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CANADIAN
ELECTRICAL NEWS
AND
ENGINEERING JOURNAL

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AND

ENGINEERING JOURAL.

VOL. X. APRIL, 1900 No. 4.

A MAMMOTH LEATHER BELT.

THE illustration on this page represents the largest leather belt ever made in Canada. It was manufactured by Messrs. Sadler & Haworth, of Montreal and Toronto, for the Ogilvie Milling Company, of Winnipeg, Man. Its dimensions are: Width, 72 inches; length, 115 feet; thickness, 3 ply; while its total weight is 2,270 lbs. The same firm recently furnished two 48 inch 3 ply belts for the Standard Electric Company of Montreal, a 38 inch belt for the London Electric Light Company, and several wide 3 ply belts for saw mills.

THE LARGEST LEATHER BELT EVER MADE IN CANADA—FROM THE FACTORY OF SADLER & HAWORTH.

GAS DRIVEN ELECTRIC PLANT.

AN interesting feature of the public service of Zurich and the neighborhood is the power plant at Oerliken, which furnishes current for the street railway lines. The installation at present includes one gas generator of 200 horse power and two of 100 hundred horse power. The generators burn anthracite from the Liege district. The gas is washed and passes through coke scrubbers and saw-dust. No smell of tar is noticed, and no trouble seems to arise in the engines, which, like the generators, come from the Maschinenfabrik Deutz. The three engines of 125 horse-power drive, each, a compound four-pole continuous current generator for 550 volts at 180 revolutions. A battery of 280 Tudor cells is connected in parallel to the dynamos. The regulating cells are changed by a motor-generator.

The guide book furnishes the following information regarding this station, which belongs to the Zurich Oerliken-Seebach system: Coal consumed per effective horse power of the gas engines, 0.65 *kilogramme* (1.4 ib.); each train makes 161 kilometers (100 miles) per day; the line having a length of 5 miles and a rolling stock of 20 cars, of which, as a rule, only 10 are running. With 3.2 passengres per car-kilometer, the income is 43 centimes per car-kilometer, and the cost amounts to 34.4 centimes.

ELECTRICAL EQUIPMENT OF THE HIGHEST OFFICE BUILDING IN THE WORLD.

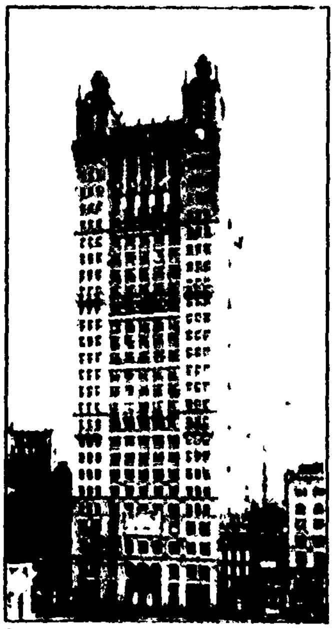


Fig. 1 Exterior of Park Row Office Building, New York City

Among the forest of lofty structures upon the lower end of Manhattan Island, the Park Row Syndicate Building stands out prominently. This mammoth office building is opposite the New York post office, and adjoins the city hall square, and marks an important centre of the city. The construction of this building, which has recently been completed, offers to the engineer, architect, and builder many points of interest. The most modern developments of art and science in each branch of work have been applied to the equipment, and characterize this building as an advance upon previous structures. The first illustration gives an idea of the number of stories and the consequent immense number of persons to be accommodated and transported. The building is somewhat irregular in plan, having a frontage of 104 feet on Park Row, and extends backward a distance of 178 feet. There are 26 stories from the ground level to the main roof, five stories in each tower, and one small story in each dome. In addition, there is a basement and sub-cellar below ground, making a total of 34 stories in all. The height of the building is 424 feet. Pile foundations are used throughout, the total weight of the building being computed at about 65,000 tons.

The building contains nearly 1,000 offices, each of which is finished in hard wood, is steam heated, electric lighted, and supplied with hot and cold water. All the offices are connected by telephones, with an information bureau at the entrance to the building, and have a messenger call box. It is estimated that the building has accommodation for 4,000 persons, and will contain this number when all the offices are let.

The Westinghouse Electric & Manufacturing Company supplied the electrical equipment, including the generators, boosters and switchboard, an account of which will be given in this article. The other branches of construction were designed and carried out so that the building should be second to none in point of equipment. The boiler room is in the center of the sub-cellar, east of the generating plant, and contains three water tube boilers, aggregating 900 h.p. The main steam pipes are designed to carry a continuous working pressure of 130 pounds to the square inch. Each boiler is provided with separators to insure the delivery of dry steam to the engines. Exhaust fans, operated by electric motors, retain the temperature of the boiler and engine rooms at a low point. From the boiler room steam is taken to heat the system of offices. In zero weather 70 degrees will be maintained by direct low pressure, or exhaust steam radiators, operated by a 16 inch main in the basement. This main is cross-connected with the exhaust from the engine and pumps. The condensation from the heating system is returned to the boilers by pumps.

In the sub-basement the three boilers are installed near the centre, between the columns. The engine and generator room is partitioned off, and in front of these, running under the pavement, is a part used for the storage battery. Coal is brought to the building through an alley and shot into the bunkers. Along one side of the sub-basement a railway track is built for conveying coal from the storage rooms to the boilers, and for carrying ashes to the sidewalk lifts in front of the building.

The engine and generator room contains five steam engines, direct connected to Westinghouse generators. Four of the engines are tandem compound. They are operated as non-condensing compound engines. It is expected that with a steam pressure of 130 pounds they will show a much better steam economy than simple engines. The fifth engine has a single cylinder, and operates a booster in connection with the storage battery.

The electric generating plant was provided by the Westinghouse Electric & Manufacturing Company, and consists of two 200 k.w., one 100 k.w., and one 75 k.w. Westinghouse standard, compound wound generators, 120 volts. Fig. 2 shows one of the 200 k.w. generators. The additional apparatus is the 40 k.w. booster dynamo, direct connected to the smaller engine, and a 20 k.w. booster driven by a 32 h.p. electric motor. Fig. 3 illustrates the booster attached to the electric motor.

In addition to the generating plant, a storage battery has been provided, of 58 chloride accumulators. The battery insures an equalization of load, and acts as a reservoir of electrical energy for supplementing the plant in case of necessity. It also supplies current for a few lights and an elevator service for night duty. The capacity of the cells in the battery is 500 k.w. hours, and the normal discharge rate is 350 amperes for ten hours, but it is capable of discharging at five times this rate, and a momentary discharge of 2,000 amperes for periods not exceeding thirty seconds.

The booster dynamos are operated in connection with the storage battery to compensate and equalize the load fluctuations and to maintain the output of the dynamos relatively constant. The two boosters are interchangeable, to serve for varying outputs, and the dynamo portions are substantially alike. The field of the dynamo portion in both cases has a series and shunt winding, the two connected differentially. Both windings can be varied, the shunt winding being varied by a rheostat in the usual way, while the series winding is varied by a series of equalizer shunts.

The series winding of the booster dynamo is arranged so as to take either the whole or a determinate portion of the current fed from the dynamos into the power circuits, and this winding, and the e.m.f. due to it, are made responsive thereby to the conditions and fluctuations of the load on the power circuits. The shunt windings are connected across the terminals of the battery or excited from the dynamo bus-bars. The armature of the booster dynamo is connected to the battery circuit. By making the proper adjustments so as to regulate the relative effects of the series and shunt windings according to the conditions of load, the condition of the charge of the storage battery, and the regulating effect desired, etc., it is possible to arrange the conditions so that for a certain critical current the battery e.m.f. will exactly equal that at the bus-bars. For a higher current the booster dynamo will act as a generator to supplement the e.m.f. of the battery, and make it discharge in parallel with the generators. If the working current falls below the critical value, the effect of the shunt winding predominates, and the booster dynamo will generate an e.m.f. in the opposite direction to supplement the charging effect of the generators. It is seen, therefore, that

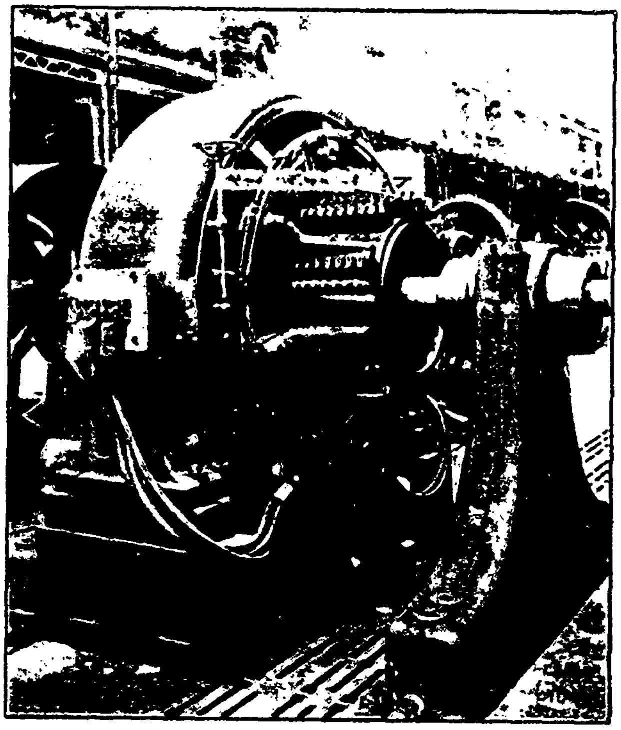


Fig. 2—One of the Two 200 k.w. Westinghouse Direct Current, "Engine Type" Generators.—Park Row Office Building, New York City.

when the load increases above the amount for which the adjustments have been made, the booster dynamo will regulate the action of the storage battery so as to make it assist the generators in supplying current, and when the power load becomes light or falls off, the booster will assist the generators in charging the battery.

The critical current admits of a wide range of regulation according to the load curve, the number of generator units that are in operation, and the condition of the battery, that is to say, whether it is empty or filled, and the rate of charge or discharge which it is desired to maintain. It is intended to keep the battery constantly charged, which can be done by adjusting the relative shunt and series fields. The regulating or compensating action can be obtained with the same ease and precision when the adjustments are such that the battery takes in more than it gives, or is gaining in charge, or when it gives out more than it takes, or is losing in charge.

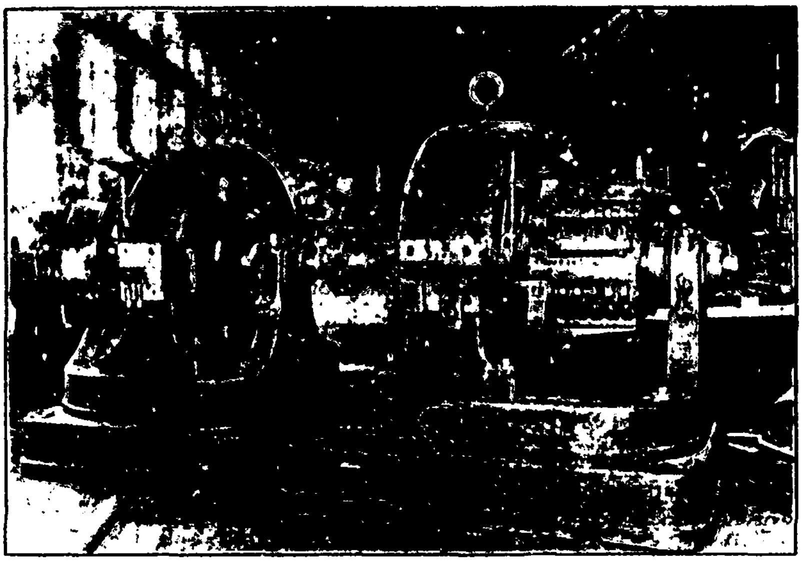


FIG. 3 WESTINGHOUSE 20 K.W. MOTOR DRIVEN BOOSTER.—PARK ROW OFFICE BUILDING, NEW YORK CITY.

Recording instruments upon the switchboard show the amount of the charging and discharging, and the station operator is kept advised at all times as to the condition of the storage battery. Current for lighting purposes is taken from the machines beyond the compounding, and the power in connection with the booster and storage battery is taken off within the compounding, by special devices, permitting the compounding effect of the battery to be varied.

The switchboard, shown in Fig. 4, was designed and built by the Westinghouse Electric & Manufacturing Company, from specifications by the electrical engineer. It is in many respects unique, not only in completeness of the appliances, and the facilities which it affords for controlling the operation of the generating plant, but in the thoroughness of the engineering design and workmanship bestowed upon it. It is arranged to control the output of the four 125 volt generators, also for one motor-driven, and one steam-driven booster, and the current from the storage battery. The switchboard has three main divisions. The centre panel serves for the electrica manipulation of all circuits from the main dynamos, booster dynamos, and the storage battery, constituting the electrical generating plant. The right panel serves for lighting feeders only and the left panel for power feeders only. The three panels are side by side, forming one continuous switchboard.

Each generator is provided in its negative circuit with a single pole—fused switch—circuit breaker and an ammeter, while the positive and equalizer circuits pass through a double pole switch, the positive circuit only being fused. One of the 200 k.w. and the 100 k.w. Westinghouse generators are connected to run in multiple, on a separate section of bus-bars at the left end of the dynamo panel facing the front, while the other 200 k.w. generator runs in multiple with the 75 k.w. on a similar section of bus-bars at the right hand end. The boosters, booster motor, and storage battery are connected through their switches to the central section of bus-bars. The central section may be thrown in multiple with either or both of the dynamo sections by means of the heavy three-pole bus-junction switches. If these are left open, the right and left sections of the dynamo panel will be entirely disconnected from the middle section, and the units corresponding to said panels will operate as if they belonged to distinct generating stations, one serving for the lighting current supply and the other for the power current supply. By closing the left "bus-junction switch," the storage battery plant may be coupled, so to speak, to the power side. By closing the right switch it may be coupled to the lighting side, and lastly, by closing both swithes, the two power plants become coupled together in one single generating plant, including the storage battery. This may also be thrown on the bus-bars independently, and the whole generating plant shut down in case of light load, the battery supplying all the necessary current.

The power and lighting sections are each provided with an ammeter, a recording wattmeter and a recording ammeter, for measuring the total current. The lighting section has provision for 48 feeders, 16 of these being 100 amperes and 32 being 200 amperes capacity. They are all provided with double pole fused switches, and 16 of the 200 ampere circuits have circuit breakers in addition. The power section provides for ten 300 ampere and ten 500 ampere circuits, each circuit being supplied with a fused switch and a circuit breaker.

The current from the storage battery is measured by a double reading ammeter, a double reading recording ammeter, and a recording wattmeter, this circuit being also provided with a 500 ampere switch and circuit breaker.

The dynamo panel carries a ground detector, a recording volt meter, a differential galvanometer, and a main station voltmeter, each being provided with suitable multipoint switches for connections to the various circuits. There are also ammeters for each booster circuit, and switches for manipulating the boosters and starting the booster motors. All the rheostats are operated by hand-wheels placed on the front of the board.

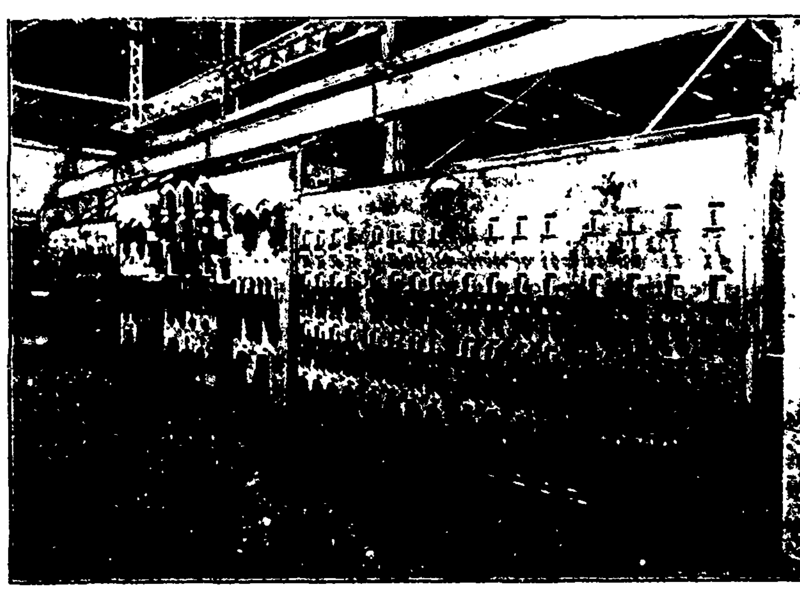


FIG. 4—WESTINGHOUSE SWITCHBOARD, FRONT VIEW. PARK ROW OFFICE BUILDING, NEW YORK CITY.

The board is constructed of the best Tennessee marble of uniform coloring, the separate slabs being joined together by accurately squared edges, presenting the appearance of three a e panels. A rigid angle and channel iron frame supports the entire board, the whole being carried on iron pedestals, which raise it six inches above the floor. The total length is 42 feet.

The power section at the left end of the switch-board is provided with a marble door, in order that the rear of the board may be conveniently reached from the engine room. The length of the power section is 12 feet, and the height 8 feet above the floor. The length of the dynamo section is 15 feet and the height 9 feet 3 inches. The length of the lighting section is 14 feet, and the height 9 feet 3 inches. An ornamental moulding of bright copper frames each section, and all the instruments, hand-wheels, double goose-necks, instrument cases, and metal trimmings are finished in bright copper. A neat grill work fills the space between the switch-board and ceiling, and hides the pedestals below the board.

Copper-finished engraved name-plates are provided for all instruments and switches, to designate the circuit each operates. All the bus bars and rear connections of the rear of the board are made of the best lake copper, the connections being secured to instrument studs by means of heavy copper nuts screwed on the studs. On account of the complicated nature of the connections the rear of the board presents a perfect network of copper, but the parts are well supported. The individual bars are carefully spaced and symmetrically arranged, and present a very neat appearance, the whole being an excellent piece of switchboard engineering. Indeed, to the careful visiting engineer, the front of the switchboard, handsome as it is, is not as attractive or interesting as the constructive details at the back of it.

The cables for the dynamo leads pass from the board directly into conduits. The feeders for lighting and power rise from the rear of the feeder panels to the ceiling of the dynamo room in conduits. Every part of the board is designed to carry its rated current without appreciable rise in temperature above the surrounding air. The circuit breakers are of a new and novel design, having laminated copper blades, closed with a toggle joint. They break the circuit at the carbon shunts supplied at the top. All the switches are of the unit blade variety. A single unit blade of definite capacity is used. One or two blades are combined in multiple to make up switches of required capacity. All switches are built of the best lake copper, no castings being used in their construction.

The switches and circuit breakers are finished by hand with a good tool finish. The main bus junction switches are of the screw press type, and are 3-pole in order to connect together the positive, negative and equalizer sections of the bus bars. They are constructed on the unit blade principle, each blade being composed of three 1,000 ampere units in multiple, each with its independent set of jaws. The blades move in and out of their jaws by turning a crank handle attached to the hand wheel, and are kept in alignment by suitable suitable guides. The capacity of each of these switches is 3,000 amperes.

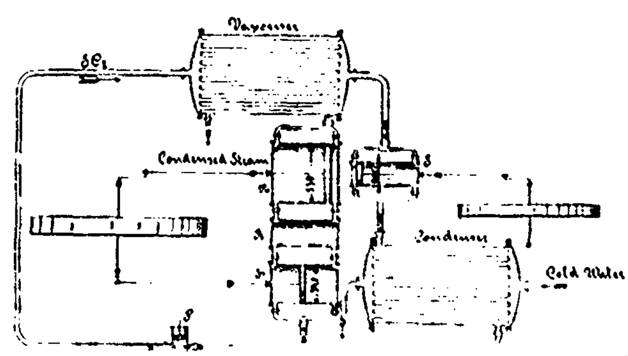
The shunt resistances for varying the compounding of the boosters are constructed of grids of special resistance metal. They are supported on the rear of the board, near the top, and are suitably connected to the various switches by hard rolled copper bars.

INCREASING THE EFFICIENCY OF STEAM ENGINES.

The recent centennial anniversary of the Royal Technical High School at Charlottenburg was made the occasion of several important announcements concerning the work of that renowned institution, which embodies in a remarkable degree the advanced technical science which has done so much to push Germany forward into the front rank of manufacturing nations. Among these, the first rank is, by common consent, accorded to the paper of Professor E. Josse, head of the mechanical laboratory, in which are described with elaborate detail the results of his experiments with an original and highly interesting process for increasing the efficiency of steam engines by utilizing the heat of the exhaust steam for evaporating another liquid having a lower boiling point than water.

It is well known that the steam boiler and engine, notwithstanding all improvements which it has undergone during the past 100 years, and its incalculable services to mankind, is nevertheless a wasteful and extravagant device for converting the energy stored in fuel into mechanical power. The ordinary simple, high-pressure engine, which, after passing steam through one cylinder, discharges it into the air, utilizes hardly more than five per cent. of the value of the fuel consumed under its boiler. The compound engine, in which the steam, after passing successively through two, three or more cylinders, is condensed, and the warm water of condensation restored to the boiler, utilizes, under favorable conditions, 12 to 13 per cent. of the fuel energy, and there the economy appears to have stopped. An eminent American engineer has recently published an article reviewing the development of the steam engine, and closes his essay with the expressed opinion that with the compound machines and improved cut-off of recent years, the practical limit of efficiency of the steam engine has been reached. The invention described by Professor Josse introduces a novel element into the problem and opens a new chapter in the record of steam-engine development.

The process is the joint discovery of Mr. G. Behrend, a Hamburg engineer, and Dr. Zimmermann, of Ludwigshafen; and, although first patented in 1889, it has only recently been matured and its application perfected by the employment of an auxiliary engine, which, utilizing the heat contained in the exhaust steam, gains as high as 56 per cent. additional motive



APPARATUS FOR INCREASING THE EFFICIENCY OF STEAM ENGINES.

power without increasing the expenditure of fuel. The principle and process involved are simple, and may be briefly described as follows:

It is plain that, with all progress which has hitherto been made in steam-engine practice through higher pressures, superheated steam, economical cut-offs or successive cylinders, there is always an important an inevitable loss of heat energy when the steam, having done its work, is discharged into the open air, or changed back to water by contact with cold water in a condenser. When the exhaust is into the open air, the steam has a temperature of about 100° Celsius (212° Fahrenheit); when it passes into condenser, the steam has a temperature of 60° to 70° Celsius (140° to 160° Fahrenheit), according to the vacuum. The corresponding latent heat of steam, given up upon change of form from steam to hot water, has hitherto run to waste in the condensing or cooling water, or in the air. Messr. Behrend and Zimmermann attacked the problem of utilizing this wasted caloric by employing it to create a new supply of steam by evaporating some liquid which has a lower boiling point than water, and for this purpose they chose after many experiments, sulphurous acid (H_2SO_3), which is not only cheap and easily obtained, but has the further advantage of a viscous consistency and lubricates the inner working surfaces of the machinery without corroding them. Their demonstrations, although not practically conclusive, were so promising that Professor Josse, as a technical authority on this subject, took up the problem, and after several months of highly satisfactory laboratory experiment, caused to be constructed and connected with an ordinary working steam engine of the compound type an additional condenser and auxiliary engine, the power of which could be exactly measured.

Referring to the diagram in which dimensions are given in millimeters,(H) and (N) represent the high and low pressure cylinders of an ordinary compound steam engine, with a stroke of 500 millimeters, (19.69 inches) and a speed of 41.5 revolutions per minute. From the low pressure cylinder (N) the exhaust steam passes into the surface condenser called in the diagram the "vaporizer." In this vaporizer or condenser, the cooling medium used, instead of water, is liquid sulphurous acid (H_2SO_3) which has a boiling point so low that it is immediately decomposed by the heat of the exhaust steam, whereby the sulphur dioxide gas (SO_2) is liberated, which passes over into the cylinder of the auxiliary engine (S), where its work is done, as in an ordinary steam engine. The auxiliary cylinder has a diameter of 300 millimeters (11.81 inches) and a stroke of 500 millimeters, with a speed of 77 revolutions per minute.

After passing through this cylinder, the sulphurous vapor enters the surface condenser, around the tubes of which cold water flows, as in an ordinary steam plant. Here the sulphurous vapor is condensed to liquid and is forced by pump (P) back into the vaporizer, where it begins its cycle again, the same (SO_2) being used over and over again indefinitely. There are, therefore, in fact, two condensers, the first serving, as it were, as boiler or steam generator for the auxiliary engine ; and this boiler instead of being fired by coal, obtains all its heat from the exhaust of an ordinary steam engine, and, instead of converting water into steam, evaporates a liquid which is much more volatile, i.e., has a far lower boiling point.

In the long series of recorded tests with the plant employed, the following results were attained :

The steam engine is of the compound type, of good, modern construction, and being given a steady load, developed 34 indicated horsepower, with a consumption of 8.6 kilogrammes (18.96 pounds) of steam per incated horsepower-hour. The auxiliary machine working with the sulphurous vapor indicated 19 horsepower, that is, an increase of 56 per cent. and yielding, instead of one horsepower, 1.56 horsepower for the same steam consumption, and reducing the steam consumption from 8.6 kilogrammes to 5.5 kilogrammes (from 18.96 to 12.13 pounds) per indicated horsepower.

The experiments showed on the average that for every 15 kilogrammes (33,169 pounds) of steam passing through the main engine, one h.p. could be gained in the auxiliary machine. Applied, therefore, to an ordinary single-cylinder steam engine, exhausting into the air at high temperature, the percentage of power saved by this new device would be very much higher than the economy reached in these experiments, which as has been shown, were made with a highly improved compound engine. From the average of these experiments, it may be broadly stated that, given a fairly economical compound engine; using 7½ kilogrammes (16.5 pounds) of steam per indicated horsepower-hour, half an indicated horsepower could be produced in the auxiliary machine for every indicated horsepower developed in the main engine. Assuming an average vacuum of 60 centimeters (23.62 inches, corresponding to a temperature of 60° Celsius (140° Fahrenheit), the saving of heat must be accomplished by using a liquid which can be vaporized to a high pressure at or below that temperature. Assuming further, the upper and lower limits of temperature within which the operation is confined to be 60° and 20° Celsius (140° and 67° Fahrenheit), the pressure of the sulphurous vapor would range from 10.05 down to 2.35 atmospheres above open-air pressure. A working pressure as high as ordinary steam-boiler pressure is, therefore, readily obtained at a comparatively moderate temperature. Moreover, the volume of sulphurous-acid vapor necessary to contain the number of heat units corresponding to the work to be performed is much smaller than the volume of steam which would be required for the same purpose. As the saving to be effected by the auxiliary engine depends directly upon the difference between the highest and lowest temperatures involved, the greatest gain will, therefore, be made either when the water in the surface condenser is as cold as possible, or when the heat of the exhaust steam from the engine is at a maximum, as is the case with a single-cylinder steam engine without condenser, which may be anywhere up to 212° Fahrenheit.

The expense of this improvement is practically all in the construction cost of the vaporizer, condenser and auxiliary engine itself, and its economy may be realized from the fact that the exhaust steam from a 2,000 h.p. central station engine should furnish power to drive an additional 1,000 h.p. engine, which can be connected as an extra cylinder to the steam engine or run independently, and thus increase by 50 per cent. the power developed without adding a pound to the quantity of fuel consumed. When, in view of the present coal famine throughout Europe, it is remembered that the steam-engine energy of Germany alone, afloat and ashore, is not less than 3,717,264 h.p., the commercial importance of such an improvement will be readily apparent.

ALUMINUM AS A CONDUCTOR.

The Chicago Record says that aluminum is to have its first important trial as a commercial conductor of electricity on the Northwestern Elevated Road. Twenty miles of inch and a half cables—150,000 pounds of the light-weight, silvery stuff—are to be strung along the steel trestle to distribute the motive power to the trolley rails of the new road. Aluminum displaces its copper rival on the new road because of its cheapness. Copper has almost doubled in price within a twelvemonth while the lighter metal has dropped a shade in the scale. James R. Chapman, the electrical engineer in charge of the new road, says : "After copper, aluminum is the best conductor among the cheaper metals. An aluminum wire has the additional advantages of being lighter to handle and of being non-corrosive." According to Mr. Chapman, a perfect joint has been made possible by a solder invented by a Chicago man.

Beginning with the January number, the publishers of *Science Abstracts*, of London, England, introduced a chapter on "Steam Plant, Gas and Oil Engines," also abstracts dealing with motor cars in general.

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D. R. STREET, Ottawa Electric Co., Ottawa, Ont.
A. SANGSTER, Sherbrooke Gas and Electric Light Co., Sherbrooke, Que.
J. F. H. WYSE, Brantford Electric & Operating Co., Brantford, Ont.
B. F. REESOR, Manager Electric Light Co., Lindsay, Ont.
W. H. BROWNE, Manager Royal Electric Company, Montreal.

MARITIME ELECTRICAL ASSOCIATION.

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ONTARIO ASSOCIATION OF STATIONARY ENGINEERS.

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REMOVAL NOTICE.

On May 1st next the Montreal office of The CANADIAN ELECTRICAL NEWS will be removed from the New York Life Building to the Imperial Building, corner St. James Street and Place d'Armes Hill.

Underground Conduits. IN the larger cities of Canada the advantages of underground conduits for electric wires are gradually being recognized by the electrical companies. The Lachine Rapids Hydrulic & Land Company have placed their wires underground along many of the principal streets in Montreal, and it is observed by the report of the directors that the system has been found eminently satisfactory. The Montreal Street Railway Company are about to take similar action. Apart from enhancing the appearance of a city by the removal of unsightly poles, we believe that the underground system will be found to have many advantages for the electrical companies as compared with the present overhead construction, at least in the congested business sections in cities. While the first cost of installation will be heavy, this will in time be overbalanced by the comparative freedom from accidents, interruption from sleet storms, etc.

The Use of Storage Batteries in Central Stations. THE history of the storage battery on the American continent has been a curious one, and illustrates the difference in methods and conditions existing between American and European practice. While on the continent the storage battery was recognized as an almost essential part of the station equipment, and in England its value was largely conceded; in America until 1894 the records show that the installations using a battery plant were few and far between and generally far from successful. The larger use of batteries in Europe is due to several causes, chief among them being the fact that by far the larger number of stations existing there are of the direct current order, while on this side the alternating stations preponderate. In addition to this it appears that until 1894 the storage field was being exploited in America by a number of weak companies, among whom considerable rivalry existed tending towards the practice of obtaining business by any method at hand, working for immediate returns only, and litigating in the patent courts. The results were that the storage battery was applied in many cases where its use was not justified, and the proper precautions were not taken to ensure that the equipment was large and substantial enough to stand the severe operative conditions imposed by heavy discharges. In Europe, on the other hand, proper engineering methods prevailed, in consequence of which we find successful installation from the first. Since that time, however, a consolidation of interests has taken place in America, and the trade is largely in the hands of one powerful company, with the result that since 1894 the sales of batteries have increased almost twelve fold. This tremendous increase is due to the fact that the larger stations in the American cities have recognized the usefulness of the storage system and applied it not only to the lighting demands, but latterly and very extensively to the needs of street railway systems.

The improvement which has taken place in the operation of the storage battery on this continent has been due not to any great advance in the direction of newer and more efficient types of cells, but to the gradual improvement of those already existing as regards their mechanical features, their more intelligent handling while in operation, and more important than any, that with proper engineering the conditions of operation have determined the type and capacity of the cells and not the mere question of first cost. These points having been given proper attention, it became evident to the larger lighting companies that the battery had a place in their equipment, and the smaller companies, although slower to recognize its value, are now more rapidly falling into line, and in Canada a careful consideration of the question will no doubt lead to the adoption of batteries in at least some of the larger steam stations. While each case must be considered upon its merits, and no general conclusions can be arrived at which will suit all cases, there are a few land marks which will serve as guides in determining the question for any particular plant.

Generally speaking, the uses to which a battery plant can be put in central station practice are as follows: First, to carry the peak of the load; second, to carry the entire minimum load for whatever time it may exist, third, to act as an equalizer or reservoir, charging and discharging as the fluctuations and variations of the load demands; fourth, to be used in sub-stations to assist the regulation over the feeders and to cut down the cost of feeder copper, which would be designed for the average load instead of the maximum. In the lighting station the first two uses are generally given first consideration, and for traction work the latter two; and in a combination station, of course, each use demands a careful investigation. The case of use for the peak of the load is usually first met with when it becomes necessary to install more apparatus to meet increased demands, and the relative merits of additional steam apparatus or battery equipment then come up for consideration. For this use in lighting stations, as the peak of the load is of short duration, the battery should be suitable for a high discharge rate for a short time, so that the cost per kilowatt available over the time under consideration should be given the first consideration and serve as a basis of comparison with the cost per kilowatt of steam plant. In the case where the battery is to be used to carry the minimum load over longer periods, say from midnight on, the kilowatt hours of capacity becomes the chief consideration, apart from its ability to be rapidly charged and discharged, and it will be found that the cost per kilowatt hour for batteries for the two cases above mentioned is vastly different. For instance, a battery for an eight hour discharge rate may cost from forty to forty-five dollars per k.w. hour, while if the discharge rate be one hour the cost will probably be nearly three times as much per k.w. hour. A point which is frequently misunderstood in dealing with rapid rate as distinguished from slow rate discharge of batteries is the efficiency. It may be stated that if an eight hour battery be discharged in one hour, its capacity in k.w. hours will probably be cut down fifty per cent., but this does not involve a corresponding decrease in efficiency, as, if the battery be recharged, the input will correspond with the amount taken out, less, of course, the inherent losses due to charging which exist in every storage cell. For this reason it becomes apparent that the cost of a rapid rate battery will be greater per k.w. hour than a slow rate battery of a similar capacity, while the efficiency should not be very different. It should also be noted that while the ampere efficiency may be 90 per cent., the watt efficiency as measured by the ratio of watt output to input will seldom be found in practice to be higher than 75 per cent., and this latter percentage should be considered, and not the former, in dealing with the relative merits of the battery and steam plant as regards its effects upon the coal consumption.

The question of depreciation is at once brought up for discussion when storage is suggested, and the battle generally ranges about that point. This is hardly to be wondered at when it is considered that the purchaser has before him the very unfavourable records of past years; and he is justified in assuming that modern installations have not been in existence long enough to demonstrate that the depreciation factor has been reduced to a commercial point by proper engineering of the plant and mechanical construction of the cells, as is claimed. The chief causes of battery failure are buckling, short circuiting, sulphating, disintegrating, and dropping of active materials, and it is safe to say that at least fifty per cent. of the depreciation accounts have been due to improper charging and discharging and general lack of attention given the cells while in the customers' hands. This is not due to the fact that the battery requires any great amount of attention, but for the reason that the action being chemical, troubles do not manifest themselves as in mechanical apparatus, and the battery which is being rapidly worn out appears upon casual inspection to be in fair condition. A proper recognition of these facts has contributed to cut down the depreciation allowed very largely. This matter of depreciation has forced many companies manufacturing batteries to guarantee this charge; and in America several large plants for severe work have been guaranteed at the rate of seven to eight per cent., while in Germany, where the experience has been more extensive, the manufacturing companies will maintain the cells for 4 per cent. of the cost per year under fair operative conditions; and many of the owners will not avail themselves of the offer, as they claim that they can maintain their equipments for less than that percentage. From these considerations it appears that, in figuring upon the depreciation and repair account of storage equipment, properly designed for the existing conditions of operation and properly inspected and handled, this portion of the plant may safely be treated as being subject to the same percentage allowance for depreciation and repairs as the mechanical portion of the station equipment. For obvious reasons the battery does not appeal to the manager operating a water power station unless the question of the load becoming greater than can be handled with the water available, becomes pressing, when the case becomes similar to that of a steam station in which the demand exceeds the capacity. In these cases it becomes a question between the use of additional steam plant and the installation of batteries. The advantage on the side of the battery is that it enables the steam plant to operate at a point nearer full load during the time of charging, and either relieves it of the peak of the load or enables the steam equipment to be shut down during certain portions of the twenty-four hours. Generally speaking, it will be be found that the cost of a battery equipment for the peak of the load will not greatly exceed, if at all, the necessary increase of steam equipment, and if it be allowed that the interest, depreciation, aud repair percentage allowance for similar investments will be about the same, the advisability of installing either depends upon the relative cost of coal and supplies and labor for the additional output. As regards the labour account, it will generally be found that the battery has the advantage, especially where it allows of the steam equipment being shut down for a sufficient number of hours to permit of a reduction of the shift. As regards the coal consumption, the losses in the battery must be placed against the losses in the rival steam equipment, making also due allowance for the saving in coal per kilowatt output of the original plant while charging the batteries, due to the fact that the engines are running under greater load and therefore at a more economical point. In figuring the loss in the batteries, it must be carefully kept in mind that this loss only exists while the battery is in use and should not be figured as an all loss loss against the equipment.

The above considerations, while applying more properly to the use of batteries in lighting stations, are also generally applicable to their use for railway operating, although for this class of work the ability of the battery to absorb fluctuations in the loads becomes the prominent feature. This application is being taken advantage of more and more by the larger street railway companies, and even in such cases as Pittsburg, where coal costs only about 45 cents per ton, storage is in use to prevent fluctuations and to minimize sudden strains on the machinery. Even although the battery under certain conditions may not appeal to the station management, the customer may find it of advantage, as is illustrated by the use of batteries by the Buffalo Traction Company, which receives its power from Niagara, stores it during light load hours, and uses it to cut down the peak of the load, thus dispensing with the use of much mechanical apparatus and effecting a saving in the cost of power taken. It may be pointed out that in the larger cities where the power demands are of the best the average yearly output of the stations are usually under 40 per cent. of the capabilities of the steam machinery which must be installed to take the peak of the load in the winter, so that the operating companies have at least 60 per cent. of their available output locked up unless batteries are used, and the extra cost of production of this extra output would only be the cost of the additional coal, and could be very cheaply sold, and it is this power which is rendered available by the battery.

THE CANADIAN ELECTRICAL ASSOCIATION.

Arrangements are progressing favorably for the annual convention of the Canadian Electrical Association, to be held in the city of Ottawa on the 27th, 28th and 29th of June. The committee appointed to arrange for papers have met with encouraging success, having secured the promise of certain papers from several persons prominent in the electrical industry. The local committee will meet at an early date to make preparations for the event, and we understand that every effort is being put forth to interest members and outsiders everywhere with a view to having a large attendance and profitable meeting, and with favorable weather the convention should be a great success. In next issue some particulars of the programme may be given.

Mr. Thomas Hawkins, well known in street railway circles in Montreal and St. John, N.B., left recently for Georgetown, Demarara, where he will superintend the installation of an electric plant. Mr. F. Brothers will leave shortly for the same place, he having been given the superintendence of the construction of an electric railway in which a number of Montreal capitalists are interested.

MONTREAL

Branch Office of the CANADIAN ELECTRICAL NEWS,
New York Life Building,

MONTREAL, April 2nd, 1900.

The Alien Labor Law keeps electrical wiring contractors of this country from going into the neighboring republic to secure contracts, yet their contractors can come in here, or rather send a representative, to take off quantities, figure on Canadian jobs at Canadian architects' offices, and there is no one to say to them "nay"; surely this is not just.

Dame Malvina Heve, widow of the late Alphonse Girouard, hotel-keeper, of Ste. Cunegonde, who was killed by an electric shock while in the act of lighting an electric lamp in his premises, is suing the Royal Electric Company for $15,000 damages. Some interesting evidence may be expected.

Spring business in the electrical contracting line looks good in this city. There are quite a number of architects soliciting tenders for wiring, one of the most notable being the combined hotel and station for the Canadian Pacific Railway Company, to be built at Winnipeg. This building is in the hands of Mr. E. Maxwell, architect.

The bad roads after the heavy snowfalls lately have made an increased demand on the Montreal Street Railway Company, so that each Windsor car resembles a box of sardines, in that humanity is packed to the greatest extent. In expiation, however, it is just possible that the high cost of iron, copper and similar necessities may be causing the management to await a more favorable time for buying, so as to increase the copper, power units and construction work. "Speed the time."

The Montreal Daily Star (Graham & Co.) intend installing considerable wiring for both lights and motors in their new building. Tenders are now being called for by the architect, Mr. A. F. Dunlop. It is stated that a United States expert was called in to draw up the specifications, which are certainly elaborate, but quite capable of having been drawn up by local consulting electrical engineers—in fact bettered.

It is now evident that the Montreal Street Railway Company will put certain feeders underground. In fact, it is also rumored that the Royal Electric Company are figuring on similar action. As the Lachine Rapids Company and Bell Telephone Company have both already made a start in this direction, the date when our "picket fence" (as a United States gentleman described the rows of poles) will be removed, may soon be in sight. Of course, no one at all acquainted with the business imagines that each and every pole will be dispensed with. A few must remain.

The heavy snow fall in this city about March 1st, simply knocked the Montreal street railway off its feet, after a gallant fight had been put up. They were not long in getting into running order again, however, and even the time of stoppage could have been materially reduced had the city been a little more prompt in carting the snow off the streets.

No troubles seem to have occurred with either the Royal or Lachine Rapids Companys' circuits during the winter blizzards.

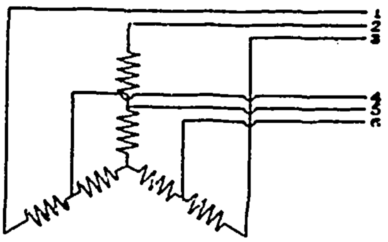
Quebec city seems to have caught it lively during the snow fall. It is reported that the street railway had some dozen or more cars, half a dozen sweepers, etc., stalled in the snow for about 24 hours.

The Jacques Cartier Water and Power Co. at Quebec are making some "fine cut" quotations in their fight for business against the existing Montmorency Company. One cent per lamp per night, less 10% for cash, is a sample of "some flat-rates."

The Power Publishing Company, World Building, New York, have favored us with a copy of a new work entitled, "Electric Wiring," by Cecil P. Poole. A perusal of this book proves it to be very interesting and valuable. It is designed to serve both as an instructor for practical wiremen who have occasion to lay out their own work, and as a convenience and general reference book for electrical engineers whose work includes the calculation of transmission circuits, etc. Reference tables and formulas are presented in convenient form. But perhaps the most valuable features of the work are the wiring tables for alternating current motors and the tables showing the corrected drop in inductive circuits. These are the only tables of the kind which have come to our notice. The price of the book is $1.00.

A SIMPLE TWO-PHASE SYSTEM OF SECONDARY MAINS.

On the distributing network of the Hartford Electric Light Company, there is in use a simple means of distributing with a minimum number of wires the two-phase currents for both lights and motors. The secondary mains are three-wire for lighting and two-phase for power, largely underground and supplied in districts by manhole transformers. Each manhole has two transformers, one for each phase; each transformer being tapped out at its central point for the neutral of the three-wire 220-volt network. The secondaries of the two transformers are shown at A and B in the accompanying diagram of connections. One outside terminal of A is connected to one outside terminal of B, and in each direction four wires are carried. It will be noticed that to the right the upper three wires are those of the three-wire single-phase circuit from transformer A, and the lower wire coming from transformer B, with the wire next above it, gives a pressure of 220 volts of the other phase to motors in that direction. The neutral of



THE CONNECTIONS OF SECONDARY NETWORKS FOR THE DISTRIBUTION OF TWO-PHASE POWER AND THREE-WIRE LIGHTING ON FOUR WIRES.

transformer A is not carried to the left, while that of transformer B is, and all lights in this direction are supplied from the three-wire system of the latter transformer, while in this direction also one wire serves commonly as one outer of the three-wire system and as one side of the secondary of the other phase. Thus four wires serve to give a three-wire lighting and a two-phase motor distribution and the lights are approximately equally divided between the two phases. The neutrals are, of course, not connected in to the motors, which run at 220 volts on each phase and are wired on the two-phase three-wire principle. It is obvious that there is between the upper and the lower wires going out in each direction an electromotive force consisting of the vectorial resultant of the two 220 volts which amounts to about 310 volts, but this increased pressure is no particular disadvantage on low-tension circuits. It is also obvious that the wire used commonly by both phases gets an increased current, but not sufficiently so to materially affect the regulation. The system has proven perfectly satisfactory.—American Electrician.

INCREASED SCALE IN BOILERS IN DRY WEATHER.

Probably very few steam users have ever noticed that the formation of scale in boilers is much more rapid and troublesome in times of protracted drought than in times when the streams from which the feed water is taken are full; yet this is a fact well established by the reports of boiler inspectors, and should be taken into account by steam users whose feed water is from streams fed mostly by surface water from rainfall. The Locomotive, published by the Hartford Steam Boiler Inspection and Insurance Company, explains the increase of scale by dry weather. The reason for this, according to our contemporary, is not hard to find, the unusual deposits of scale being due to the increased hardness of the water after a lengthy spell of dry weather. In times of drought the water is drawn necessarily from the lower levels, in reaching which it has become impregnated with lime, magnesia, and other soluble substances contained in the overlying strata. In a season of copious rainfall, on the other hand, the ground, being soaked, cannot absorb the surface water, which rapidly drains off into rivers or reservoirs, as the case may be, before it has had time to dissolve out the scale-forming substances in any quantity. In a season of light rainfall the ground can absorb practically all the water that falls, and the proportion of surface water is relatively small. Hence in dry seasons the water used in the boilers will be largely spring or hard water, and in wet seasons it will consist chiefly of surface or soft water, the deposits of boiler scale being larger or smaller in proportion. The moral of all this is two-fold. In the first place, during a dry season boilers should be more frequently opened, examined, and cleaned. Just how much oftener this should be done must depend upon local conditions and the severity of the drought; but it is suggested that, judging from observations made in the State of Connecticut, they should be inspected in such a season as the last about twice as frequently. Another fact to be remembered is that when a heavy rainfall comes, bringing a sudden supply of surface—and, therefore, soft—water, the scale that is in the boiler will be suddenly loosened up, and unless precautions are taken it will lodge over the fire sheet and cause trouble. This is particularly liable to happen during the melting of the snow in the spring, when the water will be particularly free from mineral salts.

THE CENTRAL ONTARIO POWER COMPANY.

At a recent meeting at the Queen's hotel, Toronto, of the shareholders of the Central Ontario Power Co., Limited (proprietors of the Burleigh Falls water power), lately incorporated with a capital of $750,000, for the purpose of developing the Burleigh Falls and other water powers, and for transmitting electric power to Peterborough and Lindsay and district, and for operating a radial s ystem of electric railways in the vicinity, the following directors were elected, viz.: Hon. Richard Harcourt, Toronto, president; F. A. Hall, Perth, vice-president; J. Alex. Culverwell, managing director; Hon. Senator, Peter McLaren, Perth; Eugene Coste, M. E., Toronto; James Kendrey, M. P., Peterborough; R. J. McLaughlin, Lindsay; F. W. Barrett, Edward T. Adams, M. D., Toronto; H. J. Taylor and H. E. Larkin, St. Catharines. The company have opened their head offices at Peterborough, the managing director, Mr. J. Alex. Culverwell, late of Toronto, having removed to Peterborough to take charge of the company's offices.

PERSONAL.

Mr. W. B. Close, manager of the Toronto & Suburban Electric Railway, has tendered his resignation.

The death of Mr. George H. Betram, M. P. for Toronto, and head of the Bertram Engine Works Company, which occured on March 20th, was the cause of widespread regret. Mr. Bertram was a business man of marked ability. In 1892 the firm of Bertram & Company took over the manufacturing business of the Doty Engine Works Company, with later became the Bertram Engine Works Company, and largely identified with shipbuilding. Mr. Bertram was elected to the House of Commons in November, 1897.

Mr. W. J. Gilmour, manager of the Bell Telephone Exchange at Brockville, Ont., and superintendent of District No. 6, has been appointed Superintendent of Agencies in the Eastern Department of the Bell Telephore Company, with headquarters in Montreal. This division includes the territory east of Kingston in Ontario and the whole of the province of Quebec. Mr. Gilmour has been identified with the Bell Telephone Company for fifteen years, and his removal from Brockville will be regretted by the citizens.

Mr. P. McCullough, electrican of the Toronto Railway Company, will shortly leave for Liverpool, England, where he will assume the duties of chief electrician for the Liverpool Street Railway, which is operated by the corporation. At the present time there are but a few miles of electric railway in use, but it is proposed to install a complete system to replace the horse cars. It is a source of congratulation that Canadians are being chosen to fill such important positions.

THE PROBLEM OF ARC LIGHTING FROM A 250 VOLT SUPPLY.*

By W. B. Sayer.

In the early days of electric lighting incandescent lamps were made for low voltages, and if it was necessary to use them with a high voltage, they were occasionally put in series. When the standard voltage came to be recognized as 100 no difficulty was found with incandescent lamps, but with arc lamps the difficulty of having to run two in series was met with to a comparatively slight extent. With, however, the present 250 volt supply this trouble was found to be greatly increased.

In order to meet this demand the enclosed arc lamp was brought strongly into notice, and besides having the advantage of requiring a greater voltage, it has the additional advantage of burning about twenty times as long as the open arc lamp. As regards the voltage that an enclosed arc lamp would burn satisfactorily at, the author had seen a lamp wound to take the full 250 volts across its terminals, but the result was simply an apology for light. As far, therefore, as a 250 volt circuit was concerned, there were only two arrangements in common use—viz., two enclosed arcs in series or four or five open arc lamps in series. The economy question was discussed from the consumers' point of view, and the obvious disadvantages of having five lamps in series, and so necessarily all controlled by one switch, was pointed out.

The author then went on to describe a series of tests he had carried out at the Glasgow Corporation lamp testing department by permission of Mr. Chamen. The results obtained are given in the following table, and it might be pointed out that they do not aim at theoretical accuracy, but rather at a good general practical comparison. The comparisons were made by the ordinary grease spot method, and also by the shadow method, and the ratio of the squares of the distances between the respective lamps and the position where the grease spot became invisible or the intensity of the thrown shadows equal were taken. As regards the globe used, the open arc lamp was fitted with an opaline globe, as generally now used, and the enclosed arc lamp was fitted with two obscured globes, as is customary in practical use.

TABLE SHOWING COMPARISON BETWEEN LIGHT-GIVING POWER OF OPEN AND ENCLOSED ARC LAMPS, AND COMPARISON WITH INCANDESCENT LAMPS ALL USING THE SAME POWER AND RUNNING ON 250 VOLTS.

Type of lamp.	Open arc.	Enclosed Arc		Incandescents (new clear globes)			
How arranged....	5 in series	2 in series	Single	16 of 16 c.p.		32 of 8 c.p.	
Steadying resistance	4 ohms	12 ohms	..	....		....	
Current.............	10 amps.	4 amps.	2·75 amp	4·4 amps		4·48 amps.	
Watts per lamp ...	500	500	680	1110	500	1120	500
Comparison	1	0·375	1.2	0·63	0·32	0·75	0.33
Comparison (taking 16 c.p. as unity).	3·25	1·54	0·325	.	1	..	1·07

The figures in the table speak for themselves. With regard to the steadying resistance in circuit with the single enclosed arc, this was combined with the lamp itself so that without unnecessary trouble this figure was unable to be filled in. Under the heading of power taken per lamp (in the case of the arcs, and of course per cluster in the case of the incandescents), owing to a mistake in the tests when testing the incandescent lamps, too much was taken, so a second column has been added reduced in proportion to bring the amount in line with the other figures. The comparisons were made with the open arc, but in order to make them clearer they have been reduced to a basis taking a 16 c.p. lamp as unity. It will be seen that a single enclosed arc lamp is only about one-third as efficient as a 16 c.p. lamp, that when two enclosed arcs are run in series the efficiency is about one and a half times that of a 16 c.p. lamp, while an open arc lamp has about three and a quarter times the efficiency of a 16 c.p. lamp. This shows the open type arc lamp to be over 100 per cent more efficient than the enclosed type arc lamp, the latter running under its most favorable conditions.

From these figures it is clear that the enclosed arc would have no chance of being popular with the public if a single open type arc could be used under similar conditions. The objections to open type arcs are: (1) The necessity of running five lamps in series, or if less are used, of absorbing the difference by means of a resistance; (2) Owing to five lamps being in series, any unsteadiness or flickering occuring in one lamp will be shown in the others on the same circuit, so that there will be five times the amount of flickering; (3) The necessity of having all the lamps in each series of the same size, type, and current. The enclosed arc lamps have the same objections, although to a very much less extent, but in the author's opinion any advantages in this respect are far more than counter-balanced by the less amount of light obtained from them for the same expenditure of power.

The author considers that there are two remedies that can be employed to overcome the difficulty of running open arc lamps on a 250 volt circuit—viz., (1) by the use of a step-down transformer; (2) by the use an arrangement designed by the author, and which he calls a "ganger switchboard." In this arrangement a separate pair of leads is run from every individual lamp to a central position where a main switch-board is fitted. This switchboard is so arranged that any lamp can be plugged into a circuit of five. The disadvantages of this method are two in number: (1) That special telephones or other signalling arrangements have to be employed for signalling to the main board, where an attendant has to be more or less constantly stationed; (2) all the lamps in the whole installation have to be exactly of the same pattern and size, and have to take the same current, and they must all be adjusted so as to work satisfactorily one with another in any combination. This difficulty is the more important seeing that as a rule arc lamps are now adjusted in the series on which they will be run, and are then numbered and set up in the same combinations. There was no doubt in the author's mind that when the number of lamps admitted of it the step-down transformer was the best and most satisfactory solution of the difficulty. He considered that the advantages might be enumerated as follows: (1) The economy that would result in being able to use any single lamp just when and where required; (2) the advantage of not being tied down to certain fixed sizes for the lamps, but being able to use just whatever size was required or was most suitable for the position; (3) that it was possible with equal economy to have any number of lamps installed, and not necessarily a multiple of five; (4) that extra lamps could be added when and where required; (5) that the voltage of the circuit could be made exactly that which was found to be the most satisfactory for the most efficient burning of the lamps.

There were, of course, objections also to the use of a step-down transformer for this purpose—viz., (1) the first cost, and also the maintenance cost; (2) the expenditure of power necessary to drive the transformer itself. In the author's opinion, however, these disadvantages are far more than counterbalanced by the advantages enumerated above. With regard to the latter objection, the author contended that his loss should be borne by the corporation or other supplying body, by fixing the meter in the secondary circuit of the transformer.

*Abstract of a paper read before the Institution of Electrical Engineers, Glasgow.

MOONLIGHT SCHEDULE FOR APRIL.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 7.00	A.M. 4.40	9.40
2....	" 9.00	" 4.40	7.40
3....	" 10.10	" 4.40	6.30
4....	" 11.10	" 4.40	5.30
5....	" 11.50	" 4.40	4.50
7....	A.M. 0.30	" 4.30	4.00
8....	" 1.00	" 4.30	3.30
9....	" 1.30	" 4.30	3.00
10....	" 2.00	" 4.30	2.30
11....	" 2.30	" 4.30	2.00
12....	No Light.	No Light.	.....
13....	No Light.	No Light.	.....
14....	No Light.	No Light.	.....
15....	No Light.	No Light.	.....
16....	P.M. 7.10	P.M. 9.40	2.30
17....	" 7.10	" 10.40	3.30
18....	" 7.10	" 11.30	4.20
19....	" 7.15	A.M. 0.30	5.15
20....	" 7.15	" 1.15	6.00
21....	" 7.15	" 2.00	6.45
22....	" 7.20	" 2.30	7.10
23....	" 7.20	" 4.10	7.50
24....	" 7.20	" 3.40	8.20
25....	" 7.20	" 4.00	8.40
26....	" 7.20	" 4.00	8.40
27....	" 72.0	" 4.00	8.40
28....	" 7.20	" 4.00	8.40
29....	" 7.30	" 4.00	8.30
30....	" 7.30	" 4.00	8.30
		Total.........	152.30

Mr. John M. Dixon has been appointed chief engineer of the new municipal buildings in Toronto, he having received the highest marks in the examination.

HIGH-SPEED AUTOMATIC TELGRAPHY.

American experts have been afforded an opportunity to witness the operation of the Pollak-Virag high-speed automatic telegraph system between New York and Chicago, and study the practical application of the proposed innovation to commercial work. The invention is really a combination of telegraphy, telephony and photography—rather a complicated system, it would appear, to the average mind—yet the almost incredible speed of 150,000 words an hour can be attained, it is said, without difficulty. Of course, it would be impossible to read or record messages manually and much less send them at this rate of speed, and it is

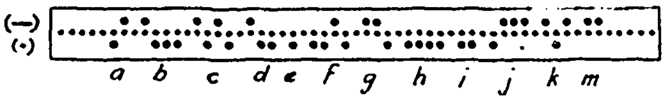


FIG. 1.—HIGH-SPEED AUTOMATIC TELEGRAPHY.—TAPE AT TRANSMITTING END SHOWING DASHES AND DOTS.

to overcome this difficulty that the telephonic and photographic features are introduced. The advantages claimed are high working speeds on the line wires with very low-voltage currents, a permanent and easily decipherable record, and automatic control of the receiver from the sending station. The fundamental idea is automatic transmission from a perforated strip of paper and receiving by photographing the movements of a telephone diaphragm.

Those who witnessed the experiments between New York and Chicago saw perforated strips similar to that shown in Fig. 1 fed into the "sender" and a series of irregular lines flashed upon a reflector, like the reproduction presented in Fig. 2, which is made from a photographic record taken on one of the trials. The apparatus employed is shown in the diagram Fig. 3. The illustrations are presented through the courtesy of the Western Electrician, from which the following description is taken:

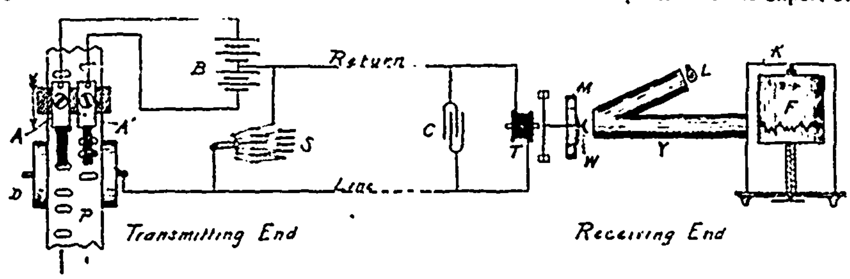


FIG. 3.—HIGH SPEED AUTOMATIC TELEGRAPHY. DETAILS OF APPARATUS.

In the preparation of the message the paper strip is perforated with two parallel lines of holes, one line representing the dashes and the other the dots of the Continental alphabet. In Fig. 3 (P) represents the paper strip; (A) and (A') are two brushes composed of fine wire mounted above a flanged drum or wheel (D) and arranged to press the paper strip firmly against it. The paper strip is moved forward in the direction of the arrow, and, as the line of holes representing the dashes pass under the brush (A), for each one there is made an electrical contract between (A) and the drum (D), and current passes from the positive pole of the battery (B) to the line. When a hole representing a dot passes under brush (A') the contact between it and the drum (D) permits the passage of negative current to the line. These impulses are carried to the telephone receiver (T), and the resultant movement of the diaphragm causes a ray of light to vibrate in the following manner: In front of the diaphragm is a small C-shaped permanent magnet (M), one pole of which terminates in a stiff flat spring having a right-angled knife edge at its free end, which is very close to a similar knife edge formed directly on the other pole of

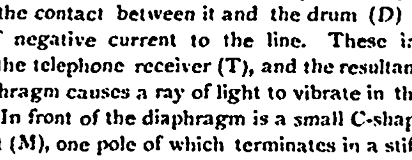


FIG. 2.—HIGH-SPEED AUTOMATIC TELEGRAPHY.—HOW THE MESSAGE LOOKS COMING OVER THE WIRE.

the magnet. A very small concave mirror (W) is held magnetically against the two knife edges through the means of a small bit of soft iron glued to its back. A stiff piece of wire is connected rigidly between the telephone diaphragm and the flat spring of (M). It follows that the very slight motion of the diaphragm is transmitted to the spring and the mirror is caused to rock upon the fixed knife edge of the magnet. The light from a small incandescent lamp (L) passes through one limb of the forked tube (Y) and falls upon the mirror (W), from whence it is reflected through the other limb of the tube (Y). A light-proof case (K) is securely joined to the tube (Y). Inside the case (K) is a cylinder (F) carrying a sheet of light-sensitized paper. This cylinder is rranged to rotate around a stationary coarse-pitched screw, so that for each rotation the cylinder moves downward about one-quarter inch. The sending station is given control over the starting of the cylinder (F) by a simple automatic apparatus.

In receiving a message the cylinder (F) is rotated, the beam of light from the mirror (W) dances up and down, leaving its spiral, zig-zag chemical trail to be developed later and fixed as in photography and then translated.

An adjustable self-induction coil (S), Fig. 3, is connected at the transmitter as shown. Its function is to regulate the time duration of the impulses, proportionating them to the resistance and capacity of the line. A condenser (C) shunts the telephone receiver, as shown, for the purpose of damping the self-vibration of the diaphragm. Without this the diaphragm would not come at once to rest following each movement, but would make several short vibrations after each current impulse. The condenser prolongs or "tails off" the impulse so that the current just ceases as the diaphragm reaches the central or neutral position.

Telegraph officials in this country have encouraged the inventors, Anton Pollak and Joseph Virag, of Budapest, and they have placed every facility at their disposal for testing their apparatus on commercial lines, but none of them speak hopefully of the innovation, although they disclaim any feeling of antagonism. They point out that, taking everything into consideration—the time required in preparing the perforted strips, in developing the photographic record, and in translating the message for delivery the advantage of high speed transmission is more than overcome by the rapidity of handling messages under the older and simpler system. The only feature of importance, they claim, that commends itself is the increase in the working capacity of existing lines made possible by the innovation, yet this would apply in only a few cases and hence would not be of universal benefit.

The United States consul at Roubaix reports that the expert of the French government has made a careful test of the Pollak-Virag system, and in his conclusions, officially communicated, he points out the following disadvantages: "The telegram must first be changed into characters, after the manner of the Morse system; then the strips must be perforated, as in the Wheatstone system; after reception, the photographed strips must be developed and then translated into ordinary language." It is thought that this complicated manipulation may lead to many errors in transmission, and for present use in France he concludes that the Baudot machine actually employed answers all requirements.

AS A TELEGRAPH OPERATOR.

The telegraph has always played an important part in war, and the official operator at the scene of action should combine skill with resource and good judgment. The proposed distribution of medals by the Dominion Government to the Canadian veterans of '66, recalls to mind that on the occasion of the Fenian invasion, about 10,000 troops were sent out from Montreal to protect the border line between the province of Quebec and the States of New York and Vermont. Attached to these troops was an official operator—a lad in his 'teens, supplied by the Montreal Telegraph Co.—A. B. Smith by name, now the well known and highly esteemed Superintendent of Construction for the G.N.W. Telegraph Co. Young Smith had his headquarters in a bed-room on the top story of the hotel at Hungerford, and during his stay at the "front" proved himself equal to all the demands of the occasion. When the Government medals are given out, as we hope they may be this year, the "official operator" of the Montreal contingent should be found on the list.

The Mayor of Toronto has outlined a proposal for the nationalization of the telephone and telegraph systems of the Dominion. An interesting discussion on this subject took place in the Dominion Parliament last month, during which the unsatisfactory telegraph service of Prince Edward Island was incidentally referred to.

ENGINEERING and MECHANICS

EXAMINATION QUESTIONS.

W. H. WAKEMAN, in The Tradesman.

The following seventy-five questions compose a list that was used one year by the examining committee of an engineering society for the purpose of testing the theoretical and practical knowledge of the men who applied for admission to its membership. No one candidate was asked to answer all of them, but selections were made according to the ability of the candidate and the time at the disposal of the committee.

Some of the points touched upon are in dispute among the best engineers in our land, and these are not supposed to be settled by us, but the answers given are sufficient to convince any reasonable committee or examining board that the candidate who gives them has some good ideas on the subjects, and few if any rejections will occur if these replies are given in an intelligent manner:

1. What is the first duty of an engineer on entering his engine and boiler rooms in the morning?

A. In a plant where he does the firing, his first duty is to ascertain where the water level is in the boilers, opening the valves on the water gauge, and trying all of the gauge cocks. If the pressure has all disappeared during the night, and a partial vacuum formed above the water line, the safety valve or some other valve should be opened to admit air. The practice adopted by some careless engineers, of starting up their fires before they know how much water they have, cannot be too strongly condemned. In all cases where the engineer has one or more firemen, he should know that they are in their proper places ready for duty, that there is plenty of water in the boilers, and that on general principles nothing will prevent starting up on time.

2. What is the last duty of an engineer at night?

A. To see that his boilers are filled to the upper gauge cock with water, then to shut off the water gauges, and know that the fires are properly banked so that no steam will be formed during the night.

3. How would you bank a soft coal fire at night?

A. Where the draft is very strong and the dampers are not tight, the surest way is to shove the fire back until nearly one-half of the grates are bare, then cover it over with fine coal that has been well wet down. In some cases it is customary to cover the fire just as it is used on the grate, but this is only done with safety where the draft can be effectually shut off.

4. Which cock or valve on the water gauge would you open first in the morning?

A. The top one, in order to blow steam through the glass and warm it up. If the lower one is opened first the water will be projected upward, and when it strikes the closed upper cock or valve it may break the gauge glass. It also throws water from the bottom of the boiler up into the top of the column, where it is not wanted.

5. Do you blow down your boilers every morning?

A. Yes. There is no better plan to be found than to open the blow-off valve a few seconds before the fire has started to make steam for the day. As the water has had a chance to settle during the night, some of the sediment will be blown out, and the blow-off pipe will never get clogged with sediment. Where this precaution has been neglected, blow-off pipes have been burnt off because there was no water in direct contact with the iron.

6. What compound do you recommend for the removal and prevention of scale?

A. I have no particular kind to recommend for all cases, but would select one that would meet the requirements of a given case.

7. When the water is low in your boiler, how do you proceed?

A. I never let the water get low in a boiler that I have charge of, unless it is caused by some accident that is beyond my control, such as the bursting of a pipe, or something similar. In such a case I would cover the fire with wet coal as quickly as possible, or with wet ashes if the coal was not at hand.

8. Would it not be better to haul the fire in order to be sure that no heat is left to burn the boiler?

A. No, because an attempt to haul a fire results in great increase of heat for a short time, when it is liable to do much damage.

9. If your boiler foams, how would you proceed?

A. Partially close the throttle valve, open the blow-off valve, and blow down, then close it and feed in more water rapidly. As soon as possible the cause of the trouble should be removed, as it may wreck the engine.

10. How would you reverse an engine?

A. If the valve gear is operated by an eccentric, and the valves have neither lap nor lead, the eccentric may be turned half way round the shaft and fastened there. The engine may be placed on one of its centers as a matter of convenience, but not of a necessity. These directions apply to a majority of engines now in use, but there are many special forms that require special directions, and there is at least one that cannot be reversed, so that if it is desired to reverse the motion of the driven machinery, the engine must be turned around on its foundation.

11. Suppose that the valve gear on your engine is driven by an eccentric held in place by set screws, and it should slip on the crank shaft, how would you proceed to set it in order to avoid delay in the mill or factory?

A. I should place the engine on one of its centers, partially open the throttle valve and move the eccentric in the direction that the engine runs until steam appears at the open drip cock, or indicator pipe at the end of cylinder where the piston is, and fasten it there. This will make it possible to run the engine until there is an opportunity to apply the indicator and properly adjust the valves.

12. Does keying up the crank pin and wrist pin boxes to take up lost motion lengthen or shorten the distance between the centers of the crank and wrist pins.

A. This will depend upon the design of the connecting rod, for with some kinds keying up shortens the distance, while with others it lengthens the same. The best design has one of each of these devices, so that the distance mentioned is kept practically constant. In common practice this is called lengthening or shortening the connecting rod.

13. What is a counterbore?

A. When the cylinder of an engine is bored out, a part at each end is made larger than the mainpart, and each one of these is called a counterbore.

14. A crank is 12 inches long. What is the stroke of the engine.

A. Twenty-four inches.

15. Which way does the water circulate in an ordinary tubular boiler?

A. Commencing at a point directly over the fire, it rises, then flows toward the rear end, falling to the lower part, then travels toward the fire box to replace what is constantly rising.

16 What causes draft in a chimney?

A. The difference in weight of the hot gases inside of it, and the colder air on the outside.

17. How many square feet of grate surface are under your boiler?

A. This, of course, will depend upon the design of boiler and grate. With an ordinary tubular boiler it is only necessary to multiply the length by the width to determine the square feet contained. For an upright boiler with a circular grate, the diameter must be squared (multiplied by itself), and the product multiplied by .7854. For a Hazelton boiler or any other kind where the grate is circular in form with a water leg in the center, the outer diameter is squared, also the diameter of water leg, and the latter subtracted from the former. Multiply the remainder by .7854 and the product will be the number of square feet in the grate.

18. How would you stop a man-hole gasket from leaking without shutting down the boiler.

A. There is no safe way to do this, for if a light pressure on the nut will not stop the leak it is best to cool off the boiler and ascertain the cause of the trouble.

19. How many kinds of safety valves are in general use at the present time?

A. Two. Pop valves and leaver valves.

20. What causes a safety valve to blow after the boiler pressure is reduced twenty pounds below the blowing off point?

A. Such action would denote that some part of the valve did not work freely. The lever should be lifted gently, and then forced down into place. This may stop it temporarily, but whenever a safety valve fails to work properly it should be repaired as soon as possible.

21. Suppose that your safety valve is set to blow at 80 pounds, but on returning to your boiler room after a short absence you find 100 pounds by the gauge, how would you proceed?

A. The excessive pressure shows that the valve is fastened to its seat from some cause, and if the lever is disturbed under such conditions it may suddenly release it, thus throwing a great stress upon the fulcrum and lever, which may cause a break that will allow the steam to be discharged with great force until the boiler is empty; therefore, it would be proper to cover the fire with fresh coal and check the draft, as soon as the unusual pressure is discovered, and use the steam as fast as possible in order to reduce the pressure, after which the lever may be carefully lifted and the valve opened.

22. How would you repair a dash pot that will not work?

A. That will depend on what the trouble is, for they are usually made very substantially, so that few repairs are necessary.

(Note—This question was introduced to test the candidate's knowledge of dash pots.)

23. What kind of oil would you use in the gag pot on a governor?

A. A light oil that will not quickly gum up the parts. Kerosene is frequently used for this purpose.

24. How thick would you carry a soft coal fire?

A. That would depend upon the amount of steam that the boiler must supply. If it is worked up to its full capacity the fire should be about twelve inches thick, but if the work is lighter a thinner fire will answer every purpose and probably give better results.

25. How would you proceed to abate a smoke nuisance?

A. In some cases the amount of black smoke emitted from a chimney may be greatly reduced by putting soft coal on the dead plate and allowing it to remain there for a short time, then shoving it on to the grate, for in this way the gases must pass over the fire and become ignited. Admitting air at the bridge wall is a good plan, and in some cases a jet of steam in the furnace makes a great difference. A large fire box makes it possible to get good results with little smoke.

26. What is a horse power?

A. 33,000 pounds raised one foot high in one minute.

27. How do you square a circle?

A. Multiply one quarter of the circumference by the diameter, or square the diameter and multiply by .7854.

28. How do you calculate the power of an engine?

A. Multiply the effective area of the piston expressed in square inches by the number of feet travelled perminute by the piston. Multiply the product by the mean effective pressure and divide by 33,000.

29. How do you determine the mean effective pressure acting on an piston of the engine?

A. By taking indicator diagrams and calculating it from them.

30. Is there more power developed on one side of the piston than on the other?

A. Yes, because on an ordinary simple engine, and also on a cross compound engine, the piston rod covers several square inches on one face of the piston.

31. At what part of the stroke does the piston travel at the highest rate?

A. Taking for example a horizontal engine and dividing the circle made by the crank pin to halves by a vertical line, the piston reaches its highest speed while the crank pin is travelling the half nearest the cylinder.

32. How would you determine the stress on a stay bolt?

A. Multiply the distance in inches between the vertical rows by the distance between the horizontal rows, and the product so obtained by the steam pressure. The final product is the stress on the stay bolt.

33. What is meant by the horse power of a boiler?

A. The evaporation of thirty pounds of feed water at a temperature of 100 degress Fah. into steam at seventy pounds gauge pressure. If the boiler is run under different conditions, the results must be reduced to an equivalent to the above.

34. How many square feet of heating surface constitutes one horse power in a boiler?

A. This will depend upon the grade of coal used and the available draft. For ordinary stationary practice with natural draft, fifteen square feet for a horizontal tubular boiler, or a water tube boiler, although some boiler makers have reduced this to twelve on account of competition.

35. How do you dercrmine the heating surface of a steam boiler?

A. By determining the number of square feet in the shell heads and tubes, on which the fire is effective on one side, and that are covered with water on the other, and adding them together.

36. Does the boiling point of water in a steam boiler increase with the pressure on its surface?

A. Yes.

37. Why are hand holes and man holes made oblong instead of round?

A. In order to make it possible to remove the covers from the boiler when necessary, also to avoid cutting away the material as much as possible.

38. The area of a safety valve is twelve square inches, the distance from fulcrum to valve is 4 inches, and the distance from fulcrum to end of lever is 30 inches. With a steam pressure of 100 pounds, how much weight must be put upon the end of lever in order to balance the pressure, neglecting the weight of valve and lever?

A. 160 pounds. It is determined by multiplying together the area of valve, its distance from the fulcrum and the steam pressure, and dividing by the length of lever.

39. The pitch of rivets in a double riveted seam is three inches, and the diameter of rivets is three-fourths inch. What is the strength of net section of plate, compared with solid plate?

A. 75 per cent. of the strength of the solid plate. It is determined by subtracting the diameter of rivets from the pitch and dividing by the pitch.

40. Which will stand the greater pressure, a large boiler or a small one, all else being equal?

A. A small boiler, because there is a less number of square inches exposed to pressure.

41. Which is the more economical, a high or a low-speed engine?

A. So far as actual consumption of steam per horse power developed is concerned, the low speed is the more economical, but other conditions may make it advisable to use a high-speed machine.

42. Is it advisable to give an engine compression; and if so why?

A. Yes; because it results in a more quiet and easy running engine.

43. Why is lead given to an engine?

A. In order to secure a high pressure of steam at the beginning of the stroke and maintain it to the point of cut-off.

44. In what position does the eccentric of an engine stand in relation to the crank on one of its centers?

A. If the connection between the valve and the eccentric is direct, and the valve has neither lap nor lead, the eccentric will stand at right angles to the crank and in advance of it. If the connection is indirect, it may stand in the same relation, or it may be 90 degrees behind it. If the valves have lap and lead, the eccentric must be advanced accordingly.

45. What is meant by the "angular advance" of an eccentric?

A. It means the number of degrees that the eccentric is advanced beyond an angle of 90 degrees with the crank.

46. How would you proceed to line up an engine?

A. Take off the cylinder-head, remove the piston and rod, draw a line through the center of the cylinder, and ascertain if the guides are parallel to it; also see that the line passes through the center of the cross head at all parts of the stroke. If the wrist-pin cannot be removed, this must be done by measurement. The crank-shaft must be square with this line, the crank parallel to it, and the crank-pin at right angles to it.

47. Does a crank-pin wear flat or round?

A. As nearly all of the wear comes upon one side of the crank-pin the tendency is to wear flat, although there may be exceptions to the rule.

48. In what position would you put the crank of an engine when keying up the crank-pin boxes?

A. With a new engine it makes no difference about the position of the crank, but with an old engine having a flat crank-pin f the engine is put upon a center and keyed up closely, it will bind and heat when started up.

(To be continued.)

Mr. E. Beck, of the Goderich Water Works Department, has been appointed engineer of the Bennett Furniture Company, of London, Ont.

A branch of the Canadian Association of Stationary Engineers has been organized at Vancouver, B. C., with the following officers: J. Saslet, president; W. Patten, vice-president; J. R. Bodger, secretary; Angus McAllister, treasurer; Chas. McFarlane, conductor; Joseph Cameron, bookkeeper; Messrs. Ryder, Dunham and MacFarlane, trustees.

SERIES ALTERNATING-CURRENT ARC LAMPS.

The successful operation of arc lamps in series on alternating current seems to be entirely assured, and has given to the alternating system th final element to enable it to compete in all particulars with the direct current system.

The San-Gabriel Electric Company, of Los Angelos, Cal., are putting in the largest plant of series alternating arcs yet installed, and will use 850 Manhattan lamps and nine regulators. The operation of the lamp is mechanical rather than electrical, the loss in the mechanism being claimed to be but five watts. The mechanism is of the concentric single solenoid type and contains no springs. The lamp carries an electrical cut-out, thus affording protection to the mechanism. They can be placed upon circuits of any current from five to eight amperes without change of adjustment. The arc voltage is said to remain constant under all conditions. At 6.6 amperes, and 72 volts at the arc, the total apparent watts at the terminal is 475; total true watts 430. The true watts at the arc are 425, showing the loss to be five watts in the mechanism and the efficiency of the lamp to be .99. The power factor of the lamp is .91. In connection with these lamps the San Gabriel Company will use nine regulating reactance coils of 25 per cent. capacity; in other words, each coil will take care of the extinguishing of 25 per cent. of the circuit. The regulator consists of a single, automatic, regulating reactance coil in series with the lamps.

A single coil is swung at one end of a lever arm, so that by moving vertically it will enclose more or less of one leg of an upright "U" shaped core, the other leg acting to complete the magnetic circuit. At the opposite end of the lever arm is a weight which overbalances the weight of the coil, so that normally the coil is held outside of and above the core. When the circuit is completed to start the lamps, magnetic attraction causes the coil to be drawn down over the core. The action of the weight holds the coil in equilibrium when the desired current is flowing through the circuit. When lamps are switched off and the current tends to rise, the coil is drawn to further enclose the iron, the reactance effect increases, and the current is thus held constant. This regulation is claimed to be absolute to within one-tenth of an ampere, on any size regulator or at any load.

The loss in the regulator is, of course, constant, either at full or minimum load, being simply the C^2R loss in the coil, plus a very slight iron loss. Regulation is said to be perfect to within onettenth of an ampere from maximum to minimum load.

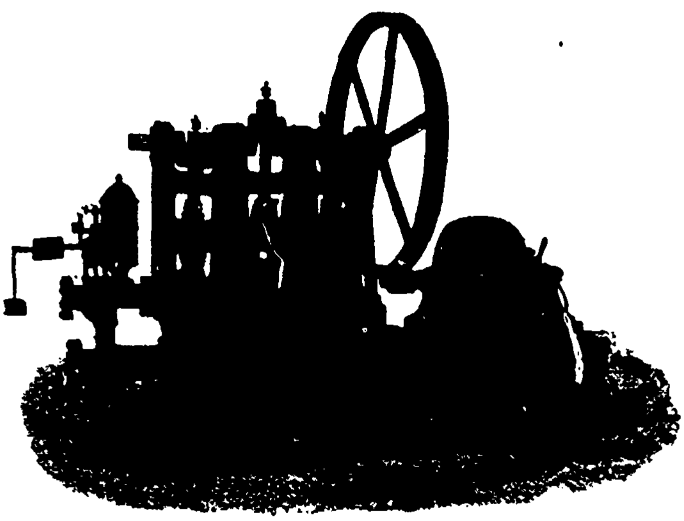
The capacity of the regulator, the insulation, etc., need only be in proportion to the number of lamps to be extinguished. This gives a very simple and compact device. It will be seen that where the regulator is to take care of but 10 per cent. of the load of the circuit, it requires an insulation against only ten per cent. of the total electro-motive force of the circuit, so that a large number of lamps, with a very high voltage, can be handled with safety. The loss in these coils is said be but 200 watts at any load, and as there will be but nine coils employed in this installation, the loss in the regulators will be 1,800 watts. The power factor of the circuit, including lamps and regulators, is 89 to 90. The lamps will run 100 in series on a 7,500 volt primary circuit. The Manhattan General Construction Company of Newark, New Jersey, furnished the apparatus for this installation.—Electrical Review.

THE SMITH-VAILE TRIPLEX ELECTRIC PUMP.

One of the latest designs of the Smith-Vaile triplex electric pump of outside packed and outside guided type is illustrated herewith. The apparatus was constructed for and installed at the plant of the National Cash Register Co., Dayton, Ohio. It is connected to two 8 inch bored wells, and supplies an abundant water supply for general purposes.

The National Cash Register Co. have supplied a separate apartment for the installation of the pump about 10 feet below the floor line of the main engine room, so that the pump might be installed as near the water level in the wells as possible. Special underground passage gives communication between the eng'... room and the pumping station for the accommodation of the operating engineer.

The sub-base of the pump is extended for the reception of a General Electric direct connected motor, provided by the National Cash Register Co. This motor is of the slow speed type, 500



THE SMITH-VAILE TRIPLEX ELECTRIC PUMP.

volt current, and its speed is such that a single reduction of gears can be employed. The main gear is of large diameter, machine cut. The pump and motor pinions are of rawhide. The pump is of the four standard type, each crank being provided with two bearings and two supports. It is also of the cross head design, cross-heads being provided with bronze shoes, adjustable for wear. Connecting rods are provided with bronze boxes at crank shaft connections, with taper key adjustment. Adjustment device is also provided at the cross-head connections. Valve areas and water passages are extra large, admitting of high speed without undue noise or hammer.

The pump is also provided with automatic combination by-pass and water relief valve of a special design, whereby the pressure is maintained at a constant point, and when the maximum is obtained, the surplus water is by-passed from discharge to suction, speed of the motor remaining constant.

The Goderich Organ Company have lately put in a new 100 light dynamo, manufactured by the United Electric Company, of Toronto. It is operated by an automatic high speed engine from the Bell Engine Works, of Seaforth.

The London Cold Storage & Warehousing Co., London, Ont., have placed an order with the Electrical Construction Co., of that city, for a 30 k.w. direct connected generator and engine for 250 volt service to supply the lights of the building and two motors of 10 and 15 h.p. respectively, which have also been ordered from the Electrical Construction Co., of their Perfection type multipolar machines.

The Pittsburg Reduction Company, of Niagara Falls, Ont., are building a plant at Shawinigan Falls, Que., for the manufacture of aluminum, and have awarded to the Westinghouse Electric & Mfg. Co., of Pittsburg, Pa., a contract for four generators of 1,250 horse power each. The Shawinigan Water & Power Company are also said to have contracted with the Westinghouse Company for two generators of 5,000 horse power each, to be used in the development of electric power for their customers.

SPARKS.

The town of North Toronto may install an incandescent lighting plant.

A fire alarm system may be installed by the corporation of Hintonburg, Ont.

The Kingsville Electric Light Company have installed a Leonard self oiling engine.

Cope & Frey, dealers in electric and gas supplies, have commenced business at Vancouver, B. C.

The power house of the Niagara Falls Park & River Railway at Niagara Falls, Ont., is being rebuilt.

The Cataract Power Company, of Hamilton, have made another reduction in their rates for lighting.

The Electric Development Company, of Philadelphia, purpose opening Canadian offices in the city of Hamilton.

The corporation of Cannington, Ont., is considering the purchase of the electric light plant from the present owners.

The electric lighting plant at Amherstburg, Ont., has been taken over by Mr. R. M. Saxby, late of the Royal Electric Company.

A proposition has been made by Tuerk Bros. to establish a factary in Berlin, Ont., to manufacture gasoline engines and automobiles.

A convention of electrical contractors of the United States was held in Pittsburg on March 16th.

The town council of Perth, Ont., have been looking into the question of electric lighting, and a report has been submitted recommending municipal control.

The streets of Port Dalhousie, Ont., are now lighted by electricity from the power house of the Toronto Rubber Shoe Company. There are fourteen arc lights in the streets.

G. Filieux, a lineman in the employ of the Royal Electric Company, Montreal, was recently killed by an electric shock at the corner of St. Lawrence street and Mount Royal avenue.

A considerable portion of the British Columbia Electric Railway Company's lines in Victoria will be double-tracked this year. It is also the intention to put in service several new cars.

Dr. Edward Gahan, of Boston, is understood to be in negotiation for the purchase of the electric light plant at Digby, N.S. If purchased, an additional dynamo and engine will be installed.

The tender of the Royal Electric Company has been accepted by the city of Halifax, N. S., for the supply and installation of an electric light plant. The tender is understood to have been $19,-438.

The Bay of Quinte Railway Company, of Deseronto, is seeking authority from the Dominion Government to operate mines, supply electrical power and manufacture electrical machinery. It is improbable that their requests will be granted.

McColl Bros. have been given the contract for boiler compound required by the city of Toronto, at 4 cents per pound, and for cylinder oil at 35 cents per gallon. The Atlantic Refining Company secured the contract for lubricating grease, at 10 cents per pound.

A Paris newspaper gives the following as the number of automobiles in use: Automobiles registered in Paris, 3,701; in the suburbs of Paris, 1,219; in the rest of France, 2,445; in the whole of Germany, 1,427; in the whole of England, 530; in the United States, less than 300.

The Railway Committee of the Ontario Legislature has reported the bill reviving the charter of the Ingersoll Radial Electric Railway, granted in 1897. The line will connect Ingersoll with Tilsonburg. The town council of Ingersoll have also decided to grant a franchise to the company.

The Engineering Society of the School of Practical Science, Toronto, have elected officers for 1900 as follows: President, F. W. Thorold; Vice-Pres., W. G. Chace; Graduate Reporter, C. H. Fullerton; 4th Year Reporter, R. Roaf; 3rd Year Reporter, J. T. Broughton; Treas., R. W. Morley; Cor. Sec., W. Brereton; Rec. Sec. A. Lang.

A charter has been granted to the Electrical Maintenance and Construction Company, Limited, of Toronto, with an authorized capital of $250,000. The provisional directors are: P. H. Patriarche, H. L. Dunn and P. D. Ball. The charter gives the company power to manufacture and operate electrical machinery, and to carry on the business of an electrical, mechanical, hydraulic and civil engineer.

Sir William Van Horne and James Hutchison, of Montreal, B. F. Pearson and Charles H. Cahan, of Halifax, and other Canadian capitalists, have obtained an exclusive franchise to operate electric railways and furnish light and power in the city of Port of Spain and the suburbs to a distance of five miles. The capital of the company will be $1,000,000.

The Hamilton, Grimbsy and Beamsville Electric Railway Company sued the Bell Telephone Company in the Division Court, Hamilton, for $60 damages for injuries to its poles and wires caused by the defendant's removal of its broken wires and poles after the snow-storm of December, 1898. Judge Monck has ruled that the defendant is not liable under the circumstances.

The new power house and plant of the Ottawa Electric Railway Company was completed last month. The work was supervised by Mr. W. H. Baldwin, hydraulic engineer of the company, and upon the inauguration of the plant he was presented with a beautiful gold watch by the president and directors in recognition of his efficient and faithful services. In a later issue we hope to publish a complete description of this power house.

The Society of Applied Science of McGill University, Montreal, have elected the following officers for the coming year: President, H. A. Burson; first vice-president, B. S. McKenzie; second vice-president, S. B. Clement; third vice-president, R. C. Wilson; treasurer, A. E. Beck; second year representative, E. Mackay; chief of the editorial board, A. R. Archer; members of the editorial board, H. E. Scott, G. Pike and J. A. Heamen.

The Cataract Power Company have commenced work on the construction of their second transmission line from the power house near St. Catharines to the city of Hamilton. It is expected that the line will be completed by the first of July next. The new line will have twice the capacity of the present wires, and will necessitate the increasing of the plant at the Victoria avenue transforming station in Hamilton. The investment for copper wire alone will be about $50,000.

Mr. W. T. Steward, electrical engineer, has submitted a report to the town council of Toronto Junction on the required changes in the lighting system of the town. Mr. Steward estimates the cost of putting in a lighting plant at the present power station at $16,000, and to place it at the water-works station at $12,000 additional. He recommends two 50 arc light dynamos at a cost of $1,000 each, one 100 k. w. alternator with instruments and switchboard, at a cost of $2,500, one 150 h. p. high speed compound engine at $1,650, and two 150 h. p. boilers at $1,200 each. The cost of transformers for 1,200 lights is placed at $1,800. Upon the basis of his estimate, the cost of lighting the streets with 100 arc lamps would be $3,419 per annum.

An interesting legal suit is now being heard in the Assize Court at Toronto. It will be remembered that in September, 1899, the warehouse of W. G. Harris, scrap merchant, was destroyed by fire, and that suit was brought against the Toronto Electric Light Company to recover damages, on the ground that the fire was caused by an electric wire. The action has already been tried and a verdict for the full amount given in favor of the plaintiffs, but the defendants claim that Judge Ferguson, who tried the case, failed to point out to the jury in his charge the exact hour of the fire. Harris claims that the company wrongfully placed wires on his building, and failed to properly insulate them, while the company claim that they were properly insulated, and that the fire was caused by spontaneous combustion.

In one branch of engineering, the development of steam turbines, much greater progress has been made in Great Britain and on the Continent than in the United States. In the electric lighting plant in Cambridge, England, several prime movers of this type are in successful operation. A Parsons steam turbine, directly coupled to a 500-kilowatt alternator, has been added lately. It runs at a high speed, 2,700 revolutions a minute. The regulation of the turbine is secured by an electric device, so that it can work in parallel with the other machines of the station when desired. A surface condenser leads from the turbine by piping and is installed in a space below the floor level. Beside it are the pumps for the water circulation, which are worked by gearing and endless screw from the main shaft. The alternator is of the four-pole type, with fixed field, and gives a voltage of 2,000 at 90 cycles. For the excitation 3.5 kilowatts is required at full load. The exciter, at 5 kilowatts, is connected directly to the shaft of the alternator.

HOW TO USE EMERY WHEELS.

An emery wheel manufacturing company gives this advice to users of such wheels: Too great a variety of work should not be expected from one grade of wheel. If the amount of grinding will warrant it, several grades can be profitably employed, each carefully selected for its particular purpose. Wheels should be kept perfectly true and in balance. In order that they may not become in the least out of true an emery wheel dresser should be used to dress up the wheels a little each day, or as often as they require it.

In mounting emery wheels never crowd them upon the arbor. Use flanges at least one-third the diameter of the wheel. Flanges should always be concaved and fitted with rubber washers between flange and wheel. Have wheels slip easily on the arbor and screw flanges only tight enough to prevent wheels from slipping. Stands on which wheels are mounted should be heavy and strong, and solidly bolted to a firm foundation. Keep machine well oiled so that arbor will not become heated, otherwise there is danger of wheels breaking from expansion of arbor.

Users of wheels are particularly cautioned not to run wheels on shaky machines or on machines in which the arbors have become loose in the boxes from wear. See that rests are properly adjusted in relation to the wheel, otherwise accidents may occur owing to work being drawn between the wheel and the rest. Never run wheels at a higher speed than the maker recommends. Don't try to grind malleable iron witha wheel that was made for brass, as no one wheel can be made which will be just right for all kinds of metals.

To obtain the best results, emery and corrundum wheels should be run at a surface speed of 5,500 feet per minute. Wheels if run too fast will heat the work and glaze, and if run too slowly will wear away rapidly and do but little work. The same speed should be maintained as the wheel wears down, and the speed of the spindle should be increased correspondingly as the diameter of the wheel is decreased. Where there is a sufficient amount of grinding to warrant the use of more than one machine, this can be accomplished by transferring from the first or larger grinder to smaller ones as the wheels wear down, otherwise by means of cone pulleys.

The snow storm early in March last caused a heavy loss to the Nova Scotia Telephone Company. Many of their wires in Halifax and vicinity were blown down. The cost of repairs was in the vicinity of $25,000.

Mr. W. T. Steward, an electrical engineer of wide experience has recently established an office in the Temple Building, Toronto, and is prepared to give expert advice on electrical projects, installations, and improvements to plants. It is Mr. Steward's avowed intention to take an entirely independent attitude as regards electric manufacturing concerns, and by so doing to give his patrons the benefit of unbiased advice such as is only possible under these conditions. He has just made a report on an electric lighting system for the town of Toronto Junction. Mr. Steward is well known in electric circles in Western Canada, having been for ten years electrician for the western division of the Canadian Pacific Railway, and afterwards engaged in the electrical contracting and supply business at Vancouver, B. C.

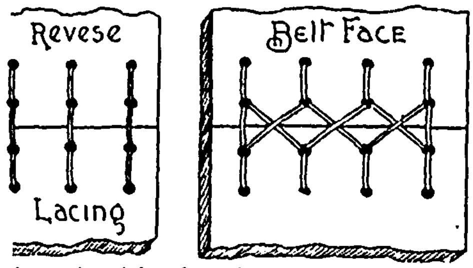
The Western Ontario Hat Co., London, have purchased two new motors in addition to the two they already have, all being manufactured by the Electrical Construction Co., of London, Ltd.

The Eric Iron Works, of St. Thomas, Ont., have placed an order with the Electrical Construction Co., of London, Ltd., for a 12 h.p. motor, which has already been installed to their satisfaction.

SUGGESTION FOR BELT LACING.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—Many suggestions are offered from time to time regarding the lacing of belts. Recently, I came across the double lath tie, which I have found very satisfactory, laced as follows: The lacing



can be made any length in a few minutes, and with one cut of a sharp knife it is easily removed. For heavy belts I use double and sometimes treble tie. By placing the ends together, sharpening them with a knife, and sewing them with one strand of the lath tie, makes the end very stiff. I can vouch for its cheapness and lasting power.

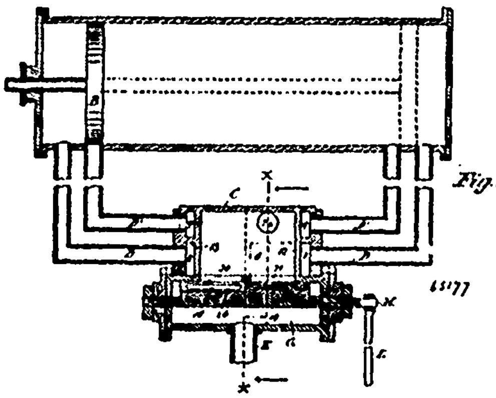
Yours truly,
"EXCELSIOR."

Mr. Stewart Randall, of Ottawa, has been engaged as electrician by the Buckingham Electric Light Company.

Mr. Daniel Mulqueen, cashier of the Toronto Railway, has been appointed by the Mackenzie Syndicate as manager of the street railway at San Paulo, Brazil.

RECENT CANADIAN PATENTS.

The William Hamilton Manufacturing Company, of Peterboro Ont., has been granted a Canadian patent for a reversing steam valve, as shown in the accompanying illustration. The claim is for a steam valve, comprising a tubular valve cylinder having a feed inlet and feed exhaust ports, a valve rocking therein and



REVERSIBLE STEAM VALVE.

having feed and exhaust passages from opposite ends alternating as described and adapted to close the feed port near one end and open the exhaust port at the other end, and vice versa, a steam chest connecting with said ports and having steam passages agreeing with said feed and exhaust ports, and feed and exhaust pipes from opposite ends of said steam chest and connecting with said steam passages and with a piston cylinder near opposite ends.

To Dr. Carl Ritter Auer Von Welsbach, of Vienna, Austria, has been granted a patent in Canada for an osmium filament for incandescent electric lamps. It consists of a process of making filaments for electric incandescent lamps from a paste of osmium, titantic acid or acid of a more basic character which will volatilize, when brought to incandescence, and binding material consisting in moulding the paste into threads or the desired filamentary form, subjecting the same to dry distillation, then applying the electric current, first slowly and until the carbon of the binding material has been eliminated at a comparatively low heat, then increasing the current until the filament is heated to dazzling incandescence, when the titanic acid or oxyd used is volatilized and the impurities, when any, eliminated and the osmium cemented into a state of purity as a stable, dense, homogenous, coherent and elastic filament ; in the substitution of alloys of osmium with other metals of the platinum group, and preferably ruthenium, in lieu of osmium alone, so as to produce metallic filaments suitable for use as the illuminating conductors of incandescent electric lamps, either alone or after being coated with refractory oxyd or oxyds.

A WESTERN ELECTRICAL PROJECT.

INCORPORATION has been granted by the provincial legislature of British Columbia to the Stave Lake Power Company, Limited, with an authorized capital of $1,000,000. The company have acquired the right and title to 75,000 inches of water at Stave River Falls, a point 42 miles from the city of Vancouver. It is proposed to generate the power at the falls and transmit it to Vancouver. It is said that the company are already assured of over 4,000 horse power on yearly contracts.

The directors of the company are : H. Abbott, director of the Canadian Pacific Railway Company ; John Hendry, president and manager of the Hastings saw mills ; W. H. Armstrong, of Armstrong & Morrison, manufacturing machinists ; G.C. Hinton, electrical engineer and representative of the Royal Electric Company, Montreal ; J. B. Ferguson, managing director of the company.

The hydraulic engineer for the company is Mr. Chas. A. Stoess, and the electrical engineer Mr. George C. Hinton Reports made by the engineers state that 17,000 horse power can be generated at the falls, and that by additional hydraulic works this amount can be doubled. The cost of the project is estimated to be $515,000. Among other information given by the hydraulic engineer is the following : Width of river, 200 feet ; average depth, 16 feet, running at a velocity of 7/10 of a foot per second, which gives a quantity of 140,324 cubic feet per minute. A flume will be constructed 18 feet high on a grade of one in 660, or 8 feet to the mile. This flume will pass from above the first fall to below the second fall. A dam will be constructed at the upper point and will likely be built of rock and earth backing and apron, with concrete cement cores. At the lower point of the flume the power station is to be located, and a reservoir will take the water from the flume. From this two steel pipes, 12 feet in diameter, will carry the water to the station, where there will be eight turbines developing 2,000 h.p. each. There will be four gates on each pipe, and each gate will serve a double turbine.

SPARKS.

The project for an electric railway between London and Port Stanley has again been revived.

The city of Winnipeg, Man., is inviting tenders up to Monday, April 16th, for the supply of a fire alarm system.

The Electrical Construction Co., of London, Ltd., have cleared out twenty-two of their list of eighty second hand machines which were recently exchanged for new ones in Winnipeg.

The Hamilton Radial Railway Company, which contemplates the operation of an electric railway from Hamilton to Oakville and Guelph, has been granted an extension of time for beginning the work until 1905.

The Ickes & Armstrong Syndicate expect to commence work on the construction of an electric railway in the town of Woodstock, Ont., within two months. Mr. J. G. Wallace, the local representative, states that the ties for the road have already been purchased.

Messrs. S. H. Jones, S. F. McKinnon, L. M. Jones and J. A. Lowell have petitioned the Ontario Legislature for an act to authorize the construction of a system of elevated railways in the city of Toronto and adjoining municipalities, and also a system of surface street railways.

The Sutherland Construction Company, composed of New York capitalists, have secured control of the horse car line between Drummondville and Niagara Falls, Ont., and propose to electrify the road. They have deposited a check of $1,250 as a guarantee that they will install a plant before July 1st next, and have asked for a twenty-year charter.

The shareholders of the Preston & Berlin Street Railway Company have elected the following officers: John Patterson, President, Hamilton; M. M. Todd, Vice-President, Galt; C. R. Hanning, Secretary-Treasurer. The company will make arrangements at once to build a line between Preston and Berlin, thus making a through connection from Galt to Preston and on to Berlin and Waterloo.

SPARKS.

The Raney Specialty Mfg. Co., of Kingston, have purchased rom the Electrical Construction Co., London, three motors for their new works.

The town of Bracebridge, Ont., is considering the installation of an electric power plant, and may also put in an electric fire alarm system.

The Canadian General Electric Company have invited tenders for the erection of a brick and steel addition to their works at Peterboro, Ont.

The streets of Kingsville, Ont., are now lighted by incandescent lamps, instead of arc lamps as previously. The service is said to have been much improved by the change.

The Electrical Construction Co., of London, Ltd., have sold to H. W. Petrie, of Toronto, two of their list of second hand motors, which are said to have given excellent satisfaction.

Mr. Peter Holl, of Thornhill, near Toronto, has invented a fender for street cars, which operates by the pressing of a foot lever by the motorman.

The W. J. Gage Co., Toronto, have puchased two new motors from the Electrical Construction Co., of London, Ltd., in addition to the two slow speed press motors which they already have from this company.

The Record Printing Co., of Windsor, have purchased from the Electrical Construction Co., of London, Ltd., a 40 light multipolar dynamo. This machine was sold in close competition with several American and other machines.

The Brampton Gas Company, of Brampton, Ont., are understood to be considering the installation of an electric light plant. The plant by which the streets of the town were lighted was destroyed by fire about one month ago.

The Georgian Bay Navigation Co. have recently ordered a 300 light dynamo from the Electrical Construction Co., of London Ltd., for one of their boats. This is to take the place of a 150 light dynamo installed two years ago by the same company.

An explosion at the gas works at Listowel, Ont., slightly damaged the electric light plant, and almost completely wrecked the gas works. Mr. William Bitton, the operator at the gas works, was [illegible] by the explosion. Since the accident, the electric light plant has been put in running order, and arrangements have been made by J. G. Hay to rebuild the gas works.

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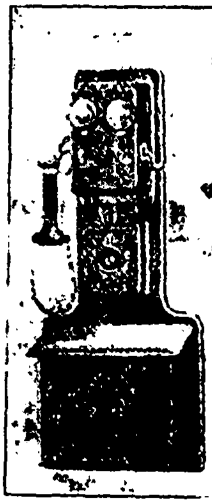

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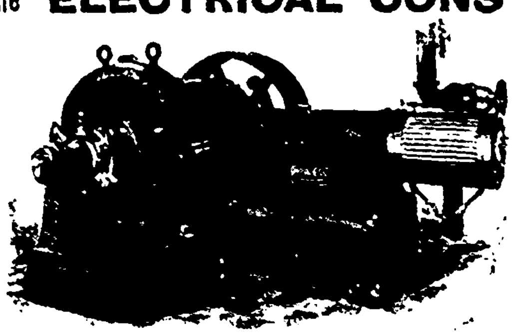

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