lever may, in practice, be considered to be half way out towards the end of the lever; but if the lever has an appreciable taper, the center of gravity will be nearer the fulcrum. The position of the center of gravity can be found, in such cases, by calculation; but it is simpler to take the lever out, and balance it across a three-cornered file, as shown in Figs. 16 and 17. It will balance when the center of gravity is just over the edge of the file, and the distance *B* can then be measured directly.

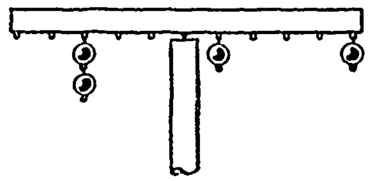


Fig. 11.

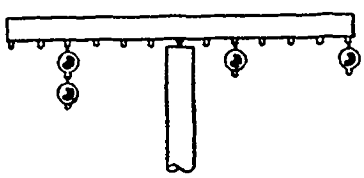


Fig. 12.

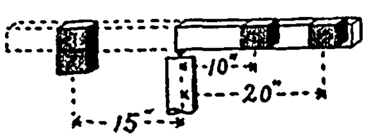


Fig. 13.

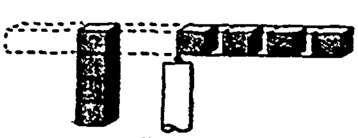


Fig. 14.

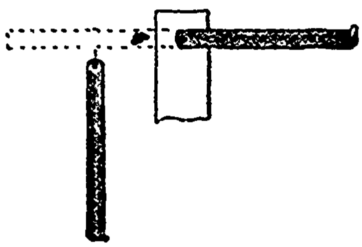


Fig. 15.

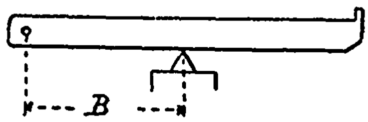


Fig. 16.

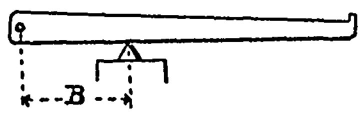


Fig. 17.

CALCULATION OF THE BLOWING-OFF PRESSURE.—We are now prepared to give a complete example of the calculation of blowing-point of a safety-valve. Let us take the valve shown in Fig. 18. The arm is 32 in. long, and weighs three pounds; the ball weighs 20 pounds and is set 28 inches from the fulcrum; the valve-stem is 4" from the fulcrum; the valve-disk is 2" in diameter, and the disk and stem, together, weigh 1½ pounds. It is required to find the blowing-off pressure. In the first case, let us consider the ball. It is possible to load the valve-disk directly (just as in the case of Fig. 2) with a weight which shall have precisely the same effect, in preventing the escape of steam, that the actual 20-pound ball has; and our first undertaking will be to find out how big this imaginary "dead weight" would have to be. When we say that it is to be "equivalent" to the 20-pound ball on the lever, we mean that it would just balance that ball, if it were on the left side of the fulcrum, instead of on the right; and hence, by Archimedes' principle, 28" x 20 lbs. must equal 4" multiplied by the imaginary "dead weight." Now 28 x 20 = 560, and 560 ÷ 4 = 140. In other words, the 20-pound weight, at a distance of 28" from the fulcrum, has just the same effect as a 140-pound weight would have, if placed directly upon the valve-disk. In the same way we may investigate the effect of the valve-arm. It weighs 3 pounds, and its center of gravity is 16" from the fulcrum. A three-pound weight, 16 inches from the fulcrum, is the same thing as a 12-pound weight, 4 inches from the fulcrum; because 3 x 16 = 48, and 12 x 4 = 48. Hence the valve-arm is equivalent to a 12-pound weight placed directly upon the valve-disk. The whole lever valve may therefore be regarded as equivalent to a "dead weight" valve loaded with 153½ pounds; for the ball is equivalent to a dead load of 140 pounds, the arm is equivalent to a dead load of 12 pounds, and the valve-disk and stem, taken together, weigh 1½ pounds; and 140 + 12 + 1½ = 153½. We have therefore found out that the valve will begin to blow when the total pressure of the steam against the valve-disk is 153.5 pounds. The part of the disk which is exposed to the stem is 2" in diameter, and its area is therefore 2 x 2 x .7854 = 3.1416 square inches. The total steam pressure against this area being 153.5 pounds, the pressure against each square inch of it will be

153.5 ÷ 3.1416 = 48.9 pounds (nearly).

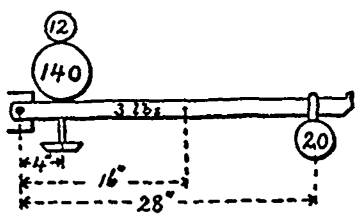


Fig. 18.—Finding the Blowing Pressure.

A valve with the dimensions given above will therefore blow off at just a trifle less than 49 pounds per square inch; and the calculation is similar in all cases.

SETTING THE WEIGHT.—The method of setting the weight, when the blowing-off pressure is given, is almost precisely the reverse of the calculation given above. As an example, consider the valve shown in Fig. 19. The dimensions are as follows: Diameter of the valve = 4", length of the lever = 66", weight of the ball = 50 lbs., weight of the lever = 18 lbs., weight of the valve-disk and stem = 7 lbs., distance of valve-stem from fulcrum = 3". It is required to set the ball so that the valve shall blow at 100 lbs. per square inch. The calculation is as follows: The area of a 4 inch disk is 4 x 4 x .7854 = 12.56

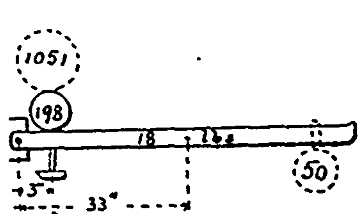


Fig. 19.—Setting the Ball.

sq. in., and if the steam pressure is 100 lbs. per square inch, the total upward pressure against the valve-disk is $12.56 \times 100 = 1,256$ pounds. If the valve were of the "dead weight" kind, a load of 1,256 lbs. on the valve-disk would therefore cause it to blow at 100 lbs. per square inch. We therefore have to set the ball at such a place that the action of the ball, the lever, and the direct weight of the valve-disk and stem, shall be equal to a direct load of 1,256 lbs. *Now, the lever weighs 18 lbs., and its "center of* gravity" is (say) 33" from the fulcrum. It is therefore equivalent to a 198-pound weight laid directly on the valve-disk; for by Archimedes' rule we must have

$$33'' \times 18 \text{ lbs.} = 3'' \times \text{equivalent dead load.}$$

Now $33 \times 18 = 594$, and $594 \div 3 = 198$ lbs., as stated above. In Fig. 19 this dead load (which is equivalent to the weight of the lever itself) is represented by the small weight marked "198"; and the large dotted ball above it (whose weight we are about to find) represents the dead load that is equivalent to the 50 lb. ball out on the lever. The dotted weight, together with the 198 lb. weight, and the weight (7 lbs.) of the disk and stem, must be equal to 1,256 lbs., as we have seen. That is, the dotted weight *must be 1,051 lbs.;* because

$$1,051 + 198 + 7 = 1,256$$

The problem has now resolved itself into placing the 50 lb. ball at such a point that it shall be equivalent to a dead load of 1,051 pounds. The valve stem being 3" from the fulcrum, Archimedes' gives us

$$1,051 \text{ lbs.} \times 3'' = 50 \text{ lbs.} \times \text{ distance of ball from fulcrum.}$$

Now $1,051 \times 3 = 3,153$, and $3,153 \div 50 = 63.06$ inches. That is the ball must be placed 63 inches from the fulcrum, in order that the valvemay blow at 100 lbs per square inch.

RULES.—The processes of calculation which are explained above may now be summarized in the following two rules*:

RULE I. To find the blowing pressure when the position of the ball is given. Multiply the weight of the ball by its distance (A) from the fulcrum, and divide by the distance (C) of the valve stem from the fulcrum. (This gives the dead weight that is equivalent to the ball.) Then multiply the weight of the lever by the distance (B) of its center of gravity from the fulcrum, and divide by the distance (C) of the valve stem from the fulcrum. (This gives the dead weight that is equivalent to the lever.) Add together the two "dead weights," so calculated, and add in, also, the weight of the valve-disk and stem. (This gives the total weight that is keeping the valve-disk down.) Then divide the sum thus found by the area of the valve disk, in square inches, and the quotient is the pressure, in pounds per square inch, at which the valve will blow.

RULE II.—To set the ball, so that the valve shall blow at a given pressure. Multiply the area of the valve-disk by the blowing off pressure, expressed in pounds per square inch. (This gives the total effort of the steam to force the valve-disk up.) Subtract, from this total pressure the weight of the valve and stem. The remainder is the "dead weight" to which the lever and ball, taken together, must be equivalent. Then multiply the weight of the lever by the distance (B) of its "center of gravity" from the fulcrum and divide by the distance (C) of the valve stem from the fulcrum. The result is the "dead weight" to which the lever is equivalent; and if this be subtracted from the total dead weight, just mentioned, the remainder will be the "dead weight" to which the ball alone must be equivalent. Multiply this remainder by the distance (C) of the valve stem from the fulcrum, and divide the product by the weight of the ball. The quotient is the distance, A, that the ball must be placed from the fulcrum, in order that the valve may blow off at the desired pressure.

CAUTIONS.—In applying these rules two things must be carefully observed. In the first place, the diameter of the valve-disk must be measured at $a\ b$, in Fig. 20, and not at $c\ d$; for the steam acts only on the circle whose diameter is $a\ b$. Again, if the valve stem has a square top, as indicated in Figs. 21 and 22, $m\ n$ must be taken as the "distance of the valve stem from the fulcrum"; because the moment the valve raises *in the least degree, the pressure* of the stem is all applied to the lever at n, as is plainly indicated in Fig. 22.

FIG. 20.

*The letters refer to Fig. 1.

Although the foregoing article is intended simply to explain the principle underlying the lever safety-valve, it may be well to touch upon one point concerning the construction of such valves. The point we have in mind is this: When the boiler is under steam, it is an easy matter to try the valve, and find out whether it works freely or not. It ought also to be easy to do this, when the boiler is out of use; and in many cases it is so. Usually *when the boiler is not under steam, it is sufficient to raise the* weight and the lever, and then to try the valve stem with the thumb and finger; but some valves are so constructed that the valve-disk is free from the stem, and in such cases that the

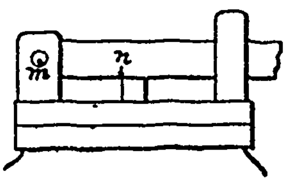


FIG. 21.

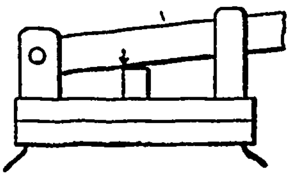


FIG. 22.

fact that the stem is free proves nothing whatever, so far as the disk itself is concerned, and the disk must be separately investigated before the valve can be pronounced in good condition. If there is no escape pipe screwed into the valve, the disk can usually be reached from the exhaust side, and its condition noted; but if such a pipe is provided (as it is, in many cases) the inspector has to examine the disk as well as he can, from the inside of the boiler. If the valve does not happen to be secured directly to the nozzle, an examination from the interior of the boiler is not practicable, and then the waste pipe has to be unscrewed, or the bonnet of the valve taken off, before the disk can be reached. These difficulties, when combined with the fact that there is often no external evidence to show whether the valve is secured to the stem or not, lead us to recommend *strongly that valves with separate disks be avoided altogether.* They have no very marked advantage over those in which disk and spindle are all in one piece, and as they are likely to deceive one into the belief that all is in good condition, when in reality the disk may be stuck fast, we feel justified in condemning their use altogether.—The Locomotive.

THE ST. JOHN, N. B., EXHIBITION.

THE recent exhibition at St. John, N. B., reflected credit on the Maritime Provinces, and attracted not only local exhibitors, but manufacturing companies in the Upper Provinces. The attendance was worthy of the interesting character of the exhibition.

The power required for the operation of the various machinery and exhibits was supplied by a Robb Armstrong engine, manufactured by the Robb Engineering Company, of Amherst, N. S., an engine built by the Burrell Johnson Company, of Yarmouth, N. S., and a Leonard Ball engine, manufactured by E. Leonard & Son, London, the latter represented by Mr. John Evans, St. John. Messrs. Waring, White & Co., also had one of their engines in operation.

Among the numerous interesting exhibits at this exhibition was that of Messrs. T. McAvity & Sons, of St. John, who showed a full line of brass goods and engineers' supplies.

Messrs. W. T. & J. W. Myers, of St. John, exhibited a number of electric elevators, motors, and dynamos. The firm are about to engage in the manufacture of electric machinery, and claim to have one of the best electric motors on the market.

THAT PULLEY ACCIDENT AT AYLMER.

On Saturday last The World published an account of a fatal accident at Aylmer, Ont., whereby Mr. J. D. McDiarmid of that place was instantly killed by the bursting of a poorly-constructed "wood split pulley." The Dodge Wood Split Pulley Co., of Toronto, while very much regretting the accident, are glad to say that the pulley in question was not one of their manufacture, and take this opportunity of advising the users of pulleys of the importance of seeing to it that they get a well-made, reliable article when purchasing. Every "Dodge" pulley manufactured is guaranteed strong enough for the heaviest double leather belt any width. To avoid accidents or mishaps ask for the "Dodge" patent and avoid inferior imitations.—Toronto World.

SOME WESTERN ONTARIO LIGHTING PLANTS.

CONVINCED that a useful hint may sometimes be gained from the study of the smaller electric plants, the NEWS appends herewith short descriptions of the installations in a number of towns and villages in Western Ontario, which will be continued from time to time as occasion offers. Economy may be practised in running a small as well as a large plant, and an account of the system and methods in use at other points may result in suggestions that will be of great benefit as well as proft to those who study them.

CLINTON ELECTRIC LIGHT CO.'S PLANT.

THIS company is making many alterations and has just added a boiler room to their building, placing two Goldie & McCulloch boilers in it, and leaving room for two more. A C.G.E. alternator of 1,000 lights, with C.G.E. equipped skeleton switch-board, has just been placed to replace two Reliance direct current dynamos. One Reliance 25 light 2,000 candle power does the street lighting. These machines are driven by a 60 h.p. Wheelock, from a 3 7-16 in. shafting, 24 ft. long. They have secured the contract for supplying the House of Refuge with 50 incandescent lights, and are extending the service in the town. A new condenser will be put in in a short time, and this little plant will be one of the most complete in the country. Johnathan Brown is the chief engineer, and Geo. White-Fraser is the consulting engineer.

MITCHELL ELECTRIC LIGHT AND WATER-WORKS.

This plant is contained in a neat little building with the engineer's (Mr. Alexander) house in connection. He said he had found that it cost him nothing to be clean, and his boiler and power rooms verified his statement.

A 100 h.p. Goldie & McCulloch boiler, fed by an upright feed-water heater of the same make, supplies steam to a 10 x 18 Wheelock engine, which drives a line of shafting 18 ft. long. To this shafting is connected a 50 light Reliance arc machine, and a 500 light Royal alternator, with an exciter connected. A steam pump is fed by an upright boiler, 13 ft. x 4 ft. It forces water to the 10 hydrants, and can be connected at any time to the other boiler. 45 arc lights and 450 incandescent lights are in use, and the service is rapidly increasing. The plant is owned by the town.

THE KINCARDINE LIGHTING PLANT.

One of the most efficient little plants in the province is the water-works and electric light plant owned by the town of Kincardine, and the board of commissioners have placed a man quite capable to run such a plant—Mr. Jos. Walker.

Two boilers 5' x 16', (Hunter Bros., Kincardine), supply steam to a steam pump, compound complex, with a daily capacity of 1,000,000 gallons, and a Corliss simple condensing engine, 15 x 36 x 125 h.p. The pump is fitted with a Fisher governor for pumping direct.

The engine drives a Thompson-Houston 1,000 light alternator, which drives a 1½ kw. Edison exciter, and a 50 light Ball arc machine. The plant was installed last year, and not a minute has been lost for repairs since its installation. The skeleton switch-board has a volt meter, an ampere meter, a ground detector, a lightning arrester, two rheostats, and a pair of double-pole fuse lights. On the switch-board of the arc machine are two lightning arresters and an ampere meter. The plant was installed and the town wired by the Canadian General Electric Co.

A NEAT ELECTRIC AND WATER WORKS PLANT.

GODERICH, Ont., owns one of the neatest little plants in Ontario, and the council has placed its care in the competent hands of Mr. W. H. Smith, chief engineer, and his staff, consisting of Harry Stowe, Jas. Andrews and Walter Brown. The large red brick building stands by the lake, at the foot of the frowning bluff on which stands the town. The water is pumped by two Gordon steam pumps, with a combined capacity of 1,250,000 gallons, to a height of 130 feet before it reaches the level of the town. Three Waterford "Reliance" arc machines, of 50, 65 and 35 lights—the first two of 1,000 c.p. each, and the last of 2,000 c.p., run by a 60 h.p. Wheelock engine, supply the town with light. The council has been undecided about buying an alternator, but one will be put in in the near future. The Canadian Government supplied a neat little nickle-plated engine, which hangs in a glass case on the wall, having a 10½ in. x 1½ in. cylinder, and it is so arranged that when the steam is turned on clockwork machinery is set in motion, which blows a fog signal at intervals for ten seconds. Two boilers, built by Crystal & Black, Goderich, supply steam, which is conveyed by an overhead main to the pumps and engine. On the walls are the usual gauges, clock, etc., with a fire alarm connected to the central telephone office and the town hall. Altogether it is an attractive plant.

SEAFORTH ELECTRIC LIGHT, HEAT AND POWER CO.'S PLANT.

If electricians and engineers wish a model by which to run their plants they should see that of the Seaforth Electric Light, Heat & Power Co., and learn a lesson in neatness, cleanliness, order and economy.

Our reporter had the pleasure of being shown through this model power house, and he admired the way in which it was managed. The building is a roomy one, 68' x 40'. The power room, office and repair shop, are 40' x 40', and the boiler room 40' x 28', with a 17' ceiling. Two Monarch boilers, 70 h.p. each, generate the steam for the two Robb-Armstrong engines, 75 h.p. and 85 h.p. respectively. These two engines drive a 4 ampere Ball arc machine, and a 55 ampere Union Electric Improvement Co's, Philadelphia, alternator. The engines are arranged so that one can do the work required, or both can be used at once, dividing the load.

In the basement below the power-room is a reservoir with a capacity of 900 barrels. It is filled from the town mains, and pumped by a Northey duplex pump with a Penberthy injector, into an Austin heater, and delivered to the boiler at 211° Fhr. A pipe leads from the heater and from the steam exhaust into an old well in the floor of the basement, and the oil which is contained in the steam and the heater is separated and used over again. They thus save 40% of their cylinder oil. Two pipes come down through the floor of the power room from the engines, and the spindle oil runs through them into a wool filterer, and is also used over again. A nice bath room, with two baths in it, is neatly fitted up in the basement. They have every comfort.

The brushes on the exciter are made of common copper screen wire, sewn together with copper wire. All repairing is done by the staff and they never send any work to the manufacturers. To show their economy, they used for the month of September, on 7 hours' run, 1½ cords of wood. The load carried was 35 amperes on the alternator, 4 amperes on one 40 arc light dynamo, and 8 amperes on the other 18 arc light, and on an 8 hour run they used 1½ cords. Neat offices and a repair room take up one end of the dynamo room, and a large store room and workshop is overhead. The staff consists of Chief A. H. Ingram; assistants, H. McKay, A. Reid, R. Bullard and J. Darling, who have done their utmost to have things neat, putting oil-cloth on the floor, and contributing charts, photos, plans, etc., to make their plant cheerful and attractive.

THE STRATFORD, ONT., LIGHTING PLANT.

It is seldom we see a small plant with three motive powers, but that of the Stratford Gas Co. possesses them, having steam, gas and water power. Their building, situated on the shore of Victoria Lake, is a substantial brick affair of one storey, and a basement 66' x 40', with a boiler room 30' x 45'.

In the main building are two Wheelock simple condensing engines—one of 100 h.p. in use 6 years, the other 200 h.p., just having been placed in position. Their fly wheels are 13' in diameter, with 22" face, the one of the smaller engine weighing 3½ tons, while that of the larger weighs 4½ tons. The line of 4 in. shafting runs the full length of the building, to which is connected the arc and incandescent light machines. There are five Ball arc machines—three of them thirty-five lights each, and the other two, twenty-five lights each—and two Reliance of fifty lights each, two C.G.E. generators of 320 lights each, 120 volts, supplying the town with incandescent light. There are four switch-boards, one for the Ball machines, with lightning arrester; one for the Reliance machines; one for the C.G.E. generators, containing two ampere meters, six knife cut-outs, two rheostats and a lightning arrester; and a separate switch-board with two volt indicators. They have also a volt-meter made by Munderloch & Co., Germany.

In the basement are the gas engine and water-wheel. The gas engine is 50 h.p., Crossley Bros., Manchester, Eng., Otto patent. The gas is supplied from the city mains through a 600 Legat meter. An immense gas-bag is used, with a valve attachment to prevent suction from the city mains. The gas engine has a 12 in. stroke and 14 in. piston, and makes 160 revolutions per minute. It drives on to countershaft, giving 530 revolutions, and from that to main shaft, making 390 revolutions. The water-wheel is a turbine, 50 h.p., 11 feet head.

In the boiler room are two Goldie & McCulloch boilers, 63" x 14', with 84 3 in. tubes each. One boiler has just been placed and another will soon be required.

Neat offices take up one corner of the main building, where charts and photos of the plant decorate the walls. Mr. Wilton, the chief engineer, took great pains in showing the ELECTRICAL NEWS representative the plant, and says that in a short time a tower will be built, rising from the centre of the building, to run the wires out of the building, and as the incandescent service is rapidly growing a new alternator will be needed.

There are six men on the engineering staff—the chief being Mr. Richard Wilton; assistants, Messrs Watson and Chown, an apprentice and two linemen. Mr. John Reid is the manager.

The service is as follows: 7 arcs in power house, 50 commercial arcs, 75 street arcs, 10 G.T.R. arcs, 10 rink arcs, 400 incandescents, 15 motors from ½ to 10 h.p.

ONTARIO ASSOCIATION STATIONARY ENGINEERS.

139 Borden Street, TORONTO, Nov. 5th, 1895.

Editor ELECTRICAL NEWS.

SIR: The following engineers were examined and received certificates during the month of October:

2nd class—O. Monger, Strathroy; T. H. Walker, Kincardine.

3rd class—J. Cronier, Cobourg; C. Stillwell, Brockville; Jas. Walker, Trenton; J. Kemsley, Picton; W. Irvin, Belleville; J. Coughlin, Hintonburg; H. E. Sutton, Cumming's Bridge; Geo. Cameron, Ottawa; R. J. Stewart, Lucknow; F. G. Hall, Kincardine; W. J. Hackett and Geo. Nelson, Toronto; R. J. Levy, Wingham; R. A. Root, J. T. Nicholls and F. A. Ballantyne, Strathroy; S. Barber, Lucknow.

Twenty-three applications for examination were received during the month, four of which failed.

The following engineers who held 2nd class certificates have passed examination for and received 1st class certificates, viz.: Jas. Queen, Toronto Junction; John Fox, Toronto. The following who held 3rd class certificates have passed for and received 2nd class, viz.: E. Carr, Brockville; A. Cunningham, Toronto; A. R. Barwick, Strathroy.

Inquiries re examinations are coming in from all parts of the province. Any engineer needing information as to examinations, who will send me a post card to that effect, will receive by-laws and copy of "Act."

A. E. EDKINS, Registrar.

THE LATE DUNCAN ROBERTSON.

Mr. Duncan Robertson, of Hamilton, treasurer of the Canadian Association of Stationary Engineers, was striken with paralysis, at the Windsor hotel, Ottawa, on the 3rd of October. He had remained in that city after the close of the convention to attend to some business, and while there was attacked by the disease stated, though he was in his usual health the evening before. As soon as possible he was removed to his home at Hamilton, but he died in a few days, much regretted by his brothers of Hamilton Branch No. 2, by the members of the Association in general, and by all who knew him.

Duncan Robertson was born in Kilbernie, Ayrshire, Scotland, Dec. 11th, 1846. He learned the trade of fitter and then went to Carlyle, remaining there for some years, when he went to the Shotts Iron Works. He came to Canada in 1871, and on arrival accepted a position at his trade with the Grand Trunk Railway Co., where he remained for about eighteen years, when he went as manager of the D. R. Dewey Coal Co., and later conducted the business of the Dominion Metallic Packing Co. till the time of his death.

He was a mason for about 27 years and when he died held the office of Junior Warden. He also belonged to the Minerva lodge of Oddfellows. He was, last year, treasurer of the Executive Council of the C. A. S. E., and was re-elected at the late convention. He was a musician of some taste, and while at Shotts acted as precentor of the Calderhead church. He leaves a widow and five children, three boys and two girls.

At the regular meeting of Hamilton No. 2, C. A. S. E., the following resolutions were adopted:

Whereas it has pleased the Almighty in his allwise Providence to remove from our midst our beloved brother Duncan Robertson, be it therefore resolved, that while we submit to the will of the Divine Providence we sincerely mourn with his family the loss of one so dear to them.

Resolved, that we tender our sincere sympathy to them in their sad bereavement

Resolved, that a copy of these resolutions be transmitted to the family of our late brother.

Resolved, that a copy of these resolutions be spread upon the minutes of this Association and a copy be forwarded to the press for publication.

(Signed) { E. C. JOHNSON, President.
WM. NORRIS, Cor.-Sec.

Here is one of the latest electrical jokes from Pearson's Weekly

Customer: "*Why do you call this electric cake?*"

Baker's Boy: "I 'spose becuz it has currants in it."

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Note.—Secretaries of the various Associations are requested to forward to us matter for publication in this Department not later than the 20th of each month.

TORONTO ASSOCIATION NO. 1.

The annual dinner of the above Association will be held at the Richardson House, Toronto, on the evening of Wednesday, the 20th inst.

OTTAWA ASSOCIATION NO. 7.

At the last regular meeting of the above association the following resolutions were adopted:

Whereas it has pleased the Lord Almighty to remove from our midst an esteemed and worthy brother, Mr. Duncan Robertson, and

Whereas he has been a most active worker in our organization, seeking as a member and as an officer to advance the interests of this Association and the welfare of its members; therefore be it

Resolved—That we place on record our appreciation of his services as a brother, as an officer of this organization, and of his merits as a man,

Resolved—That we do most sincerely mourn his loss as a brother, and that we tender our heartfelt sympathy to the widow and family of our departed brother, in this their hour of great sorrow and loss, and that as a tribute of our respect for his memory, the charter of this Association be draped in mourning for a period of thirty days.

Resolved—That a copy of these resolutions be spread on the records of this Association, also a copy be presented to the family of the deceased brother and to the city papers and engineering journals for publication.

FRANK ROBERT
THOS. WENSLEY
F. G. JOHNSON
WM. HILL
F. W. DONALDSON
} Committee.

PERSONAL.

Mr. James A. Baylis, who has been one of Mr. Dunstan's right-hand men at the Bell Telephone Exchange in Toronto, has been promoted to the position of chief electrician at the company's head office in Montreal. This is a well-deserved recognition on the part of the company of the brightest young man in the service. Mr. Baylis' popularity among the telephone fraternity in Toronto was attested by the presentation to him of a complimentary address accompanied by a smoker's outfit by the office and construction staffs. The presentation was made by Mr. Lash.

TRADE NOTES.

The Clinton Electric Light Co. are installing a 1000 light alternator of the Canadian General Electric Co.'s make.

The Lozier Bicycle Co., of Toronto Junction, have purchased a 500 light isolated plant from the Canadian General Electric Co.

The Babcock & Wilcox Co. have sold a 300 h.p. boiler to the Ottawa Electric Railway Co.

The Dunnville Electric Light Co. are installing a 75 kilowatt alternating plant of the Canadian General Electric Co.'s monocyclic system.

The new paper mill now being built at St. Croix, Hants Co., by H. McHart, Esq., will be lighted by electricity, the dynamo and plant for the same being furnished by John Starr, Son & Co., Ltd., of Halifax.

The Welland Vale Manufacturing Co., of St. Catharines, have installed an isolated plant of 100 light capacity. The Canadian General Electric Co. had the contract.

John Starr, Son & Co., Ltd., Halifax, N. S., are moving their office, stores and factory to 134 Granville street, where they will have greatly increased facilities for manufacturing their specialties.

The Canadian General Electric Co. will shortly install an Edison direct current alternating plant at Creemore, Ont., a monocyclic plant at Dunnville, and an alternator at Sudbury.

The ship "Mohawk" has been undergoing extensive repairs at the dockyard at Halifax. The contract for the electric light wiring was awarded to John Starr, Son & Co., Ltd. This has just been completed with lead covered cable throughout to the entire satisfaction of the engineer in charge.

The Unique telephones manufactured by John Starr, Son & Co., Ltd., Halifax, N. S., are coming into very general use throughout the Dominion. They have been adopted by the Engineer's Department of the Imperial Government for connection of their different coast stations, after exhaustive tests of other makes of instruments. Several large contracts have recently been made for complete equipment of lines and exchanges, and the firm report that their staff is taxed to the utmost to fill orders.

Messrs. Wm. Kennedy & Sons, of Owen Sound, are building the outfit for the water power plant of the Canada Paper Co.'s mills at Windsor Mills, Que. It consists of three 60 inch and two 40 inch "New American" water wheels, with main driving gear, bridgetrees and shaftings. They are at work on the models now. They have just sent the last of twenty-four 51 inch "New American" wheels to the Sault Ste. Marie Pulp & Paper Mills, and are reported to find an increasing demand for their electric water governors.

Messrs. Ahearn & Soper, of Ottawa, have lately closed contracts for a 250 light plant at the Edson Fitch mill, Etchemin; a 1000 light alternator at Coaticook, Que.; a 400 light machine for the Bell Telephone Co., Montreal. At Alexandria, Ont., they are installing a 1000 light municipal plant with 45 street lamps, putting in the plant complete, including Robb-Armstrong engine. At Oshawa they are just installing a 275 h. p. generator to be driven by two Robb-Armstrong engines, and at Prescott a 100 light plant for the Prescott Elevator Co.

WHAT IS SAID OF DODGE PATENT FRICTION CLUTCH PULLEY.

QUACO WEST, St. John Co., N.B., Oct. 29th, 1895.

GEO. H. EVANS, Esq.,
Agent Dodge Wood Split Pulley Co., St. John, N.B.

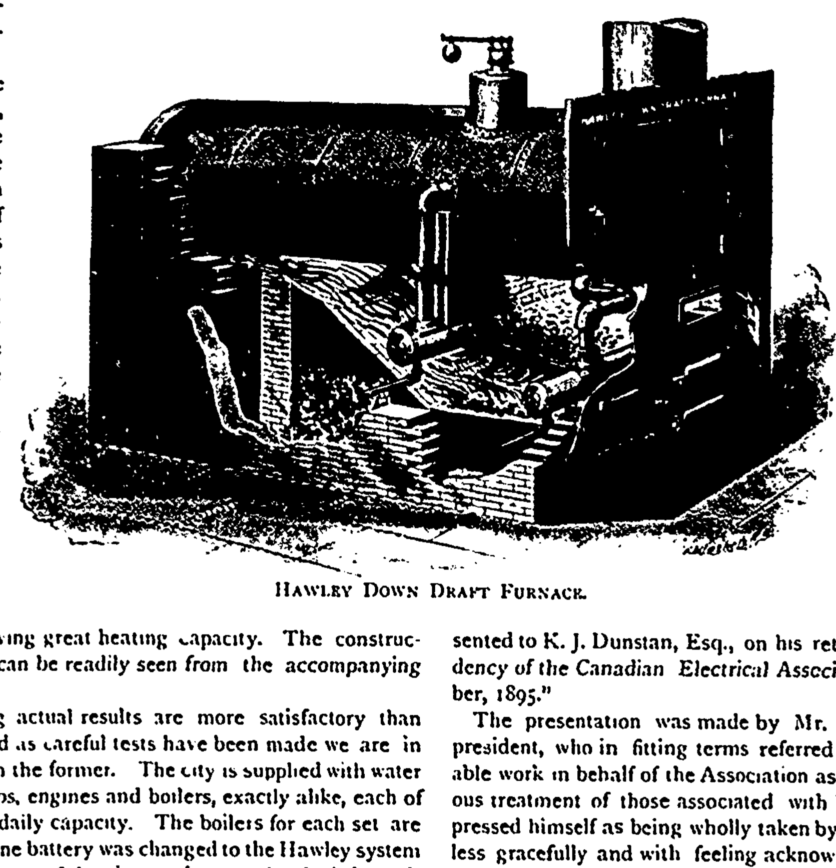
DEAR SIR,—I have had one of the Dodge Wood Pulley Co.'s Split Friction Clutch Pulleys in use for the last month. It transmits 50 h.p in a stationary rotary saw-mill, and never slips or shows the least sign of weakness. It gives me perfect satisfaction in every respect.

Yours respectfully, (Sgd.) S. PATTERSON.

A SUCCESSFUL DOWN DRAFT FURNACE.

ATTEMPTS almost without number have been made to construct a furnace adapted to burn soft coal, which would consume its own smoke, thus doing away with a public nuisance and effecting economy in fuel. The records of the patent office show that inventors have not been behindhand in grappling with the problem, but as is so frequently the case, a large proportion of the attempts have proved abortive. The Toronto Water Works seem to have discovered a furnace which fills the bill, and after a prolonged test, Mr. Keating, the city engineer, Mr. Pink, chief engineer at the pumping station, and the other officials who have to do with it, pronounce it an unqualified success.

The furnace which seems to fill such a long felt want, is known as the Hawley Down Draft Furnace. The head office of the company which constructs them is in Chicago, with branch offices in a number of the cities of the United States. The principle is very simple. The furnace is two storeys high, that is, there are two grates, one above the other. They do not occupy any more space than the ordinary furnace, for in converting the fire places at the water works the boilers did not require to be raised. The upper storey is closed at the back by a wall of fire brick, the lower one is open at the back to allow the heat to pass under the boiler and back through the return flue in the usual manner. The draft is therefore downwards through the fire on the upper grate. There is a fire also on the lower grate, but it does not require to be fed with fuel from outside, what drops through being sufficient to keep it going. By being carried downwards the smoke is consumed, as anyone can see by a glance at the tall chimney, from which no cloud of black smoke issues as is usual where soft coal is burned. The furnace is guaranteed to consume 95 per cent of the smoke.



HAWLEY DOWN DRAFT FURNACE.

The upper grate is formed of a series of tubes opening at their ends into steel drums, or headers, which are connected with the boiler, through which the water circulates, giving great heating capacity. The construction of the furnace can be readily seen from the accompanying cut.

But figures giving actual results are more satisfactory than mere assertions, and as careful tests have been made we are in a position to furnish the former. The city is supplied with water by two sets of pumps, engines and boilers, exactly alike, each of ten million gallons daily capacity. The boilers for each set are four in number. One battery was changed to the Hawley system on the recommendation of the city engineer, who had investigated it at Buffalo and other places, and a careful record kept of the work of the two plants from the 19th of June till the 8th of September, 80 days, the battery with the old style of furnace using hard coal, grate size, and that with the Hawley furnace using soft coal screenings. The results were as follows.—

	Hawley Down Draft.	Direct Draft.
Quality of fuel used	Soft Coal Screenings.	Hard Coal Grate Size.
Quantity of fuel consumed	948 tons, 998 lbs.	916 tons, 140 lbs.
Price per ton	$2.27	$4.19
Total cost of fuel	$2,153.09	$3,838.33
Net quantity of water pumped, 4 per cent. allowed for slip - imperial gallons.	743,996,365	728,545,308
Cost of fuel per million imperial gallons, net	$2.906	$5.267

It will be seen that a large saving, amounting to about 45 per cent., has been effected by the use of the down draft furnaces. The two batteries were run as nearly as possible under similar conditions, any disadvantage being placed on the down draft.

It will be observed that the consumption of coal in the down draft furnace was a little greater than in the direct draft, but compared with the saving effected this is insignificant. The advantage in favour of the down draft system is so great that it is the intention to convert the other battery to that system at once.

The consumption of coal at the works amounts to about 10,000 tons a year, or say 25 tons a day. Soft coal screenings are supplied at $2.27 per ton, while under last year's contract $4.19 was paid for hard coal. The latter is at present supplied for $3.36, but that is an exceptionally low rate, offered partly to prevent the down draft furnace from being introduced. The test was made on the basis of the $4.19 rate for hard coal.

The down draft question having been satisfactorily solved by these tests, there is no reason why it should not be adopted elsewhere. In the case of the Toronto waterworks it will pay for itself in nine months.

The Hawley Company only guarantee a saving of 35 per cent. in fuel by the use of their furnace. As will be observed, the saving at the waterworks has been 45 per cent. The Hawley furnace has also been tried at the Toronto Incandescent Light Works, but there it has not given such satisfactory results, owing to the fact that screenings were used instead of hard coal previous to the introduction of the down draft furnace, and therefore the economy was not so marked

PRESENTATION TO MR. DUNSTAN.

EVERY member of the Canadian Electrical Association is agreed that Mr. K. J. Dunstan, the retiring president, discharged his duties in a manner highly creditable to himself and in the best interests of the organization. For the purpose of giving tangible expression to this opinion, some of Mr. Dunstan's associates descended upon him at his office on the 29th ult., and presented him with an enlarged and suitably framed photograph of the group of members taken at the recent convention in Ottawa, accompanied by a pair of opera glasses for Mrs. Dunstan. The photograph bore the inscription: "Presented to K. J. Dunstan, Esq., on his retirement from the Presidency of the Canadian Electrical Association, Ottawa, September, 1895."

The presentation was made by Mr. A. B. Smith, the new president, who in fitting terms referred to Mr. Dunstan's valuable work in behalf of the Association as well as his ever courteous treatment of those associated with him. Mr. Dunstan expressed himself as being wholly taken by surprise, but nevertheless gracefully and with feeling acknowledged his appreciation of what he was pleased to term the thoughtful kindness of his confreres, to whom he also tendered thanks on behalf of Mrs. Dunstan.

Manson Campbell, of Chatham, has installed an isolated plant. The Canadian General Electric Co. furnished the apparatus.

The Kingston Street Railway Co. proposes extending its track to the Grand Trunk railway station. One man offers a bonus of $500.

The Canadian General Electric Co. are installing a 40 kilowatt direct connected incandescent plant for the Victoria Ladies' College in Whitby. The engine is of the Robb-Armstrong type.

Mr. Norman Ross is looking after the installation of two 200 kilowatt generators for the St. John Street Railway Co., which are being supplied by the Canadian General Electric Co.

The Canadian Pacific Telegraph Department has just completed stringing two number 6 gauge iron wires between Detroit and Buffalo. They will be used by the Postal Telegraph Co. as part of two new quadruplex circuits between New York and Chicago.

ELECTRIC RAILWAY DEPARTMENT.

AMERICAN STREET RAILWAY ASSOCIATION.

THE annual convention of the American Street Railway Association was held this year in Montreal, and was by far the most successful of the similar gatherings held by that organization. It continued in session five days, and during that time dealt with a number of important subjects. The convention met on the 15th of October and continued till the 20th.

FIRST DAY.

When the convention had been called to order, the President, Joel Hurt, Esq., introduced Mr. J. O. Villeneuve, Mayor of Montreal, who, followed by Alderman Stevenson, welcomed the delegates, the president responding to the addresses of welcome.

President Hurt then delivered his inaugural, in which he dwelt upon the rapid strides made by the street railway industry. There are in operation in the United States 179,300 miles of steam roads and 13,500 miles of street railways. While the street railway mileage is 7½ per cent. of the steam mileage, the passenger receipts are 45 per cent The capital of the street railways is $1,300,000,000, or 11 per cent. of the capital invested in steam roads. New questions would, he said, come up for consideration in relation to the handling of freight, mail, small parcels for retail stores, building material in suburban localities, milk and funeral cars. He referred to the necessity of co-operation to defeat hostile legislation, and the importance of impressing patrons with the idea that friendly treatment helped to secure the best service. He suggested amalgamation with steam roads whereby the latter should carry passengers between distant points and then transfer them to street lines, for their final destination. He thought the time had come for raising a larger revenue for association purposes, either by assessment or an increase in membership dues, and said the most important question for their consideration was that of enlargement of the scope of the association.

At the afternoon session Mr. Wessels read a paper on "The Present Status of the Air-Brake," which was followed by a discussion.

Mr. Seely brought up the question of street paving, relating how in a certain city the contractor had refused to put down asphalt unless all traffic was stopped. The mind of the convention was that such a demand was unreasonable.

SECOND DAY.

A discussion took place on the "Labor Question," followed by a paper on "Transfers," which caused further discussion.

At the afternoon session the report of the Executive Committee was presented, recommending some changes in the constitution. The report refers to a deficit of $4,087.33; also recommends that the scope of the Association be extended so as to include a bureau of information for the purpose of collecting and distributing statistical and general information on all matters affecting street railway interests; also that associate members be admitted so as to increase the income. It further recommended a uniform charge of $5 for banquet tickets. A committee of ten was appointed to devise means for paying off the deficit.

The Association was asked to appoint a delegate to co-operate with the National Electric Light Association in securing the adoption of a standard code of rules for electrical construction and operation. The Executive Committee was instructed to take action.

After considerable discussion on the report of the Executive Committee, final action was deferred till next year's meeting.

On invitation a visit was paid to McGill University, and very favorable comment was elicited by the equipment of the engineering building, which contains extensive hydraulic, engineering and electrical laboratories, and a laboratory for testing the strength of materials.

THIRD DAY.

A paper on "Cross Ties and Poles" was submitted by Mr. N. W. L. Brown. Some of the points brought out were these: The life of a pine tie of best quality is only six years. There is great diversity of opinion as the best wood for ties, and some engineers claim to have solved the problem by using metal. Metal ties require to be imbedded in concrete, but as concrete is not necessary in first-class roadbed construction, metal ties are not economical. In New Orleans, where the soil is very damp, red cypress gives good results, but it does not hold the spikes properly. Creosoted ties are strongly recommended as the most economical. They last long, are a perfect insulator, not subject to electrolytic action from leakage of current, and tend to prevent the rails from rusting. Sap pine ties treated with creosote should last 24 years. A creosoting plant is recommended for roads having an extensive mileage, where car floor, trestle bridge and cross arm timbers can be similarly treated. As to poles, iron cannot be depended on for more than 15 years. Red cedar lasts about as long, but small poles are limited to the duration of their sap wood, and large poles are generally hollow at the butt and contain rotten knots. On the whole creosoted poles 30 feet long and 8 inches at the top are recommended, pine being eminently suitable for the purpose.

The report of the Committee on Patents was presented. It suggested a bureau to deal with all matters pertaining to patents as they affect street railways, pointing out how the rights of the roads might be preserved by such a bureau, and their interests protected from vexatious law suits. Those availing themselves of the bureau to pay a sum annually, in addition to the membership fee, to cover expenses.

In the afternoon the Committee on Ways and Means reported. It recommended that the members be requested to contribute not less than $15 each to pay the debt, that a uniform charge of $5 be made for banquet tickets, that individuals and firms, other than companies, lessees and owners of street railways, be admitted to associate membership, and that the convention should be opened on Wednesday and last four days.

A spirited discussion took place, especially on that clause of the report relating to associate membership, which resulted in its being tabled on a vote of 87 to 11. The sum of $4,475 was pledged towards the deficit.

The Nominating Committee reported, recommending that the following be the office-bearers for the ensuing year, and they were unanimously elected:—

President, H. M. Littell, Brooklyn, N.Y.; Vice-Presidents, G. C. Cunningham, Montreal; William H. Jackson, Nashville, Tenn.; J Willard Morgan, Camden, N.J.; Secretary and Treasurer, T. C. Penington, Chicago; Executive Committee, Joel Hurt, Atlanta; Prentiss Cummings, Boston; C. G. Goodrich, St. Paul, Minn.; A. Markel, Hazleton, Pa., and W. F. Kelly, Columbus, O.

The recommendation of the committee that the next convention be held at St. Louis, Mo., was adopted.

The Committee on the Use of Salt and Sand on Tracks reported, recommending both, salt to remove ice and sand to give the wheels a proper grip. In St. Louis 3,000 tons of salt are used each winter without objection from the authorities or health board.

In the evening the banquet was held at the Windsor Hotel. It was destined to be the crowning feature of the best street railway convention ever held. About 250 sat down. The room and tables were handsomely decorated. Mr. Joel Hurt, the President, occupied the chair, and among those present were Mayor Villeneuve, Chief Justice Sir Alex. Lacoste, U. S. Consul General Anderson, Hon. L. Beaubien, Minister of Public Works, Senator Ogilvie, and others. A most enjoyable evening was spent.

FOURTH DAY.

The subject of free music and other entertainment by street railways came up for discussion. Several managers stated that their companies owned parks and gave free concerts in them, and they found it pay. Accidents from crowding on such occasions were rare. Mr. Pennington stated that on Chicago day at the World's Fair, when 800,000 people were carried, only one accident occurred, and that of a trivial character.

Mr. J. F. McElroy read a paper on "Electric Car Heating," which was practically the same as that read by him at the New York state convention at Albany.

FIFTH DAY.

According to the original programme the convention should have adjourned on Friday, but the Committee of Arrangements had planned a trip to Ottawa for Saturday. A special train of seven cars carried the visitors to the capital, where they were transferred to the cars of the Ottawa Electric Railway, and taken to the Parliament Buildings, where a reception was held in the Senate Chamber. An address of welcome was delivered by Sir Mackenzie Bowell, Premier, who referred to the local electric railway system, which was unexcelled on the continent. He hoped the United States visitors would go back with a better opinion of Canada than ever.

Mr. J. H. Gallinger, of New Hampshire, replied. The delegates, he said, were there to cultivate a spirit of amity with Canada, and they loved her more than was generally realized. He thought there was room for two great nations on this continent, and paid a high compliment to Canadian institutions and hospitality.

After lunch at the Russell House and a trip over the street railway, the visitors returned to Montreal by special train.

NOTES.

The feeling is gaining ground that there is too much of a tendency to lose sight of the business aspect of these conventions in the cultivation of the social. While there can be no objection to the delegates having a good time, the interests involved in an organization representing a capital of $1,300,000,000 are too great to be lightly passed over, and when so much time is spent on excursions, receptions and banquets, and so little in discussions on matters affecting the welfare of the companies and the public whom they serve, the Association can hardly be said to be fulfilling its true function.

The subjects of brakes, ties and poles, and heaters were well treated, but such topics as underground wires, underground trolleys, closed conduits, the relation of motor and truck, etc., were not touched upon.

The opposition to the admission of supply men as associate members of the Association caused considerable feeling. Unless they are admitted the Association is likely to suffer in some of its best interests.

The Asso iation has become almost entirely electrical in its character. The cable and horse-car men have dropped out of sight.

It is unsatisfactory to have papers read by their titles only. It is true members have the opportunity of reading them when they are printed in the proceedings, but a discussion, when questions can be freely plied, is often of great advantage in bringing out points which are otherwise lost sight of.

There were too many executive sessions to which only a couple of hundred had access.

The Association should now be in good shape for future usefulness. It has arranged to clear off its debt and elected an efficient staff, with a capable secretary.

The following Canadian delegates appear in the list of those present: W. Bellingham, E. B. Biggar, K. W. Blackwell, Wm. T. Bonner, H. T. Bovey, J. E. Bulmer, John Carroll, J. H. Cass, J. E. Chapman, A. J. Corriveau, G. C. Cunningham, W. F. Dean, J. J. Durack, L. J. Forget, Frank J. Green, C. W. Henderson, E. A. Hewitt, J. F. Hill, W. J. Hinphy, Geo. Hunt, Stonewall Jackson, E. D. Julien, J. M. de Bosch Kemper, George J. Kilpin, J. D. Lamb, T. Lamoreux, H. R. Leyden, E. Lusher, Alex. McPherson, A. Roy McDonald, Duncan A. McDonald, Alex. McDonnell, James Ross, James R. Roy, George D. Smith, Montreal, Que., A. W. Dingman, James Gunn, Edward S. Piper, Charles Morton, O. J. T. Thomas, Toronto, Ont.; Thos. Ahearn, W E. Christie, J. D. Fraser, J. E. Hutcheson, Charles F. Medbury, J. W. McRae, Wm. F. Powell, W. Y. Soper, W. W. Wylie, Ottawa; R. Mackenzie, W. Phillips, Niagara Falls, Ont.; T. C. Lazier, Belleville, Ont.; Frederic Nicholls, Toronto, President Brantford Electric Railway; J. M. Campbell, Kingston, Ont.; Charles E. A. Carr, London, Ont.; J. M. Jenckes, Geo. E. Smith, Sherbrooke, Que.; H. Brown, St. John, N.B.; J. H. Coleman, Tottenham, Ont.; George H. Penty, Victoria, B.C.; M. Coventry, Windsor, Ont.

The Executive Committee make the following recommendations: First, that the Association undertake, through its Secretary, the work of compiling statistical matter relating to the construction, equipment, operation and management of street railways, and the furnishing to members of general information upon matters of insurance, legislation and improvements affecting their interests; second, the election of an executive committee of ten, consisting of the four officers and six others, the latter to be elected for three year periods, two each year; third, the election of the secretary and treasurer by the executive committee; and, fourth, the raising of funds for carrying out the larger work by a system of annual dues based upon gross receipts.

The exhibition of street railway appliances was a prominent and useful feature of the convention. Supply men, with a keen eye to business, were on hand in full force with everything necessary for the proper equipment of railway lines.

A number of the delegates took part, on invitation of the Forest and Stream Club, in a fox hunt. Horses were provided for all who wished to participate. Mr. Hurt specially distinguished himself.

In selecting St. Louis for the next convention it was felt that a good choice had been made. The street railway system of that city is said to be one of the best on the continent.

The hospitality of the people of Montreal was unbounded and called forth many expressions of appreciation.

SPARKS.

Eganville is to be lighted by electricity. Water power will be used.

A fine large bronze statue of Benjamin Franklin is to be placed in Lincoln Park, Chicago.

A dynamo burst recently in the Renfrew light station and was so completely demolished that a new one had to be obtained.

Brockville town council has given its assent to the use of the streets for the proposed electric railway. It is stipulated that the road must be completed and in operation within two years.

The engine in the C. P. R. laundry at Owen Sound, Ont., has been in use for the last 60 years, and is said to be in the best of running order yet. It was made in Manchester, Eng., by John Ellis, jun.

According to the Toronto city engineer's report for 1894 recently issued, the total length of street railway track within the city limits is 82.54 miles, of which 15.56 miles was laid during the year under review.

Franklin L. Pope, the well-known patent solicitor and electrical engineer, was instantly killed on the 13th of October, in his house at Great Barrington, Mass., by coming in contact with a live wire, while experimenting.

The statement of claim has been fyled in the Sunday street car case at Hamilton. The action is brought under the provisions of the R. S. O. of Ontario, cap. 203, entitled "An Act to prevent the profanation of the Lord's Day."

J. Hill, Brussels, Ont., claims he has discovered a process for the tanning of leather for belting and other purposes by the use of crude petroleum. He says that the tanning is done in half the time taken for bark tanning and will wear twice as long. He is trying to get some American capitalists interested.

Writing to the Scientific American, a correspondent replies as follows to another correspondent who asked for some composition for filling cracks in a commutator: You reply that the only way to repair will be to take the commutator apart and replace the mica. But if he happens to have no appliances for this work, a temporary repair can be made of thick shellac solution and dry plaster of Paris. Fill the crack with the shellac, then put on the plaster, kneading it with a knife blade until it is stiff and smooth. Let it dry five or six hours or longer, before scraping off the top even with the surface. It should be thoroughly dry before the armature is used. I have used this method for repairing street railway motor armatures for more than a year, and no armatures have come back in that time for a fault due to this filling.

A joint stock company has obtained from the government, letters patent for the exclusive manufacture, at Kincardine, of bicarbonate of soda and chloride of lime by electrolysis. The officers are as follows, viz: President, E. H. Hilborn; vice-president, H. Glazebrook, Toronto; secretary and manager, John Tolmie, Kincardine. The company is to be known as the Ontario People's Salt & Soda Co. They have built an addition to the salt works 140x60 in which the soda and lime will be manufactured. They are having manufactured for them a steel stand pipe 60 feet high by 3 feet in diameter, and 2 steel scrubbers 18 feet high by 4 feet in diameter for washing the carbon out of the carbonic acid gas. Thirty-two tanks 50x10x1½ will be required. In a separate building being built for this purpose, the carbonate of lime will be made. The building will consist of two air tight chambers. The whole plant will be run by their own private electric plant.

The Ottawa, Canada, Electric Co. has proved itself one of the most progressive lighting companies on the continent. The fact that in a city with a population of but 40,000 it runs 50,000 lights, speaks volumes, and we question whether any other city in the world can approach such figures. But even more interesting is an item in president Ahearn's last report, just presented, showing an income of $421 from heaters. We have not struck this item in any similar balance sheet before, and make its acquaintance with a great deal of pleasure. The expenses per contra charged against heaters are only $12, from which we infer that the service must be quite profitable. It is true that $421 is not a large proportion of the $147,000 received for all services, including incandescent, arcs and motors, but it is a decided beginning and is much larger than the motor account once was with some incandescent companies or the incandescent account with many large arc companies. The Ottawa example of more than one lamp per head of population, and of $421 revenue from heaters at an incidental outlay of only $12 is a mighty good one to copy.—N. Y. Electrical Engineer.

SPARKS.

Lanark, Ont., is talking of electric light.

St. Jacob's, Ont., is to be lighted by electricity.

The electric cars are hereafter to be run in Ottawa until midnight.

Thirty new electric lights will be placed on the streets of Ottawa.

A class in electricity has been organized by the Y.M.C.A., Ottawa.

Mt. Forest, Ont., talks of having an all night electric light service.

Alexandria, Ont., has decided to have electric light and water-works.

Forty-five horses, formerly used on the London Street Railway, were recently sold for $28 each.

The Ottawa Electric Light Company has had to resort to the use of steam on account of low water.

The Montreal Street Railway Company has declared its usual half-yearly dividend of four per cent.

The Montreal Park & Island Railway will extend their line to St. Laurent, a distance of seven miles.

The Neepawa Electric Light & Power Company is applying for incorporation. The capital stock is $20,000.

Winchester, Ont., is agitating for an electric railway between Morrisburg and Ottawa, passing through Winchester.

The Bell Telephone Co. is about to erect a handsome building in Winnipeg, to cost between $15,000 and $20,000.

The Western Electric Light, Heating & Power Company has been formed to take over the lighting of Vancouver, B.C.

A Pacific cable connecting British North America with New Zealand, via Hawaii, is among the possibilities of the near future.

The Ottawa Carbon & Porcelain Works have turned out their first lot of porcelain insulators. They have $25,000 worth of orders on hand.

During the week of the Central Fair, the Ottawa Electric Railway Company carried 207,821 passengers, not including transfers, without accident.

Mr. George Sleeman, proprietor of the Guelph Street Railway, was given a handsomely framed picture of the first conductors and motormen of his road.

Stock to the extent of $40,000 has been subscribed for an electric line between Cobourg and Port Hope. The township of Cavan offers $10,000 for a branch.

The case of the Bell Telephone Co. against Skinner, for cutting their telephone wires at Sherbrooke, Que., resulted in a verdict of not guilty.

A Scotch firm of means proposes to build an electric road from Schomberg, Ont., to some point on the Northern division of the Grand Trunk—probably either King, Aurora or Newmarket.

The Toronto Street Railway Co.'s earnings for October were $78,216.98, of which the city's share is $6257.35. This is $28,316 less than in September, and $2,090 less than in October, 1894. Receipts for sprinkling, advertising, etc., will bring it up to a considerably larger gross amount. The Montreal Co. has earned so far this year $1,102,777, as against $896,000 for the same period in 1894.

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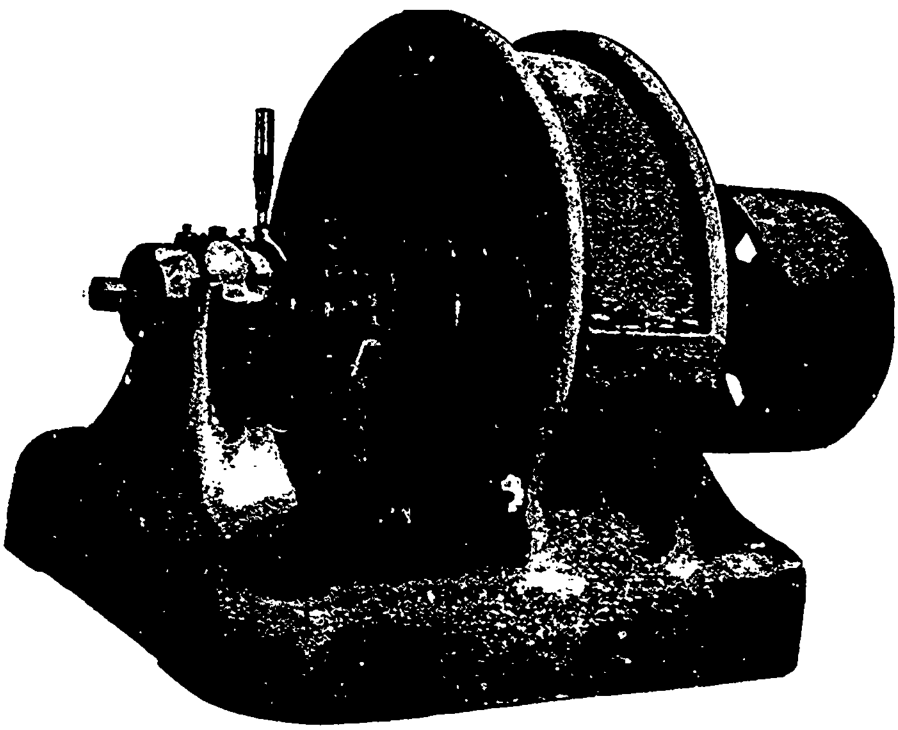

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INCANDESCENT LAMPS, ARC LAMPS AND MOTORS

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SPARKS.

An order has been passed for the winding up of the St Jean Baptiste Electric Co., Montreal.

The Waterloo Board of Trade has decided to recommend a bonus of $30,000 to the International Radial Railway.

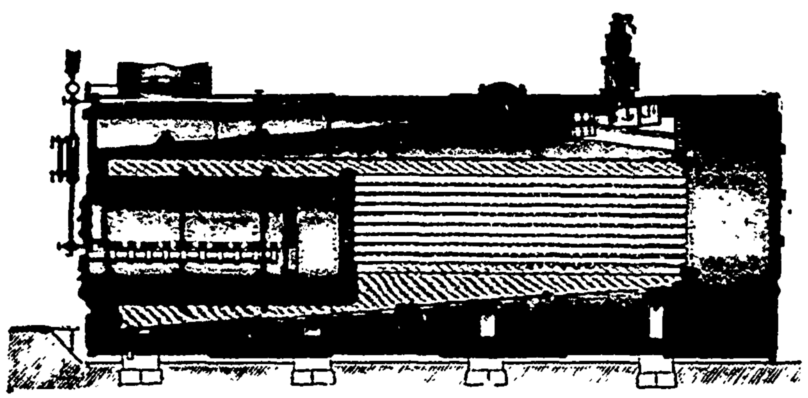
The Prince Albert Electric Light Co have purchased a 500 light alternating plant from the Canadian General Electric Co.

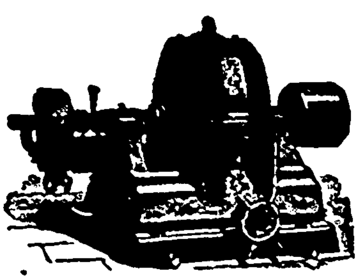
E. W. Snider, of St. Jacobs, Ont., has purchased a 100 light incandescent plant from the Canadian General Electric Co. for lighting his mill and residence

The Canadian General Electric Co. have installed a 600 h. p generator for the Winnipeg Street Railway Company This machine is of the same type as the 1,200 h. p. generator that company recently installed for the Toronto Railway Co.

The charges of bribery against Mr. William Kyle and Mr Robert F. Segsworth, of Toronto, in connection with the Niagara Falls street railway, have come to an end. That against Mr. Kyle was terminated by his death a short time ago, and when Mr. Segsworth appeared for trial at the Welland assizes, the case against him was dropped.

The annual meeting of the Merchants' Telephone Co. was held at Montreal on 1st October. The report showed that the company has 700 subscribers. Eleven hundred dollars worth of capital has been forfeited by shareholders not paying up. The following directors were elected: Messrs. M. T. Lefebvre, Joel Leduc, A. S. Hamelin and L. H. Henault. At a subsequent meeting Mr. F. X Moisan was re-elected president, Mr. Joel Leduc vice-president, and Mr. L. E. Beauchamp, treasurer.





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